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Federal Democratic Republic of Ethiopia Ministry of Education

INFORMATION TECHNOLOGY

TEACHER GUIDE

GRADE 12

FDRE
MOE

Federal Democratic Republic of Ethiopia Ministry of Education

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Foreword

Education and development are closely related endeavors. This is the main reason why it is said that education is the key instrument in Ethiopia's development and social transformation. The fast and globalized world we now live in requires new knowledge, skill and attitude on the part of each individual. It is with this objective in view that the curriculum, which is not only the Blueprint but also a reflection of a country's education system, must be responsive to changing conditions.

It has been almost three decades since Ethiopia launched and implemented new Education and Training Policy. Since the 1994 Education and Training Policy our country has recorded remarkable progress in terms of access, equity and relevance. Vigorous efforts also have been made, and continue to be made, to improve the quality of education.

To continue this progress, the Ministry of Education has developed a new General Education Curriculum Framework in 2021. The Framework covers all pre-primary, primary, Middle level and secondary level grades and subjects. It aims to reinforce the basic tenets and principles outlined in the Education and Training Policy, and provides guidance on the preparation of all subsequent curriculum materials – including this Teacher Guide and the Student Textbook that come with it – to be based on active-learning methods and a competency-based approach.

In the development of this new curriculum, recommendations of the education Road Map studies conducted in 2018 are used as milestones. The new curriculum materials balance the content with students' age, incorporate indigenous knowledge where necessary, use technology for learning and teaching, integrate vocational contents, incorporate the moral education as a subject and incorporate career and technical education as a subject in order to accommodate the diverse needs of learners.

Publication of a new framework, textbooks and teacher guides are by no means the sole solution to improving the quality of education in any country. Continued improvement calls for the efforts of all stakeholders. The teacher's role must become more flexible ranging from lecturer to motivator, guider and facilitator. To assist this, teachers have been given, and will continue to receive, training on the strategies suggested in the Framework and in this teacher guide.

Teachers are urged to read this Guide carefully and to support their students by putting into action the strategies and activities suggested in it.

For systemic reform and continuous improvement in the quality of curriculum materials, the Ministry of Education welcomes comments and suggestions which will enable us to undertake further review and refinement.

ADDIS ABABA, ETHIOPIA FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA

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UNIT 1

INFORMATION SYSTEMS AND THEIR APPLICATIONS

Unit Overview

Information systems have had an impact far beyond the world of business. New technologies create new situations that we have never dealt with before. The introduction of new technology can have a profound effect on human behavior. New technologies also give us capabilities that we did not have before, which in turn, create environments and situations that have not been specifically addressed in ethical terms. Users should also be aware of the consequences and implications of information systems' use and access on the one hand and maintaining the rights of creators and innovators on the other. This unit deals with the fundamentals of ethical, legal, social, environmental and health issues, intellectual property rights, digital identity management, and the role of digital technologies in citizens' engagement.

This unit is expected to be covered in 12 periods.

Sub Units	Number of Periods Allotted
Ethical, Legal, Social, Environmental and Health issues in the use of Information Systems	4
Intellectual property rights	2
Digital identity management	2
Collaboration through digital technologies	2
Engaging in citizenship through digital technologies	2

Learning Outcomes

At the end of this unit, learners will be able to

- Explain ethical and legal issues in information systems
- Explain environmental, social and health issues in information system
- Recognize the basics of intellectual property rights
- Describe digital identity management
- Appreciate the role of digital technologies in citizenship

1.1. Ethical, Legal, Social, Environmental and Health issues in the use of Information Systems

Learning Competencies:

At the end of this section, learners will be able to:

- Explain ethical and legal issues in information systems.
- Explain social, health and environmental issues of information systems.

This topic is expected to be covered in 4 periods.

Instructional Strategies:

1. **Interactive Lecture -** is an active learning strategy in which the teacher employs activities to enhance students' engagement during the lecture

- Before the interactive lecture teaching, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration-**

- If you have access to a projector, show learners selected and recommended

videos that can help the learners grasp the concept better. (You can use recommended video link below or you can select appropriate videos on your own).

- Ethical and Social Issues in Information Systems
  - https://www.youtube.com/watch?v=bZn0IfOb61U

- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**- is the action or process of exchanging ideas on issues, topics or concepts in order to reach at a common understanding

- Use the activities given in this section to facilitate discussions on issues and Implications of Information Systems addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Required Instructional Resources:

- blackboard and chalk
- computer
- internet
- projector or display screen
- textbook

Assessment Strategies:

1. **Portfolio** - is a compilation of academic works and other forms of educational evidences assembled for the purpose of evaluating work quality, learning progress and academic achievement of students.

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts

- Work samples and your comments
- Assigned case stories
- Activity diary.

2. **Question and answer**- is a teaching method that allows direct communication or two-way traffic between the teacher and students

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercise /Assessment Activity** - are activities designed to help students develop knowledge, skills and positive values

- **Homework**: is a work or an activity that is done by students at home.
- **Classwork**: is an activity which is done in the classroom.
- **Assignments**: activities given by teachers for students to be done relatively over an extended period of time both individually and in groups.
  - You are advised to facilitate classwork for Activity 1.1 (#1), 1.2 (#1,#2,#4,#5,#6), 1.3 (#1), 1.4 (#1). you can use Activity 1.1(#2), 1.2(#3,#7 and #9,) and 1.3 (#2) for a homework individual assignment. Give activity 1.2 (#8 and #10) as group assignment.
  - Please make sure that students get feedback on their work as early as possible.

4. Observation - is a systematic watching of events and behaviors in educational settings.

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 1.1.

Make sure to explain the concept of digital (online banking) services for students better understanding to come up with the specific solutions for the brainstorming question.

Encourage students to discuss the many methods for gaining access to their online bank accounts, as well as the consequences of doing so. Tell the students about appropriate methods for safeguarding their online bank and other service accounts while they enjoy and use digital banking and other related services.

Ask the students to share their experiences about online and digital banking services including mobile, internet and card banking services and how someone could get access to a user's online bank account.

Explain issues that include critical questions the students' needs to answer about their use of digital services. e.g. what types of data should be shared and with whom?

Key points:

- Doing financial transactions on a public computer, tablet, or smartphone puts your bank account information at risk. Despite the fact that banks take every precaution to encrypt data sent over the internet, hackers may be able to retrieve login information and use it at a later date.
- The problem that banks and financial organizations face is that, on top of the security methods enforced by each bank and financial institution, users aren't always vigilant in securing their online personal and financial information.
- **Additional Reading for Teachers** - Hassen Osman (2006). Securing Your Information in an Insecure World: What You Must Know about Hackers and Identity Thieves, ISBN-13 : ₱978-1419650093

Answer to Activity 1.1

#1

Encourage students to refer all required resources and come up with possible answers.

Let each student have a turn to express their opinion. Share with students the fact that law enforcement agencies and security authorities monitor citizen's digital data and information used in the current digital world for national security-related purposes.

Officials from the government and law enforcement agencies can keep an eye on social media for useful information. Law enforcement agencies monitor social media for unlawful activities. During an investigation, law enforcement will frequently look at a suspect's social media pages to see what information they can find. Though each social network has its own protocols for responding to law enforcement requests, it's crucial to remember that the extent to which these sites cooperate, or don't comply, with law enforcement may not be clearly disclosed in their privacy policies.

Divide the students in to two groups, one in favor of and the other against, government agencies monitoring citizen's data and encourage group discussion.

- Facilitate the discussion among students and encourage learners to raise their concerns and ideas about agreeing/disagreeing about governments' attempts to monitor citizens' data and information used in the current digital world for national security purposes.
- Students compile and reflect their arguments to the class. Please also summarize the purpose of such monitoring attempts with respect to national security-related scenarios in framed and allowed manner.

It is also recommended to bring practical case studies and examples to elaborate the idea in more depth.

#2.

Encourage students to search all relevant resources including the Internet to find out which government agency is in charge of protecting Ethiopia's information and information infrastructure from harm. Currently Information Network Security Administration (INSA) aims to protect the national interest through building a capacity that enables safeguarding the country's information and information infrastructure.

Ask students to browse the INSA website (https://www.insa.gov.et) to get more information about INSA and the procedure to follow in order to report any attempts to harm national information and its infrastructure.

Note- it is always recommended to refer to the current concerned government office for the protection of our national information and its infrastructure.

Direction Brainstorming 1.2

- Start the session by discussing the impact of emerging information systems and the internet technologies in our daily social life. Before you start the class, please ask learners to reflect on Internet' technologies impact on our social life. Gather students' opinion and summarize the main impacts of Information systems and the internet technologies on our social life

Additional Tips for Teachers:

https://www.bbvaopenmind.com/en/articles/the-impact-of-the-internet-on-society-a-global-perspective/

Answer to Activity 1.2

#1.

It is noted that students who spend more unmanaged time on social media sites and playing computer games are likely to demonstrate poor academic performance. This is because they spend time chatting online and making friends on social media sites, enjoying long hours of video games instead of reading books and course-related resource and references. Ask students to form groups and discuss the

influence of inappropriate computer gaming and social media use on their' ability to accomplish higher academic goals. Encourage students to present their group's summarized findings to the class.

#2.

Research suggests that increased hours spent online may be associated with cyberbullying behaviors. Teenagers adjust to a different set of social standards when they connect with their peers online than they do in person. Due to the anonymity, they have online and their freedom to do so without being penalized against, they are frequently more aggressive or judgmental on social media. Cyberbullying is more prevalent among those who are addicted to social media and those who spend more time online.

Schools can help students in discussing cyberbullying to offer them an opportunity to understand the effects of their behavior and educate them for potential risks, whether it be through an awareness campaign or support group.

Additional Resources for Teachers - Read the following article to understand how social media addiction is linked to cyberbullying. It is also advised to refer to other similar research outputs to get more in-depth information.
https://news.uga.edu/social-media-addiction-linked-to-cyberbullying/

#3.

In the 21st century, students are expected to acquire many skillsets to be competitive and effective with their respective career choices. This includes understanding 21st century skills ,which refer to the information, practical abilities, professional skills, work habits, and character attributes that students need to succeed in today's environment, especially when they transition into college, the workforce, and maturity. In line with this, students' needs to have basic digital skills which are a set of skills for performing basic tasks involving the use of hardware, software and basic online operations. Examples of basic digital skills are: use basic hardware; use basic software and operate safely in an online environment

Encourage students to refer and explore 21st century skills to for their inputs and appropriate preparation. Those skills include Critical thinking, Communication skills, Creativity, Problem solving, Perseverance, Collaboration, Information

literacy, Technology skills and Digital literacy.

Additional Resources for Teachers- Refer Global framework on core skills for life and work in the 21st century by international labor organization (ILO)

#4.

Students can avoid plagiarism by through keeping track of the sources they consult in their work, paraphrasing or quoting the sources, crediting the original author in an in-text citation and in their reference list and also using a plagiarism checker before they submit the work.

#5.

Please facilitate students' discussions so that they can openly share their friends and family's technology use practices to one another for shared insights and peer learning. Encourage them to share both good practices and limitations during their reflection.

#6.

- Please facilitate the student's discussion about the possible area of habits improvements and guide the students by showing the impacts of each habit for their future.
- Show them, percentage of life video from internet using the link below so that students can understand the impact of social media addiction in their day-to-day life!
- If you have access to projector/plasma screen and Internet access, please download and present the following short videos named as "Percentage of Life" which is about the social media addiction impacts for the learners to support the discussion above.
    * Link - https://www.youtube.com/watch?v=0Y6v_1dwF3c&t=175s
    * You can also use additional resources from the internet that matches the topic at hand.

#7.

Please encourage the students to select any of the topics discussed above from unit one and support the proper ways of acknowledging the authors and sources while they present their reports.

#8.

Please encourage students to refer to previous national cyber-attacks reports from designated offices in our country and support them to identify the trending and common types of cyber-attacks and associated security mechanism to minimize the harm.

Please also tip the required skills for becoming cyber warrior for those interested students and aware all students about the advantage having the proper cyber awareness as a digital citizen.

At the time of the book preparation, the responsible agency for incident reports was Information Network Security Administration of Ethiopia (INSA).

Website www.insa.gov.et

#9.

- Appreciate the students to take a time and think of a type of job that they would like to have in the future. Support their potential professional skills and study program prioritization process
- Please also tip the students the advantages of such processes for their future and initial career plans preparations.

#10.

- Let students form a group of 3 students and work to find out list of jobs that have been made obsolete by advancement of technology like artificial intelligence, and jobs that are being created as a result of advancement of technology.
- Please tip the students that even if there are jobs become obsolete due to technology, there are also many jobs and opportunities created as a result of

technology advancements.

- Students needs also understand the role of technologies in each and every friend of disciplines and it is a mandatory requirement to have a better digital literacy and awareness to be successful on the current digital ecosystem irrespective of age, sex, geographical presence or educational levels.
- Please also summarize the students and show the next potential of technology in all aspects of life for students better understanding.

Direction Brainstorming 1.3

Ask students to discuss about the potential impacts of information systems on environmental pollution.

Environmental pollution is one of the most serious challenges worldwide. It is caused by uncontrolled release of wide-ranging pollutants on the earth. This is also true in the case of information system manufacturing process which creates large amounts of waste and uses computers and electronics that get thrown out when they break or become outdated. These electronics contain all sorts of hazardous materials that are very unsafe for the environment. So, we should always keep in mind about information systems disposal techniques while we maximize proper and environment ecofriendly information systems usage.

Answer to Activity 1.3.

#1.

Facilitate students group formation and assign a separate area of green technologies including solar technologies wind technologies, bio gas technologies etc. to explore the available green technologies on their community and beyond. Then encourage students to discuss about the role of green technologies for environmental protection and healthier life of the community in more depth.

#2.

- Direct and motivate the students to be a guardian and ambassadors of their environment from pollutions. Suggest how they can form a club or join

an initiative that advocates the protection of the environment and e-waste management techniques in their community.

- Assess any similar clubs or initiatives in your community and try to link the students for their insights and involvement as part of the community

Direction to Brainstorming 1.4

#1.

Please encourage students to take time and discuss in groups the negative impacts of information systems on people's lives and to bring practical examples and let them share their findings with the class.

The widespread adoption of Information Systems brings many potential benefits to health care. At the same time, problems with Information Technology and Systems can disrupt our health; the following are common problems.

- Computer Vision Syndrome
- Radiation
- Sleeping Disorders and Decrease in Productivity
- Loss of Attention and Stress
- Fear of technology
- Internet addiction and more.

In line with this, internet use can cause a combination of psychological, social, educational, or occupational problems in a person's life. Excessive usage of the Internet has been linked to academic, social, and interpersonal issues in numerous research studies. Excessive internet use can lead to a high degree of psychological arousal, which can lead to lack of sleep, long periods of fasting, and limited physical activity, as well as physical and mental health issues like depression, poor family connections, and anxiety.

Answer to Activity 1.4.

Mobile health makes use of technological tools to track health, collect data on health, and deliver remote care. This enables the development and maintenance

of health and wellness programs outside of the clinical context by nurse leaders, doctors, and patients. Due to the widespread use of mobile devices in healthcare settings, the number of medical software applications (apps) on these platforms has grown quickly. There are now many apps available to help health care professionals with many crucial tasks, including managing information and time, maintaining and accessing health records, communicating with patients, consulting with other professionals, gathering references and information, managing and monitoring patients, making clinical decisions, and learning and practicing medicine. In this regard, there are plenty of attempts in our country as well to extend the medical services to the community using mobile devices.

Encourage students to assess the current available medical software applications (apps) in our country and see what sort of information's and services are available.

1.2. Intellectual Property (IP)

Learning Competencies:

At the end of this section, learners will be able to:

- Define Intellectual property (IR)
- Explain the types of intellectual property rights (IPR)

This topic is expected to be covered in 2 periods.

Instructional Strategies

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive teaching, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Audio Visual Resource -**

- If Internet access is available, please demonstrate the video about Intellectual Property Right concepts using the link below.
- Video link: - https://www.youtube.com/watch?v=UqZJPuyK9VY
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion.**

- Use the activities given in this section to facilitate discussions about Digital Identity Management issues addressed in the textbook among students.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Assessment Strategies

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students to assess their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises / Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate a classwork for Activity 1.5 (1). As you see fit, you can use Activity 1.5 (2) for group assignment.
- Please make sure that students get feedbacks of their works as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 1.5

- Assign brainstorming questions as homework and let them present their findings in class. Select randomly a few students to share their understanding.
- **Additional Tips for Teachers -** Intellectual property is a category of property that includes intangible creations of the human intellect. There are many types of intellectual property, and some countries recognize more than others. The most well-known types are copyrights, patents, trademarks, and trade secrets. Currently, Ethiopian Intellectual Property Authority is in charge of handling and processing all intellectual property-related rights in Ethiopia. Additional information can be obtained from http://www.eipo.gov.et/.

Note- It is advised to revisit the mentioned website address for any updates or changes regularly

Answer to Activity 1.5

#1

- Patents prevent others from making or selling an invention, but trademarks protect the words, phrases, symbols, logos, or other devices used to identify the source of goods or services from usage by other competitors.
- Trademarks give the owner exclusive use of certain images and phrases, and the right to prevent others from using a similar mark that would

confuse consumers about who was producing the goods or services the consumer was buying.

Additional Tips for Teachers

- For more information, please visit the United States patent and trademark office (https://www.uspto.gov/) or Ethiopian Intellectual Property Authority's official website (https://eipo.gov.et/) or any relevant resources as appropriate.

#2 .

- Please group the students and encourage them to refer Ethiopian intellectual property authority's official website (https://eipo.gov.et/) Or other relevant resources to come up with the requirements to get a patent. Let students prepare report within their groups and present their judgment as to whether Koket's software can have the patent right or not.

1.3. Digital Identity Management

Learning Competencies:

At the end of this section, learners will be able to:

- Explain digital identity management
- Understand the benefits of digital identity management

This topic is expected to be covered in 2 periods.

Instructional Strategy

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive teaching, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Demonstration

- If Internet access is available , please show students about digital identity management: How much of your personal information do you control?
- Video link: - https://www.youtube.com/watch?v=H69l_trRArU
- Please use appropriate audio to accommodate visually impaired students.

3. Discussion

- Use the activities given in this section to facilitate discussions about Digital Identity Management issues addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Assessment Strategy

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples and your comments
  - Assigned projects
  - Activity diary.

2. Question and answer

- Please ask students to assess their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises/ Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork for Activity 1.6 (1). As you see fit, you can use Activity 1.6 (2) also for an assignment, or homework.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 1.6.

Encourage students to brainstorm the differences between digital and physical identity.

In today's digital ecosystem, everyone and everything has a digital identity. Digital identities (online identities) allow systems, services, and apps to know who they are interacting with. As the number of people, devices, and services, continues to grow exponentially, it is critical to manage the complete identity lifecycle and to ensure that the right access is granted only to the right person, or device.

Answer to Activity 1.6

#1.

There are many ways that information exchanged during our online activities can be used for purposes other than what the user intended. Any time you choose to engage in online business and social networking sites, you are taking certain risks. However, these practical tips may help learners to minimize the risks.

- Learn about the privacy options offered by any platforms you use, and regularly check your privacy settings.
- Use caution when disclosing your birthdate, age, or location. Data mining firms and identity thieves might find this material beneficial.
- Use third-party programs with caution.
- If you decide to accept a friend request from a stranger on social media, use privacy settings to restrict the information that the stranger can see, and use

caution when adding personally identifying information to your profile.

- If you have experienced stalking, harassment, or domestic abuse, exercise extra caution.
- When you no longer require access to social networking sites or other internet accounts, log out.

#2.

The development of the continent's trade, governance, social protection, financial inclusion, domestic resource mobilization, security, and human rights can all be impacted by the use of digital identity as a key catalyst. This makes it simple for anyone to check and share personal information with a wide range of internet service providers. Additionally, you can decide which credentials to give each service provider. By establishing trust between parties, a renewable digital identity provides consumers control over who may access this data. Hence Nation ID project of Ethiopia assumed to get the mentioned benefits for our citizens while achieving Ethiopia digitization approach in online service delivery in all sectors possible.

1.4. Collaborating through digital technologies

Learning Competencies:

At the end of this section, learners will be able to:

- Understand how to use Digital Technologies for collaboration
- Explain types of collaboration tools

This topic is expected to be covered in 2 periods.

Instructional Strategy

You are advised to use the following instructional strategies for this section:

1. **Interactive Teaching**

- Before the interactive teaching, , assess students' level of understanding using brainstorming questions.

- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Demonstration

- Internet access is available , please demonstrate the video about digital collaboration tools using the link below or you can select another videos to demonstrate the concept. . .
  - Video link: - https://www.youtube.com/watch?v=TSz2CxnuGkQ
- Please use appropriate audio to accommodate visually impaired learners.

3. Discussion

- Use the activities given in this section to facilitate discussions about Digital Identity Management issues addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. Question and answer

- Please ask students to assess their understanding of the topics at the beginning.

Make clarifications and corrections if the students have any misconceptions or misunderstandings.

- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises/ Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork for Activity 1.7. As you see fit, you can use Activity 1.8 as a group assignment.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 1.7

Encourage students to share their opinions about the potential benefits of digital collaboration tools to support their learning practices with and outside of classrooms. This will help to get their understanding about the role of digital collaborations tools for easing learning and teaching process.

Digital collaboration is not just about introducing new collaboration tools — it's about a way of working or learning that makes collaboration easier for students / teachers even when they are learning and teaching from different physical locations. That is why there is a need to better understand what digital collaboration really is and how it can change the way we learn and teach in the future.

Teachers can give a more dynamic learning experience by utilizing technology to facilitate a collaborative approach to teaching. Classes can be modified to meet the needs of each student. Utilizing online resources enables students to work at their own speed, pursue interests, and engage with classmates while doing so.

Answer to Activity 1.7

- Please encourage learners to come up with the most common collaboration tools they are using in their day-to-day activities. Learners might also ask

their elders and family members about their commonly used collaboration tools and the types of services obtained by each tool.

Answer to Activity 1.8.

- Based on the availability of the internet and associated resource, the teachers will choose a tool for digital collaboration activity and lead students' hand on skill demonstration as per the direction mentioned in the text book. Please encourage students to apply the steps and conduct the activity to meet the activity objective.
- Let students present their lessons and challenges during the activity. If learners can't get Internet access, please make sure to explain the intent of the activity to practice digital collaboration tools in the current digital work culture.

1.5. Engaging in Citizenship through Digital Technologies

Learning Competencies:

At the end of this section, learners will be able to:

- Understand how to engage in citizenship through digital technologies

This topic is expected to be covered in 2 periods.

Instructional Strategy

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If Internet access is available, please demonstrate the video about Digital Citizenship using the link below or you can select another videos to demonstrate the concept.
  - Video link: - https://www.youtube.com/watch?v=yfZN4_gP5kQ
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**

- Use the activities given in this section to facilitate discussions about Digital Identity Management issues addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students to assess their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings. Relate the concept of citizenship to grade 9 &10 Citizenship lessons and associate the role of digital technologies to support their initiatives as a digital citizen.

- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork for Activity 1.9 (1). And make Activity 1.9 (2) group assignment.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs

Direction to Brainstorming 1.7.

- Encourage learners to describe digital citizenship and support them to relate to role of digital technologies for digital citizenship. Let students form a pairs and discuss possible ways to apply digital technologies for citizenship engagement in their community and nationally.

Answer to Activity 1.9

#1.

Encourage students to bring suggestions and recommendations on how they can actively engage in their community's pressing issues using digital technologies as part of their citizenship role. Let learners present their concerns and discuss in groups what they can change in their own community. Also note that digital citizenship is about using technology in a positive and secure way. Digital citizenship goes beyond discussions about personal responsibility. A good digital citizen knows how to use digital technology successfully to interact with others, participate in society, project a positive image, and consume digital information in a safe and responsible manner. It's about being engaged citizens who create a positive and useful digital footprint and perceive chances instead of threats, opportunities instead of difficulties, and good image rather than a negative image.

#2.

Encourage students to assess issues in their community that need attention. Then, using available digital tools and selected social media outlets. Ask students to prepare a campaign to disseminate their message and show their ideas about the public. Students can take community issues including but not limited to community cultural heritage and tourist attraction sites that need to be promoted to the remaining community, unwanted cultural practices to inhibit their executions, or any national agendas that need citizens engagements to show the purposes and intentions for the large regional and global community.

As per the available resources and time, you can organize "Digital Citizenship Challenge Ambassador" competition among students to motivate their engagements and to show the real power of digital tools as a weapon to create awareness to wider community. Encourage students to be their community digital citizenship ambassador by making positive impacts by selecting and promoting societal challenges.

Answers to Review Questions

Part I- Answer Keys to True/False Questions

1. True

2. True

3. False

4. False

5. True

6. True

Part II – Answer Keys to Multiple choice questions.

1. **A**

2. **D**

3. A

4. A

5. D

Part III- Discussion Answers

#1.

Not all ethics violations are treated equally. Individuals who act unethically risk losing their jobs and their reputation, organizations risk losing their credibility, general morale and productivity may suffer, or the behavior may lead to huge fines and/or financial loss.

People will also be subjected to more severe sanctions based on the extent and type of the ethical violation committed, such as censure, permanent prohibition from holding any governmental office, restitution, decades in prison, and fines up

to hundreds of thousands of birr. As a result, it is recommended that you follow the law in all of your acts and activities.

#2.

Copyright, patent, and trademark are all different types of intellectual property (IP). Although three types of IP are very different, and people often confuse them. The major issues are summarized below.

	Copyright	Patents	Trademark
What's Protected?	Original works of authorship, such as books, articles, songs, photographs, sculptures, choreography, sound recordings, motion pictures, and other works	Inventions, such as processes, machines, manufactures, compositions of matter as well as improvements to these	Any word, phrase, symbol, and/or design that identifies and distinguishes the source of the goods of one party from those of others
Requirements to be Protected	Work must be original, creative, and fixed in a tangible medium	An invention must be new, useful, and non obvious	A mark must be distinctive (i.e., that is, it must be capable of identifying the source of a particular good)
Rights Granted	Right to control the reproduction, making of derivative works, distribution and public performance and display of the copyrighted works	Right to prevent others from making, selling using or importing the patented invention	Right to use the mark and to prevent others from using similar marks in a way that would cause a likelihood-of-confusion about the origin of the goods or services.

#3.

The 3 common component of digital collaborations includes peoples, tools and devices.

#4.

Digital citizenship refers to confident and positive engagement with digital technologies. A digital citizen is someone who has the knowledge and skills to participate in a global digital society and effectively use digital technologies to interact and communicate with others and to create and consume digital content. With the revolution in digital communications and the facilitation and speed modern technologies provide in communication operations and accessing information sources. And with the consequences, this revolution carries with positive effects on the individual and society if the means of communication and modern technologies are optimally utilized. And the negative effects stand out with the rebellion against the ethical rules, legal controls and basic principles that govern human affairs.

Part IV: Group Case Study

Please encourage the students to form groups and assess nearby schools, higher institutions, learning academies or private business companies that are implementing digital collaboration tools for their daily business operation. Assist the students in schools, offices or business units' recommendations and linkup to any concerned office holders. In line with this, encourage the students to prepare a check list to conduct the given activity. Then facilitate their case summery presentations for the class. Please summarize the purpose of the activity towards creating awareness to students about the current digital work space which is dominated by different collaborative tools and systems.

UNIT 2

EMERGING TECHNOLOGY

Unit Overview

This unit introduces concepts of emerging technologies and the various types of technologies that fall under the category of emerging technologies. particularly, big data, cloud computing, fog computing, and the internet of things (IoT) are discussed in detail. The areas of applications of the technologies and related topics are also covered.

This unit is expected to be covered in 10 periods.

Sub units	Number of periods allotted
Big data	3
Cloud computing and its services	3
Fog computing	1
Internet of Things (IoT)	3

Learning Outcomes

At the end of this unit, students will be able to:

- Describe the meaning and use of bigdata
- Explain cloud computing and fog computing
- Apply cloud computing services
- Explain the Internet of things (IoT) and its applications

The topics covered in the unit are:

- Big Data
- Cloud computing and its services
- Fog computing
- Internet of Things (IoT)

2.1. Introduction to Big data

Learning Competencies:

At the end of this section, students will be able to:

- define and explain bigdata
- explain characteristics of bigdata
- familiar with advantages, limitations and application of bigdata

This topic is expected to be covered in 3 periods.

Instructional Strategies:

1. **Interactive Lecture**

- Before the interactive teaching, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept of Big data. (You can use recommended video link below about Basics of Big data, or you can select appropriate videos by your own from the Internet).

- What Is Big Data? Introduction To Big Data
- https://www.youtube.com/watch?v=bAyrObl7TYE
- Please use appropriate audio to accommodate visually impaired learners.

3. Discussion

- Use the activities given in this section to facilitate discussions on Big data concepts in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources:

- blackboard and chalk
- computer
- internet
- projector or display screen
- textbook
- software's (web browsers, office packages)
- textbook
- smart mobile phone (Optional)

Assessment Strategies:

You are advised to facilitate homework for Activity 2.1 (#1 and #2). Activity 2.1 (#3) can be an assignment for students.

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercises /Assessment Activity (homework, classwork, assignment)**

- You are advised to facilitate homework for Activity 2.1 (#1 and #2). Activity 2.1. (3) can be an assignment for students.
- Please make sure that students get feedback on their work as early as possible.

4. **Observation**

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 2.1.

Every digital service we use generates enormous amounts of data in the digital environment in which we live. The amount of data generated is growing across the board, including in terms of data volumes. We are developing Bigdata as a result of the enormous volume of created data. Big data is a term used to describe a group of data sources that are so many and intricate that it is difficult to process them using standard data processing software or easily accessible database management tools.

Direction to Brainstorming 2.2.

The information may originate from openly available resources such as websites, social media, the cloud, mobile apps, sensors, and other hardware. Companies can see consumer information including purchase history, searches made or videos viewed, likes and hobbies, and more by accessing this data. Big data analytics examines data using analytical methods to uncover information such as occult patterns, correlations, market trends, and consumer preferences. As a result, analytics support businesses in making decisions that result in effective operations,

content customers, and higher profitability. Benefits includes improved efficiency, cost optimization, possible hazards detection, and focused and targeted marketing.

Answer to Activity 2.1

#1.

Customer data consists of the behavioral, demographic, and private data that companies gather on their clients. To better comprehend, communicate with, and interact with target customers, brands gather customer data. Three methods can be used to gather customer information: directly asking customers, indirectly following customers, and supplementing your own data with information from external sources. Ways to include collect data includes surveys, newsletter and blog subscriptions, promotions, competitions, and offers, customer orders, transaction history,web-tracking, marketing analytics, social media.

#2.

Customer data analytics is the process of gathering and analyzing customer information in order to better understand customer wants, price sensitivity, uncertainty when selecting products or services, etc., and create focused marketing and sales initiatives. Analyzing bigdata can be used to learn how frequently people interact with a company and to acquire fresh insights into brand perception and, can also be utilized to assess the effectiveness of various marketing strategies, resulting in increased profits. Data can be used by businesses to make decisions about:

- Discovering new clients.
- Improving client retention.
- Increasing client satisfaction.
- More effective marketing management.
- Monitoring social media activity.
- Trends in sales forecasting etc.

#3.

While gathering pertinent consumer data will help to categories target market more accurately and uncover purchase trends, it also frequently causes decision-makers to place an undue amount of reliance on the data and delegate decision-making. It is certainly admirable to use the evidence to guide a careful decision, but following

it without question or accounting for experience and gut feelings might result in bad choices. Massive data analysis goes against privacy rules. It is applicable for changing client records.

These limitations include the following, without being restricted to:

- Keeping big volumes of data on traditional storage can be costly.
- Massive data analysis violates privacy standards.
- It has the ability to alter client data
- It must be studied for a longer period of time in order to enjoy the benefits.
- The outcomes of big data analysis are occasionally false.

2.2. Cloud Computing

Learning Competencies:

At the end of this section, students will be able to:

- Define and explain cloud computing
- Explain cloud computing services
- Explain types of cloud computing

This topic is expected to be covered in 3 periods.

Instructional Strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of Cloud computing using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Audio Visual Resources**

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept better. (You can use recommended video link below about Cloud Computing Basics or you can select appropriate videos by your own).
  - Link- https://www.youtube.com/watch?v=M988_fsOSWo
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**

- Use the activities given in this section to facilitate discussions on issues and Implications of Information Systems addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- blackboard and chalk
- computer with internet service
- projector or display screen
- software (web browsers, office package)
- textbook
- smart mobile phone (optional)

Assessment Strategies:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples

- Assigned projects
- Activity diary.

2. Question and answer

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate homework for Activity 2.2 (1) part of class work and 2.2 (2) group class work activity.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 2.2

Encourage students to reflect their opinions when they hear the term cloud

- The term "Cloud" came from a network design that was used by network engineers to represent the location of various network devices and their inter-connection. The shape of this network design was like a cloud.
- Encourage students to reflect on their understanding and define what cloud computing is.

Answer to Activity 2.2

#1.

- Please encourage students to mention at least 2 cloud services familiar with. Ask students to share their experiences how they started using it and what types of services were used.. Twitter, LinkedIn, Instagram , TikTok etc.
- Answers include but are not limited to:
  - Mail services like Yahoo, Gmail
  - Social media platform services like Facebook
  - File storage services like drop box
  - Google Classroom
  - Microsoft Education Center
  - Virtual meeting applications like Zoom, Google Meet, Microsoft Teams etc

#2.

- Please select available cloud based file sharing application based on access and ease of use criteria and support students to install the selected application on their devices / school computers.
- Let students practice to save files on the cloud as per the activity details on their students textbook.

Note – You can recommend any file management application including dropbox (https://www.dropbox.com/) per the accessibility and let them practice saving files on the cloud.

Answer to Activity 2.3

#1.

- **Software as a Service (SaaS)-** The most well-liked option for businesses in the cloud sector is software as a service (SaaS). How come? All you need to utilize it is a browser and an internet connection, and it's totally automated. Due to the SaaS delivery model's need that providers manage all technical issues; customers do not need to rely on their internal IT resources.

- **Platform as a Service (PaaS)-** Increased developer productivity is one of the platforms as a service's (PaaS) most important benefits. Rapid development and more frequent functionality releases made possible by PaaS directly promote business agility.
- **Infrastructure as a Service (IaaS**) benefits include the most flexible and dynamic model, Cost-effective due to pay-as-you-go pricing, and easy to use due to the automated deployment of hardware

#2.

- SaaS is becoming an increasingly popular delivery model as an underlying technology that support web services and service-oriented architecture (SOA). Advantages includes easier administration, Automatic updates and patch management, Compatibility, Easier collaboration, and Global accessibility.

#3.

Encourage students to share their insights about SaaS and PaaS based services in our context. This might include but not limited to different Google and Microsoft Services as mentioned on their textbook.

2.3. Fog computing

Learning Competencies:

At the end of this section, students will be able to:

- Define and explain fog computing
- Understand the advantages of fog computing over cloud computing

This topic is expected to be covered in 1 period.

Instructional strategies:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of Fog computing using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students'

prior knowledge and understanding of the topic.

- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Demonstration

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept of Fog computing. (You can use recommended video link below about the basics of Fog computing or you can select appropriate videos by your own).
  - Link : https://www.youtube.com/watch?v=Sk6k9-5WGh8
- Please use appropriate audio to accommodate visually impaired learners.

3. Discussion

- Use the activities given in this section to facilitate discussions about Fog computing in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- computer with internet connection
- projector or display screen
- software (web browser, office package)
- textbook
- smart mobile phone (optional)

Assessment Strategies:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts

- Work samples
- Assigned projects
- Activity diary.

2. Question and answer

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate homework for Activity 2.4 as part of classwork.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 2.3.

#1.

fog computing differs from cloud computing in that cloud is a centralized system, whereas fog is a distributed decentralized infrastructure. fog computing acts as a go-between between hardware and remote servers. It controls whether data should be sent to the server and which should be processed locally. fog serves as an intelligent gateway that offloads cloud workloads, allowing for more efficient data storage, processing, and analysis.

Additional Tip for Teachers –

https://www.sam-solutions.com/blog/fog-computing-vs-cloud-computing-for-iot-projects/

Answer to Activity Questions 2.4

#1.

- fog computing places some of transactions and resource at the edge of the cloud, instead of establishing channels for cloud storage and utilization, and it also reduces the need for bandwidth by not sending every bit of information over cloud channels, and instead aggregating it at certain access points.

#2.

With the advent of the internet, the world has become a global village.

fog computing serves as a liaison between hardware and data centers, putting it closer to end users and making it more appropriate than cloud-based services for time-sensitive applications like video streaming, self-driving cars, smart grids, and smart cities.

2.4. Internet of Things (IoT)

Learning Competencies:

At the end of this section, students will be able to:

- Define and explain Internet of Things (IoT)
- Understand advantages and applications of Internet of Things (IoT)

This topic is expected to be covered in 3 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of Internet of Things (IoT) using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.

- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Audio Visual Resources

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept of IoT. (You can use recommended video link below or you can select appropriate videos by your own).
  - Link : https://www.youtube.com/watch?v=LlhmzVL5bm8
- Please use appropriate audio to accommodate visually impaired learners.

3. Discussion

- Use the activities given in this section to facilitate discussions on issues and Implications of Information Systems addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- computer with internet connection
- maintenance tools
- projector or display screen
- software (web browsers, office packages,
- textbook
- IoT appliances and sensors (optional)
- smart mobile phone (optional)

Assessment Strategies:

You are advised to employ use different assessment strategies for this section.

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples and your comments
  - Assigned projects
  - Saved documents
  - Activity diary.

2. **Question and answer**

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercises/ Assessment Activity (homework, classwork, assignment)**

- You are advised to facilitate homework for Activity 2.5 as part of classwork.
- Please make sure that students get feedback on their work as early as possible.

4. **Observation**

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 2.4

- Encourage students to find out about the benefits of the Internet other than social media and for the purpose of dissemination of information. Please relate the application of the internet in all sectors including the newly emerging technologies like internet of things. Ask students to reflect on their observation and understanding during class time.

Answer to Activity 2.5

#1.

- Some of the areas of home automation led IoT enabled connectivity, such as lighting control, gardening, safety and security, air quality, water-quality monitoring, voice assistants, switches, locks, energy, water meters, and more.
- Please encourage students to think list of routine activities that can be supported and managed by IoT at homes and support to identify the required list of devices, and other connectivity resources to apply it.

#2.

- Encourage students to work on the assignment by focusing on Ethiopia. Ask students to assess and present similar initiatives from other countries as per the availability of resources in your context.
- It is also recommended that students choose topic that interest them such as agriculture, manufacturing, banking or any other industry.

Answers to Review Questions

Part I. Answer Keys to True / False Questions

1. **B.**
2. **A**
3. **A**
4. **D**

Part II (a)- Answer keys to matching questions

1. **B**
2. **C**
3. **A**
4. **E**

Part II(b). Answer Keys to matching questions

1. **B**
2. **E**
3. **C**
4. **F**
5. **D**
6. **A**

Part III. Discussion Answers

#1.

- IoT aims at extending internet connectivity beyond computers and smartphones to other devices people use at home or for business. The technology allows devices to get controlled across network infrastructure remotely.

#2.

- IoT home automation is a technique for automating the control of household appliances using multiple control system paradigms. Windows, refrigerators, fans, lights, fire alarms, kitchen timers, and other home electrical and electronic equipment can all be controlled using a variety of control techniques. There are plenty of application of IoT including Elderly Care Monitoring, Smart Smoke Detectors, Home Energy Monitoring and Control, Smart Door Locks etc.

Note – Please support the students in selecting the required IoT Appliances and application software's for their group project activity. You can also support students by identifying the potentials IoT application areas to focus based on the availability of resources and support ecosystem.

#3.

- Big data is becoming a transformative tool for all aspects of education. Educators are using big data to craft personalized lesson plans, predict learning outcomes and even help students find colleges and majors that fit their interests and skills.

  Additional Audio Visual Resources – Students can browse Panorama Education website(https://www.panoramaed.com/)

#4.

- **Privacy control** - With fog computing, you can better control the level of privacy. You can process and analyze sensitive data locally rather than having to sending them to a centralized cloud for analysis. By keeping the process local, the IT team can monitor, track, and control any device that collects or stores data.
- **Increased business productivity and agility** - Fog computing helps improve productivity and increase the speed of business processes.
- **Data security** - Data security is among the most important aspects of the business. Fog computing allows you to connect multiple devices to a network.

Part IV.

- Please support the students in selection of organizations or community groups to conduct the assignment. Based on the available support systems and resources, you can consider to weight the assignment as part of your assessment plan to motivate their efforts. Also encourage student's effort so that they can get sense of real-life applications of IoT process and its associated requirements. The main objective of this group case study is to help students understand about IoT applications process and requirements in real world.
- You can also demonstrate any previously prepared sample projects if any to explain how they can easily plan for their group case study.

UNIT 3

DATABASE MANAGEMENT SYSTEMS

Unit Overview

This unit is the continuation of concepts and technologies of database management systems(DBMSs) from grade 11. The unit covers implementation of relational database using relational database management systems(RDBMSs), particularly Microsoft Access and manipulation of database using Structured Query Language (SQL). More specifically, it will focus on how to store, organize, and use data in the database using SQL.

This unit is expected to be covered in 20 periods.

Sub Units	Number of Periods Allotted
Overview of relational database management systems	2
Database manipulation using SQL language	2
Using SQL in Microsoft Access	2
Data definition language	4
Data manipulation language - INSERT, UPDATE, and DELETE	5
Data query language – SELECT	5

Learning Outcomes

At the end of this unit, students will be able to:

- Describe the relational database management system.
- Explain Fields and Records.
- Apply SQL DDL to create tables in a database.
- Differentiate between SQL DDL, DML and DQL.
- Apply SQL DML to manipulate records in tables.
- Apply SQL DQL to query records of tables.

Instructional strategies:

1. **Interactive Lecture:** is an active learning strategy in which the teacher employs activities to enhance students' engagement during the lecture.

2. **Demonstration:** is a practical exhibition and explanation of how something works or is performed.

3. **Discussion:** is the action or process of exchanging ideas on issues, topics or concepts in order to reach at a common understanding.

Required instructional resources:

- Computer with Microsoft Access DBMS installed
- Internet connection
- Projector or Display Screen
- Textbook

Assessment strategies:

1. **Portfolio:** is a compilation of academic works and other forms of educational evidences assembled for the purpose of evaluating work quality, learning progress and academic achievement of students.

2. **Question and Answer:** is a teaching method that allows direct communication or two way traffic between the teacher and students

3. **Exercises:** are activities designed to help students develop knowledge, skills and positive values.

- **Homework**: is a work or an activity that is done by students at home.
- **Classwork**: is an activity which is done in the classroom.
- **Assignment**: activities given by teachers for students to be done relatively over an extended period of time.

4. **Observation:** is a systematic watching of events and behaviors in educational settings.

3.1. Overview of Relational Database Management Systems

Learning competencies:

At the end of this section, students will be able to:

- Understand Relational Database Management System (DBMS)
- Describe features of RDBMS

This topic is expected to be covered in 3 periods

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. Interactive lecture

- Before the Interactive lecture, assess students' level of understanding using brainstorming questions on the database model they leant in grade 11. Students in grade 11 coved relational and other data models, so give students the chance to brainstorm what they know on different data models.

- Give focus on relational DBMS as the unit is about manipulation of RDBMS.
- During your lecture, don't forget to stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. Demonstration

- Demonstrate relational DBMSs as per examples given in the textbook.
- You can use projector (if you have access), or chalkboard or white board for your demonstration. Verbally describe your demonstration to help students with visual impairment.
- Please consider zooming in the demo to assist low vision students.

3. Discussion

- Use brainstorming and Activity 3.1 given in this section to facilitate discussions among students.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- While students discuss, observe the discussions carefully to notice areas where the group/ students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer with MS Access installed. As a pre-requisit, a 2013 or later version of access is assumed to practice and demonstrate activities in this unit.
- Internet connection
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. Question and answer

- Please ask students of their understanding of the topic at the beginning, in the middle and end of session. Make clarifications and corrections if the students have any misconception or misunderstanding. In the brainstorming question 3.1, students are expected to describe, clearly define database, DBMS and the different data model they have learnt in grade 11. At least they should be clear about the relational data model, how it differs from other data models and what the main features of relational data model are. Ask the difference between databases (i.e. schema designed using DBMS to store data) and DBMS (software tools used to maintain database) to clear the misconception. You can also tell students that there are many RDBMS tools to manage relational databases, such as MySql, Oracle, MS SQL Server, MongoDB, and Maria DB. You can also challenge students to expand their answers and knowledge by asking the limitation of RDBMS in general in the era of big data, to think and examine how it is addressed through other models such as NoSQL.

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate a classwork on brainstorming and Activity 3.1.
- Please make sure that students get feedbacks of their works timely.

4. Observation

- Please make sure that all students are participating and contributing to the class activities. Support and encourage low performing students for better performance, and those with special needs.

Direction to Brainstorming 3.1

#1

In grade 11, the students learnt the different data models. Data model is a blue print for building a database. It is an abstract model that organizes elements of data and standardizes how they relate to one another. It shows relevant entities and relationships to be included in the database. An entity is a distinct object (a person, place, thing, concept or event) in the organization that is to be represented in the database. A relationship is an association between entities. For example, customer buys products. Customer and products have relationship.

The **relational model** stores data into collections of two dimensional tables called "relations". In the relational data model, data and relationships are represented as tables, each of which has a number of columns with a unique name. (Refer to grade 11 unit three, database managment systems, for more)

Answer to Activity 3.1

#1

Fields	Example
Book Title	IT for Grade 12
Email	hana@gmail.com
Sales Date	April 12, 2022
Body temperature	36.5 °C
Weight	72kg
Cost of material	1250 birr
Expire date	January 2021
Opening hour	08:30A.M

#3

A patient can be described by many fields including: name(Text), address(Text), data visited(Date), blood pressure(real), age(integer), etc.

Answers to Activity 3.2

#1

A database management system (DBMS) is a software system used to create, maintain, and provide control access to the database. There are different types of DBMS which are built based on different data models. Features of the RDBMS are sum-

marized below:

Relational database management system
• The relationship is based on relational data model • The basic structure of a relational database is table that comprises rows that are made up of one or more columns. • Table represents entities or event, column represent attributes, and each row represents records. • SQL is a language for relational database. • Primary key is a field uniquely identifies each row. • Foreign key is a field which is a primary key in another table and used to create link or relationship between tables. • The most common DBMS for the last 40 years. • Limitation - now challenged with big data – which require highly flexible and adaptable schema. • Examples of RDBMS include MS Access, Oracle, MongoDb, etc.

#2

Field also referred to as column is an attribute that describe the entity or the event in a table. E.g. fields for **Person** includes Name, age, address; fields for **Book** includes book title, author, page number, edition; fields for **Sales** includes item name, price, date, quantity, etc.

#3

A record also called a tuple, is a row in a table. E.g. a record from 'Student' table could be: id: 'S1001', name: 'Maru', age: 20.

3.2. Database manipulation using SQL

3.2.1 Using SQL in Microsoft Access

Learning competencies:

At the end of this section, students will be able to:

- Describe SQL
- Explain the purpose of DDL, DML and DQL commands
- Open SQL in MS Access.

This section is expected to be covered in 2 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Start the class by reviewing the previous session particularly relational DBMS features. You can take the first 3 to 5 minutes for this purpose. This help you to assess students' level of understanding to start the day's lesson.
- Based on the textbook provide your lecture on basic concepts of data manipulation using SQL, describe purpose and category of different SQL command, and demonstrate where to start SQL using Access. Relate your lecture to earlier lessons on RDBMSs and what they know from grade 11 on databases.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please demonstrate how to start SQL query in Access. In the absence of projector you can use blackboard or white board for your demonstration.
- Please consider zooming in the demo to assist low vision students. Verbally

describe your demo to help visually impaired students.

3. **Discussion**

- Use the activities given in this section to facilitate discussions among students on SQL and starting Query in Access.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- Internet connection
- Microsoft Access
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students of their understanding of the topics at the beginning, in

the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.

- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts. Ask the challenges they face in Activity 3.3, such as pop up window (which they can cancel), default query name (which they can rename and save).

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate a classwork for Activity 3.2. As you see fit, you can use Activity 3.3 for a classwork, an assignment or homework.
- Please make sure that students get feedbacks of their works as early as possible.

4. Observation

- As the topic requires students to actively participate in the discussion and practice using MS Access, please walk around and observe that the students work. Encourage those who lag behind to do better, and provide support to those with special needs

Direction to Brainstorming 3.2:

Direction – SQL is a language for database whereas programming language is a language to write different types of applications(desktop or web based). SQL is for manipulating database. You can use SQL to create, insert, update and delete records of a table.

Answers to Activity 3.3:

#1

SQL command
CREATE TABLE table_name
ALTER TABLE table_name
DROP TABLE table_name
INSERT INTO table_name
UPDATE table_name
DELETE

#2

SQL command	Category
CREATE TABLE table_name	DDL
ALTER TABLE table_name	DDL
DROP TABLE table_name	DDL
INSERT INTO table_name	DML
UPDATE table_name	DML
DELETE	DML

Direction to Brainstorming 3.3

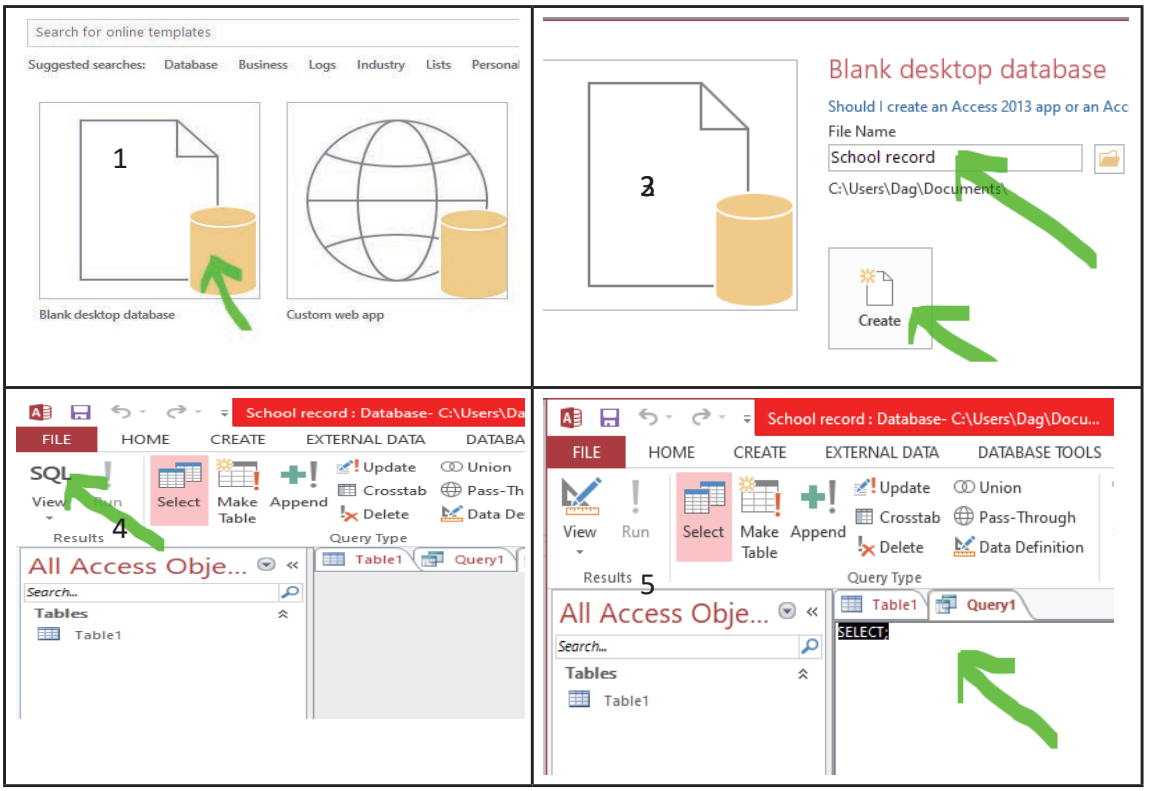
MS office package consists of various applications such as Ms Word, Ms Excel, Ms Access, Ms PowerPoint, Ms Publisher, etc. The purpose is to remind students that Ms Access is one application in the office package and a default installation for database management.

There are two ways to check that Microsoft Access is installed in your computer. The first option is using the windows start search. Just type 'access' in search area. This should result list of installed apps in the computer. The second option is click on start menu icon --> then click on 'App apps' --> find Microsoft Office from the list find Access if it is installed. If the Microsoft Access is installed the version is usually the year following the name of the package. E.g. Acess 2013, Access 2017,etc.

Answers to Activity 3.4:

#1

The following screen shot shows the step by step demo to open query on MS Access.



3.2.2 Data Definition Language (DDL)

Learning competencies:

At the end of this section, students will be able to:

- Describe DDL language
- Write SQL command to create, modify and drop table.
- Create relationship between tables using ALTER command.
- Create relationship using 'Relationships' database tool in MS Access.

This topic is expected to be covered in 4 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the interactive-lecture, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties. As good practice tell students not use space as part of field name as it generate error. E.g. Use FirstName instead of First Name.

2. **Demonstration**

- If you have access to a projector, please demonstrate how to use DDL in MS Access.
- Please consider zoom in the demo to assist low vision students.

3. **Discussion**

- Use the activities given in this section to facilitate discussion on DDL using MS Access.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- Internet connection

- MS Access
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary

2. **Question and answer**

- Please ask students of their understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.
- Ask questions like how columns, data types, table name, primary key are described in the CREATE TABLE command. How relationship is created between two tables.
- How foreign key is described and what is the precaution. Ask also how to use ALTER command to modify column definition or type, set primary key or add foreign key one the table is created.
- Ask how a relationship can be created in 'Relationship' window and what the line and symbol mean.
- Semi-colon at the end of SQL statement is optional, it doesn't cause any error. But it is good practice to use it for code clarity.

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate a classwork for Activity 3.4. As you see fit, you can use Activity 3.5 for a classwork, an assignment or homework.
- Please make sure that students get feedbacks of their works as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who lag behind to do better, and provide support to those with special needs

Answers to Activity 3.5:

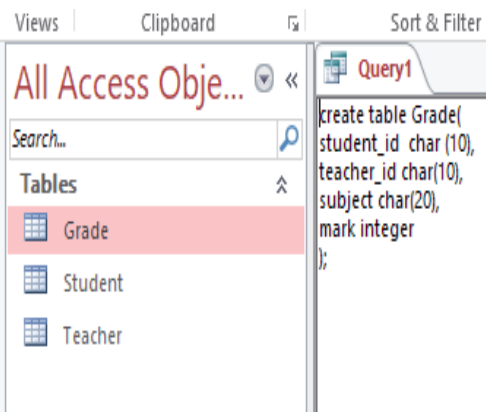
#1 and 2

SQL commands and the resulting tables are presented below.

```
create table Student(
student_id  char (10) primary key,
name char(20),
sex char(1),
age Integer,
grade_level Integer
);
```

```
create table       Teacher(
teacher_id char (10) primary key,
name char(20),
sex char(1),
age integer,
specialization char(15),
);
```

```
create table Grade(
student_id  char (10),
teacher_id char(10),
subject char(10) REFERENCES Course(C_
Code),
mark integer
);
```



#3

Missing comma between columns (P_Name and P_Age) and closing curly brace ‘)’

CREATE TABLE Patient (pid INTEGER, P_Name TEXT, P_Age INT)

Missing the keyword TABLE next to CREATE.

CREATE TABLE Physician (id CHAR, name TEXT, DoB DATETIME, PRIMARY KEY(id))

Missing brace around field ‘pid’ and incorrectly spelling ‘REFERENCES’ as ‘REFERENCE’

CREATE TABLE Treatment (ptid INTEGER REFERENCES Patient (pid), drId CHAR REFERENCE Physician (id))

#4

From the nature of data value, first decide the appropriate data type and then count the maximum character in the data value.

employee id	Name	position	Bank account	Bank
1	Herpasa Mekonnen	Internist	7555666111	Wegagen
4	Selamawit Kassu	Head of Clinic	4509008755	Dashen
6	Animaw Mekuwanint	Paediatrician	1000010150198	CBE
7	Sirage Aliyu	Psychiatrist	1080880880880	Abyssinia
Auto number or COUNTER data type in MS Access	Text, max size 17 or you can make it 20	Text, max size 18 or you can make it 20	As INTEGER can't hold the value you can use Text size 13	Text size is 9 but depending on the possible value size added you may set to 15

```
CREATE TABLE Physician(
employeeId  COUNTER, Name TEXT(20), Position TEXT(20), BankAccount TEXT(13),
Bank TEXT(15),
PRIMARY KEY(employeeId)
)
```

Answers to Activity 3.6:

#1

ALTER TABLE Physician ALTER COLUMN employeeId CHAR(7);

ALTER TABLE Physician ADD PRIMARY KEY(employeeId);

ALTER TABLE Physician ADD COLUMN dateOfHire DATETIME;

#2

The following ALTER command modifies the grade table to create a relationship between course and grade, and department and grade.

```
ALTER TABLE Grade ADD FOREIGN KEY(stu-
dent_id) REFERENCES Student(student_id), FOREIGN
KEY(teacher_id) REFERENCES Teacher(teacher_id);
```

Or you can write the following two alter statements.

```
ALTER TABLE Grade ADD FOREIGN KEY(student_id)
REFERENCES Student(student_id);

ALTER TABLE Grade ADD FOREIGN KEY(teacher_id)
REFERENCES Teacher(teacher_id);
```

Answers to Activity 3.7:

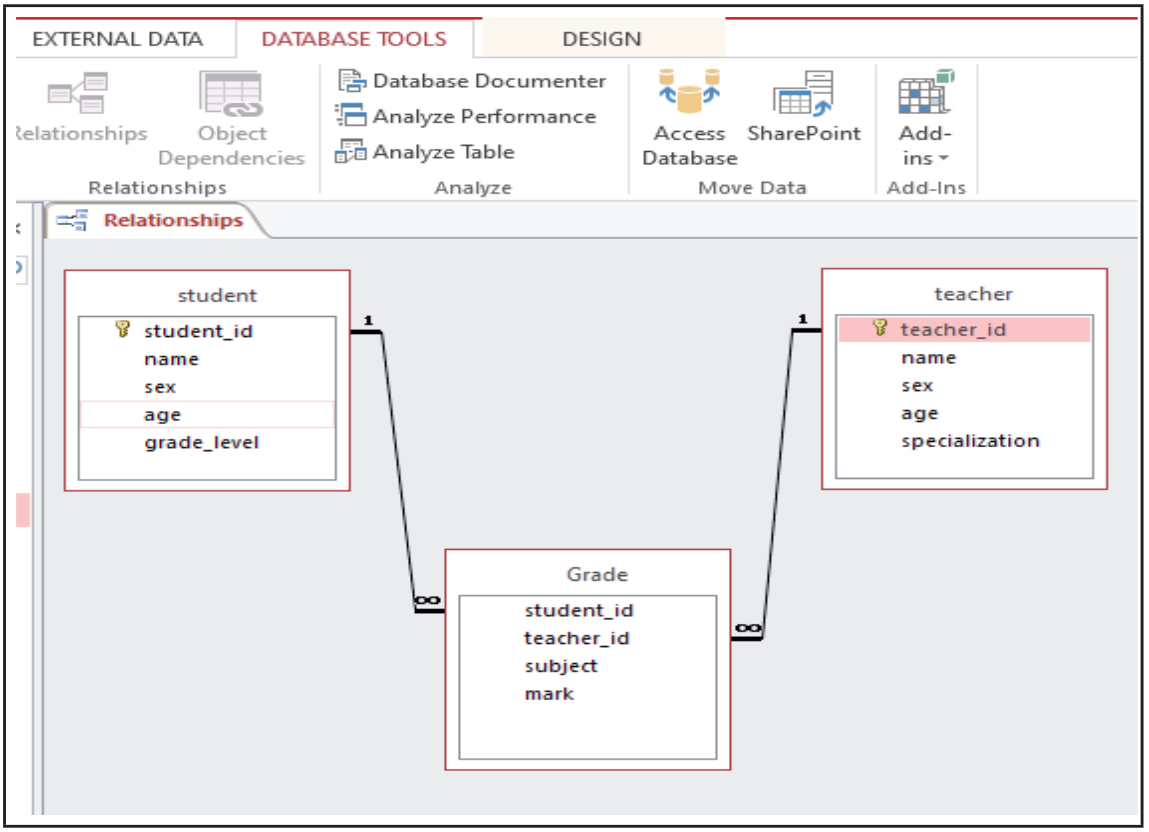
#1

```
CREATE TABLE School (SName  CHAR(50), Level CHAR(20));
DROP TABLE School;
```

Answers to Activity 3.8:

#1

When you open your database and click the 'Relationships' database tool, you should see relationship diagram similar to the diagram below. This is a relationship created using ALTER command (See your answer for Activity 3.5 question 2 above).



3.2.3 Data Manipulation Language

Learning competencies:

At the end of this section, students will be able to:

- Describe data manipulation language(DML).
- Use DML commands to manage data in the database.
- Demonstrate DML commands in Microsoft Access.

This topic is expected to be covered in 5 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the gapped-lecture, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students'

prior knowledge and understanding of the topic.

- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Demonstration

- If you have access to a projector, please demonstrate how use DML using MS Access.
- Please consider zooming in the demo to assist low vision students.

3. Discussion

- Use the activities given in this section to facilitate discussions on DML using MS Access among students.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- Internet connection
- MS Access
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students of their understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercises (homework, classwork, assignment)**

- You are advised to facilitate a classwork for Activity 3.8. As you see fit, you can use Activity 3.9, 3.10, 3.11, and 3.12 for a classwork, an assignment or homework.
- Please make sure that students get feedbacks of their works as early as possible.

4. **Observation**

- Please make sure that students participating and contributing to the class activities. Encourage those who lag behind to do better, and provide support to those with special needs

Direction to Brainstorming 3.4

Direction – Students have some background about data manipulation when they learnt about data and information both in grade 11 and 12, unit one. Data manipulation can relate to the processing of data. Data can be manipulated to update some part of the content, add or insert new content, or delete or remove

unnecessary content. Therefore, the same concept applies in a database to insert new records, update existing records, or delete records.

Answers to Activity 3.9:

#1

You can use one of the two INSERT INTO commands to add data. Here are samples:

INSERT INTO Student VALUES('1001/2013', 'Halima Ali', 'F', 16, 11);

INSERT INTO Teacher VALUES('2001/2010', 'Roman Nesibu', 'F', 31, Physics);

INSERT INTO Grade Values('1001/2013', '2001/2010', 'Physics', 80);

#2

.The key work INTO has no space. Number of fields and number of destination fields are not the same. You can rewrite as:

INSERT INTO GRADE VALUES('1012/13', '2023/2010', 'English', 90)

These are field names, missing value for name, the field Sex expect a single value (F or M). You can replace appropriate data value.

INSERT INTO TEACHER VALUES('1234/2013', 'Muna', 'F', 20, 12)

Fields and values mismatch. You can rewrite as:

INSERT INTO STUDENT (Student_id, Name, Sex) VALUES('1015/13', 'Yared','M')

#3

INSERT INTO Student (Student_id, Name, Age) VALUES('1001/2014', 'Meymuna', 20);

INSERT INTO Student (Student_id, Name, Age) VALUES('1002/2014', 'Alehegne', 20);

INSERT INTO Student (Student_id, Name, Age) VALUES('1003/2013', 'Kello', 19).

Answers to Activity 3.10:

#1

Update command for student and teacher table

UPDATE Student SET name='Halima Mohamed' WHERE (student_id ='1001/2013');

UPDATE Teacher SET specialization='Economics' WHERE (teacher_id ='2010/2010');

Answers to Activity 3.11:

#1

Update all records in student table

UPDATE Student SET grade_level=12;

Answers to Activity 3.12:

#1

Delete command to delete one record from student table

DELETE FROM Student WHERE student_id='1010/2013';

#2

Delete all records in grade table

DELETE * FROM Student;

3.2.4 Data Query Language – Select Command

Learning competencies:

At the end of this section, students will be able to:

- Describe data query language(DQL).
- Use data query language(DQL) command to select data from the database.
- Demonstrate data query language based on different criteria on Microsoft Access.

This topic is expected to be covered in 5 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the gapped-lecture, assess students' level of understanding using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please demonstrate how to use data query language(DQL) using Microsoft Access.
- Please consider zooming in the demo to assist low vision students.

3. **Discussion**

- Use activities given in this section to facilitate discussions on data query language(DQL) using Microsoft Access.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- Internet connection
- MS Access
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary

2. **Question and answer**

- Please ask students to check their understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercise/ Assessment Activity (homework, classwork, assignment)**

- You are advised to facilitate a classwork for Activity 3.12. As you see fit, you can use Activity 3.13 and 3.14 for a classwork, an assignment or homework.
- Please make sure that students get feedbacks of their works as early as possible.

4. **Observation**

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who lag behind to do better, and provide support to those with special needs

Direction to Brainstorming 3.5:

Direction – Students usually query various types of information from Google or other applications. The same analogy works in database, so a query can either be

a request for data results from a database or for action on the data, or for both. A query can give an answer to a simple question, perform calculations, combine data from different tables, add, change, or delete data from a database.

Answers to Activity 3.13:

#1

```
SELECT * FROM Grade;
```

#2

```
SELECT * FROM Student;
```

#3

The symbol (*) means all fields in a table. When the table has many columns, it is good practice to use asterisk instead of listening all fields which could cause for error because of naming error.

Answers to Activity 3.14:

#1

```
SELECT * FROM Grade WHERE mark>50;
```

#2

```
SELECT  * FROM Teacher WHERE sex='F'
```

#3

```
SELECT Name FROM Student WHERE grade_level=12;
```

Answers to Activity 3.15:

#1

```
SELECT * FROM Teacher WHERE specialization='Mathematics' ORDER BY name;
```

#2

```
SELECT * FROM Teacher ORDER BY sex;
```

#3

```
SELECT * FROM Patient ORDER BY Temperature DESC;
SELECT * FROM Patient ORDER BY VisitDate ASC;
```

Answers to Review Questions

Part I: Answer Keys

1. D
2. C
3. B
4. C
5. A
6. A
7. C
8. B
9. C
10. B
11. B
12. C
13. D

Part II: Answer Keys

Please advise the student to select a database problem in students' surrounding. Sample problems are listed as hint in the student text book. Guide to work on the following:

- Identify entity (table) and potential attributes for the table.
- Identify relationship between entities.
- Implement the table on MS Access.
- Insert at least three records in each table created.
- Modify at least one table by adding additional column.
- Write queries to select records.

UNIT 4

WEB DEVELOPMENT

Unit Overview

This unit is about a widely applicable markup language called XML. Overview of XML, syntax rules for writing XML documents, integrating style, comparison of XML vs HTML, and publishing website are discussed in depth. When required links are provided for further reading.

This unit is expected to be covered in 25 periods.

Sub units	Number of periods allotted
Introduction to XML	1
Elements of XML Documents	7
Creating XML Documents	7
HTML vs. XML	3
Publishing website s	7

Learning Outcomes

At the end of this unit, students will be able to:

- Explain extensible markup language(XML)
- Analyse an XML document
- Describe basic XML tags
- Apply the syntax rules of XML documents
- Create simple XML documents
- Compare and contrast HTML vs. XML

The topics covered in the Unit are:

- Introduction to XML
    - Elements of XML Documents
    - Start your XML Documents
- HTML vs. XML
- Publishing website

Instructional strategies:

1. **Interactive Lecture:** is an active learning strategy in which the teacher employs activities to enhance students' engagement during the lecture.

2. **Demonstration:** is a practical exhibition and explanation of how something works or is performed.

3. **Discussion:** is the action or process of exchanging ideas on issues, topics or concepts in order to reach at a common understanding.

Required instructional resources:

- Computer
- Internet connection
- Projector or Display Screen
- Textbook

Assessment strategies:

1. **Portfolio:** is a compilation of academic works and other forms of educational evidences assembled for the purpose of evaluating work quality, learning progress and academic achievement of students.

2. **Question and Answer:** is a teaching method that allows direct communication or two way traffic between the teacher and students

3. **Exercises:** are activities designed to help students develop knowledge, skills and positive values.

- **Homework**: is a work or an activity that is done by students at home.
- **Classwork**: is an activity which is done in the classroom.
- **Assignment**: activities given by teachers for students to be done relatively over an extended period of time.

4. **Observation:** is a systematic watching of events and behaviors in educational settings.

4.1. Introduction to XML

Learning competencies:

At the end of this section, students will be able to:

- define extensible markup language (XML),
- describe the purpose of XML,
- describe XML tags,
- create user defined tags to structure documents.

This topic is expected to be covered in 1 period.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Students covered HTML in grade 11, so before starting interactive lecture, assess students' level of understanding about markup language, HTML tags, purpose of HTML using brainstorming questions.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic Markup language, HTML and its tag.
- During your lecture, don't forget to stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please show students sample XML documents, or write sample XML code on the blackboard or white board using a variety of color to focus the different part, or
- Please consider zooming in the demo to assist low vision students, or use jaws (screen reader) to assist the visually impaired students.

3. **Discussion**

- Use activities given in this section to facilitate discussions among students. Questions in Activity 4.1 and Activity 4.2 are good for this purpose.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- While students discuss, observe the discussions carefully to notice areas where the group/ students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section. If you have access to computer and internet connection, you can use to demonstrate sample XML document from the internet using projector. In limited connection environment you may write sample XML document from the textbook, e.g. Figure 4.1.

- Computer
- Internet connection
- Projector
- Textbook

Assessment strategies:

You may use the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students'

learning progress. For this section, the portfolio might include:

- Rough notes and drafts
- Work samples and your comments – while students are conducting discussions and activities in this section.
- Activity diary.

2. Question and answer

- Please ask students at the beginning, in the middle and end of sessions, to know the level of their understanding of the topic. Make clarifications and corrections if the students have any misconception or misunderstanding. Questions in Activity 4.3 are helpful for this purpose.

3. Exercises(homework, classwork, assignment)

- You are advised to facilitate a classwork on Activity 4.3.
- Please make sure that students get feedbacks of their works timely.

4. Observation

- Please make sure that all students are participating and contributing to the class activities. Support and encourage low performing students for better performance, and those with special needs.

Direction to Brainstorming 4.1

#1

Students can remember many facts about markup language from grade 11 IT text-book unit three of 'Web Development', about the definition of markup language, tags used in HTML, purpose of tags, presenting web content, etc.

Answers to Activity 4.1

#1

There are many facts about XML: definition, purpose, parts of XML, tags, features, tools to edit XML, etc.

XML is a standard open format markup language for structuring a document, rather than formatting information on a page. XML is considered as structured data. XML is for structuring data, looks a bit like HTML text but is meant to be read. It was developed in the 1990s (as HTML does not allow the definition of new text elements and is not extensible). XML facilitates data sharing, transfer, platform changes and availability. It is appropriate for handling data with a complex structure. XML has its own standard. For example, XML as a markup language uses tags which are enclosed in a less than symbol "<" and a greater than symbol ">". However, HTML uses predefined tags such as <head>, <title>, <h>, <body> , etc., while XML uses custom tags. You define your tag that meet the exact needs of your document.

If you have internet access, please find more information on the following websites:

https://www.w3.org/XML/1999/XML-in-10-points

https://history-computer.com/complete-history-of-the-extensible-markup-language/

Answers to Activity 4.2

#1

In XML you can use custom tags that can be appropriate to describe the document. For instance, for structuring regions and cities in Ethiopia, the possible tag could be <Country>, <Region>, <Regional Cities>, etc. However, in HTML we have standard tags such as <Head>, <Body>, <Title>, <H1>, etc. (Please refer Grade 11 ICT textbook section 4.3 about HTML Basics).

#2

No, because HTML is about the presentation, whereas XML is about the structure of a document. Both HTML and XML complement each other instead of one replacing the other.

#3

XML used for structuring data for storage where a relational database is inappropriate, and structuring data for presentation on Web pages.

4.1.1 Elements of XML Documents

Learning Competencies:

At the end of this section, students will be able to:

- Describe elements of XML documents.
- List XML tags and their purpose.
- Write a simple XML document.

This topic is expected to be covered in 7 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Based on the feedback gained in section 4.1, in this section before starting the interactive lecture on elements of XML, you may ask or remind the basic elements of markup language – like use of tags to design the structure of a document.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic. A discussion on elements of XML starts by presenting a sample XML document and describing the interpretation using examples. Besides, additional elements of the XML are discussed. As the topic is estimated to be completed in three periods, you may divide the text content in to three which can be managed in a period.
- During your lecture, don't forget to stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please display XML tags and elements in sample XML documents. In the absence of a projector, you may write sample XML documents from the textbook and demonstrate for the class.
- Please consider zooming in the demo or describe orally to assist low vision students.

3. Discussion

- Use activities given in this section to facilitate discussion on elements of XML documents and writing a simple XML documents. Question 1 in Activity 4.4 is appropriate for this purpose.
- As you see fit, use small groups and let a member of each group report the result of their discussion on elements and writing XML tags to the class.
- While students discuss, observe how they understand XML elements, write XML tags and use tags carefully to notice areas where the group or students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section. Computer with projector can be used to demonstrate the elements and write XML tags. Internet connection if available is appropriate to demonstrate various sample XML documents.

- Computer
- Internet connection
- Projector
- Textbook
- XML Notepad editor at https://microsoft.github.io/XmlNotepad/

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Work samples and your comments
  - Assigned activity
  - Activity diary.

2. **Question and answer**

- Please ask students of their understanding of the topic at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding. The question in Activity 4.4 is appropriate for this purpose.

3. **Exercises (homework, classwork, assignment)**

- You are advised to facilitate a classwork or homework on Activity 4.4 question 2.
- Please make sure that students get feedbacks of their works timely

4. **Observation**

- As the topic requires students to understand elements of XML and practically write XML documents, please walk around and observe that the students are actively engaged in the activities. Encourage those who lag behind to do better, and provide support to those with special needs.

Answers to Activity 4.3

1

Direction - Observe whether the student correctly identify the elements of XML document (discussed under Figure 4.2 of student textbook) and describe their purpose.

#2

This is not the only way or structuring the food menu. Try to examine the logical organization of the data if students are coming up with a different structure.

XML structure for food menu data

```
<?xml version=”1.0” encoding=”UTF-8”?>
<food_menu>
        <food>
                <description>
                        <food_name>Kitfo</food_name>
                        <price>100.00br.</price>
                </description>
        </food>
        <food>
                <description>
                        <food_name>Dorowet</food_name>
                        <price>120.00br.</price>
                </description>
        </food>
        <food>
                <description>
                        <food_name>Shero</food_name>
                        <price>70.00br.</price>
                </description>
        </food>
</food_menu>
```

4.1.2 Start your first XML document

Learning Competencies:

At the end of this section, students will be able to:

- Write XML in a text editor and save it with an .xml extension.
- View/open an XML file using a browser.
- View XML source code using ‘view page source’.
- Describe an XML document viewed on a browser.

- Open an XML file using XML Notepad.
- Modify an XML file using XML Notepad.
- Describe a syntax rules of XML.
- Explain entities.
- Use XML document with document type declaration(DTD).
- Describe the structure of document type declaration(DTD).

This topic is expected to be covered in 7 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the interactive lecture, remind students about elements of XML documents.
- Using the textbook, lecture the class about starting your first XML document. The topic is wide and estimated to take three periods. Divide the topic into three to fix your daily lesson plan.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- Please download and install the XML editor suggested for the course (i.e. XML Notepad). Other XML editor more accessible can also be used. If you have access to a projector, please demonstrate how to create an XML file, write and save XML elements on a text editor, and display XML on a browser, as well as on XML Notepad.
- Please consider zooming in the demo to assist low vision students.

3. **Discussion**

- Use questions in Activity 4.5 and Activity 4.6 to facilitate a discussion on XML writing, opening and modifying using text editors and XML Notepad

and display examples on browsers among students.

- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- XML Notepad downloaded and installed before the class
- Internet connection
- Projector
- Textbook
- XML Notepad editor at https://microsoft.github.io/XmlNotepad/

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Work samples and your comments on Activities.

2. **Question and answer**

- Please ask students question(s) to check their understanding of the topic at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding. Questions could include – writing correct XML elements, organize given data correctly, use XML editor correctly and displaying XML using a browser.

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate a classwork based on the three activities one for each period.

As you see fit, you can use Activity 4.5, Activity 4.6 and 4.7 for a classwork, an assignment or homework.

- Please make sure that students get feedbacks of their works as early as possible.

4. Observation

- As the topic require students to practically write, open and modify XML, please walk around and observe that the students are actively engaged in the activities. Encourage those who lag behind to do better, and provide support to those with special needs.

Answers to Activity 4.4

#1

Direction - Please assist the students to write the XML document given as example in the student textbook in any text editor (notepad, wordpad) and save it as test. xml. Then, open it using at least two browsers and let them discuss the differences or similarities they observed such as color-code, plus(+), and minus(-)

#2

Direction - Let them repeat activity 4.4, but open from XML Notepad. In case you do not have XML Notepad, please download from the following URL.

https://microsoft.github.io/XmlNotepad/

Answers to Activity 4.5

#1

All of the XML coding has some errors – root or parent, attribute, case-sensitive, and special symbol related. The correct XML codes are as follows.

Corrected XML code
<note><to>Lucy</to><from>Hadar</from></note>
<student id=”1010”><name>Edossa</name></student>
<Birth_Date>Date of Birth</Birth_date>
<compare>10>5</compare>
<FullName> Robso Amanueal </FullName>

Answers to Activity 4.6

#1

XML document with internal DTD
<?xml version=”1.0”?> <!**DOCTYPE** textbook [<!**ENTITY** author “Author: Addis Ababa University. “> <!**ENTITY** copyright “ Copyright: Ministry of Education.”>]> <textbook>&author;&copyright;</textbook>
Output on browser
This XML file does not appear to have any style information associated wi −<textbook> Author: Addis Ababa University. Copyright: Ministry of Education. </textbook>

Additional Tips: Please see the following website for more details on XML.
https://www.w3schools.com/xml/

4.2. HTML vs XML

Learning competencies:

At the end of this section, students will be able to:

- Compare and contrast HTML and XML.
- Describe the benefits and drawbacks of XML.

This topic is expected to be covered in 3 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the interactive lecture, brainstorm the students' understanding by discussion of features of XML vs HTML.
- Using the textbook, lecture the class about XML vs HTML – compare and contrast, advantages and disadvantages.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please show students a sample XML document vs. a sample HTML document for comparison.
- Please consider zooming in the demo to assist low vision students.

3. **Discussion**

- Use activities given in this section to facilitate discussion among students. Brainstorming, Activity 4.9 and Activity 4.10 are appropriate for this purpose.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- Internet connection

- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts on activities.
  - Activity diary.

2. **Question and answer**

- Please ask students at the beginning, in the middle and end of sessions, to know the level of their understanding of the topics. Make clarifications and corrections if the students have any misconception or misunderstanding. Use questions on Activity 4.9 and Activity 4.10.

3. **Exercises (homework, classwork, assignment)**

- You are advised to facilitate a classwork for Brainstorming. As you see fit, you can use Activity 4.9 and 4.10 for a classwork, an assignment or homework.
- Please make sure that students get feedbacks of their works as early as possible.

4. **Observation**

- Make sure that all students are participating and contributing to the class activities. Support and encourage low performing students for better performance, and those with special needs.

Direction to Brainstorming 4.2:

Direction - XML is for structuring the data whereas HTML is for formatting the presentation of the document. Both are types of markup language. Both use tags.

HTML tags are predefined while in XML you can define your own tag for the document, etc.

Answers to Activity 4.7

#1

Direction - Ask students to form small groups and brainstorm the features of HTML vs. XML. As students discuss, shape their discussion to see from different angles such as purpose, tags used, file extension, etc.

Answers to Activity 4.8

#1

Direction - Ask students to mention at least one advantage/disadvantage of XML mentioned in the student text book.

4.3. Publishing Website

Learning competencies:

At the end of this section, students will be able to:

- Create style for XML documents.
- Integrate external style into XML documents.
- Design a simple XML document with style.
- Describe website publishing.

This topic is expected to be covered in 7 periods.

Instructional strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive lecture**

- Before the interactive lecture, assess students' level of understanding about website, webpage, http, etc.
- Using the textbook, lecture the class about website publishing.

- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. Demonstration

- If you have access to a projector, please demonstrate designing XML from the scratch on text editor or XML Notepad, and demonstrate website directories and files.
- Please consider zoom in the demo to assist low vision students.

3. Discussion

- Use the activities given in this section to facilitate discussion among students on designing XML document using text editors, browsers and XML Notepad.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where students need support.

Required instructional resources:

The following instructional resources are recommended for proper handling of the section.

- Computer
- XML notepad
- Internet connection
- Projector
- Textbook

Assessment strategies:

You are advised to employ the following assessment strategies for this section:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:

- Rough notes and drafts
- Work samples
- Assigned projects
- Activity diary.

2. Question and answer

- Please ask students at the beginning, in the middle and end of the sessions, to know the level of their understanding of the topic. Make clarifications and corrections if the students have any misconception or misunderstanding.

3. Exercises (homework, classwork, assignment)

- You are advised to facilitate a classwork for Activity 4.11. As you see fit, you can use Activity 4.11, 4.12. 4.13, and 4.14 for a classwork, an assignment or assignments.
- Provide feedbacks to students work timely.

4. Observation

- As the topic requires students to practically design XML document with style, please walk around and observe the students are actively engaged with the exercises. Encourage those who lag behind to do better, and provide support to those with special needs

Direction to Brainstorming 4.3

Students can mention various issues concerning website publishing such as hosting company, steps involved in publishing, domain registration, etc. They can mention the literal meaning of the word "publishing" – putting a website on a webserver for it to be accessible by the wider public.

Answers to Activity 4.9

#1

a. www.ethiopia.gov.et or ethiopia.gov.et or to https://www.ethiopia.gov.et
b. Root directory: Ethiopia.gov.et; sub-directory: Application1, Application2, Application3, Media; Image directory: Media; Home page: index.html

#2

Along with the hint given in the textbook, you may advise students to check other federal ministry official websites. Example: Ministry of Health – www.moh.gov.et, Ministry of Foreign Affairs – mof.gov.et, etc.

#3

Direction - Assist students to use Google search or use https://www.whtop.com/top.10-alexa-ranking/country-et to get two web hosting companies and list the web hosting features they provide.

Answers to Review Questions

Part I: Answer Keys

1. E
2. A
3. B
4. C
5. G

Part II: Answer Keys

1. C
2. B
3. B
4. C
5. A
6. A
7. C
8. B
9. A
10. A

Part III: Program Writing

The work of all the students may not be necessarily the same in structure and using style. Instead you need to see if the structure is sound/ logical. Depending on their preferences, various styles can be applied by the students. Assist them to explore more in the project.

UNIT 5

MAINTENANCE AND TROUBLESHOOTING

Unit Overview

In this unit students will learn installing and uninstalling of software, basics of software troubleshooting in computer systems by focusing on network troubleshooting and basic network system and maintenance tools to maintain faulty systems.

This unit is expected to be covered in 10 periods.

Sub units	Number of periods allotted
Installing and uninstalling of software	2
Software troubleshooting	3
Tools to speed up computer system	2
Network troubleshooting	3

Learning Outcomes

At the end of this unit, students will be able to:

- Practice installing and uninstalling software.
- Explain software troubleshooting.
- Describe network troubleshooting steps.
- Identify network maintenance tools

5.1. Install and uninstall software

Learning Competencies:

At the end of this section, learners will be able to:

- Learners will understand basic steps to install and uninstall computer software

This topic is expected to be covered in 2 period.

Instructional Strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of the concept using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept better.
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**

- Use the activity given in this section to facilitate the discussion about installing and uninstalling software's addressed in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- blackboard and chalk
- computer with internet connection
- mobile devices (optional)
- maintenance tools
- projector or display screen
- software (web browsers, selected application software's)
- textbook

Assessment Strategies:

You are advised to employ use different assessment strategies for this section.

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. **Exercises /Assessment Activity (homework, classwork, assignment)**

- You are advised to facilitate classwork for Activity 5.1(#1 and #2) , Activity 5.2 (#1 and #2). as class laboratory activity within their groups. As you see fit, you can use Activity 5.1 (#3)and 5.2(#3) for a homework assignment.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 5.1.

Encourage students to reflect about the effect of installed applications on computers speed and efficiency.

- The number and type of application installed on the machine has direct effect on the speed and efficiency of the computer system. Both the operating system and applications installed will have an impact on device performance since it can directly affect the security, performance and speed. Hence it is recommended to select and install the required applications and make sure that to manage the background running applications for better computer speed and efficiency.

Answer to Activity 5.1.

#1.

- Please remind students that users required to study the detail requirements of any software's before installation takes place. Once having the required information's, it is possible to install software's for our use.
- It is advisable to check for types of operating systems (Windows, Unix/ Linux, Mac etc.) and availability of appropriate place to install the files. Software's have their own disk space requirements based on the file size and the nature of software's. Some software's also required better CPU processing power and graphics rendering functionality to mention few. It is also equally important to choose the source of the application to protect from any harm before downloading and installing it specially in case of online software sources. In addition, it is advisable to scan flash disks, CDs or hard disks before opening to get any files and software's.

#2.

- Select common application software for students and encourage them to install on their computer laboratories and help the students to understand the steps and procedures of software installation. You can also demonstrate the steps prior to the student's lab activity for better understanding and ask the students for any installation steps change.
- Please answer students' questions about the steps to install software's on computes and other mobile devices as required and support their laboratory activities as required. If there is no computer laboratory at school, you can demonstrate the installation and uninstallation activity with your laptop or desktop and encourage students to record the steps and procedures followed. You can also download common application software from the Internet or you can use pre-purchased software as per the availability.

#3.

- Please support students' effort to select application software that can support their digital literacy skills and encourage them to share their findings and procedures followed to get the right source of information to get the applications.

Answer to Activity 5.2.

#1.

- Encourage students to share their experiences related to uninstalling apps. Let them discuss about the steps followed and also any steps differences so far. Please also tip the students the evolving operating system version changes that might also create some changes on icons layout and arrangements. Share your experiences on these matters based on their concern and questions.

#2.

- Please lead the students group activity to identify potential installed applications and their suggestion list for possible uninstallation to optimize the computers performance. Group and orient students about how they can prepare list of applications and present it to the class. Remind also it needs prior approval from teachers or owners of the computers before making any

practical action to uninstall applications.

#3.

- Please encourage students to share their experiences on this matter. Let them discuss about the possible causes that inhibits to uninstall some apps from their mobile devices. Encourage students to explore all possible reasons and let them share their findings to class.
  - Please share the students the possible reasons including the two primary reasons mentioned below
  - Apps may be system apps which are critical to the operation of our smartphones.
  - Apps preinstalled on the device.

5.2. Software Troubleshooting

Learning Competencies:

At the end of this section, learners will be able to:

- Understand the basic steps of software troubleshooting
- Explain common software problems and solutions

This topic is expected to be covered in 3 periods.

Instructional Strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of software troubleshooting using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept better.
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**

- Use the activities given in this section to facilitate discussions on issues relates to software troubleshooting in the textbook.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- blackboard and chalk
- computer and mobile device (optional) with internet connection
- projector or display screen
- software (web browser, selected system and application software's)
- textbook

Assessment Strategies:

You are advised to employ use different assessment strategies for this section.

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Activity diary.

2. Question and answer

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork for Activity 5.3. (2) and activity 5.4. As you see fit, you can use Activity 5.3(1) for a homework assignment.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to Brainstorming 5.2.

- Ask students what will be their actions if they lost all of their files when they open their machines. This will help them to understand the proper troubleshooting process at all cases and scenarios. Please also share them the right procedures to apply to back up their files from storage with a support of back up software's. Let also students remind the use of regular backups to solve such incident**s.**

Answer to Activity 5.3

- Encourage students to assess the most common software-related problem that can be caused by malicious software like viruses and Worms and let students present their findings to the class. Next, tell students the proper procedures they need to follow to protect their computer system from malicious software attacks.

Additional Tips for Teachers:

- Malicious software (Malware), being one of the common causes of data breaches, is something every IT system user should be concerned about. It's a fact that many businesses will install anti-virus and forget about it, not knowing that malware can still bypass anti-virus software and firewalls. The truth is, no anti-virus or anti-malware will protect you from all malware. If an infection slips through, it means that your confidential information will be put at risk.
- With that being said, it's important to know the different types of malwares and how to prevent them. Since malware is so widespread and hundreds of thousands of new malicious files are reported every day, there's no single solution that will prevent all malware. For this reason, it is always e recommend to use multiple solutions to add more layers of protection to your computers.
- As a result, it is recommended to be make students aware of the impacts of malwares, malware source, proper protection mechanisms, and the importance of backup files.

#2.

Please support the students to come up with all possible solutions for the computer frozen case scenario.

The suggested solution will include the following Sometimes our computer may become completely unresponsive, or frozen and will not be able to click anywhere on the screen, open or close applications, or access shut-down options.

Solution 1- *(For Windows only): Launch Windows Explorer. To do this, press and hold Ctrl+Alt+Delete on your keyboard to open the Task Manager. Next, locate and select Windows Explorer from the Processes tab and click Restart. You may need to click More Details at the bottom of the window to see the Processes tab.*

Solution 2: *Press and hold the Power button. The Power button is usually located on the front or side of the computer, typically indicated by the power symbol. Press and hold the Power button for 5 to 10 seconds to force the computer to shut down.*

Solution 3: *If the computer still will not shut down, you can unplug the power cable from the electrical outlet. If you are using a laptop, you may remove the battery to force the computer to turn off. Note: This solution should be your last resort after trying the other options.*

Answer to Activity 5.4

- Problem: The screen is blank
  - **Solution 1**: The computer may be in Sleep mode. Click the mouse or press any key on the keyboard to wake it.
  - **Solution 2**: Make sure the monitor is plugged in and turned on.
  - **Solution 3**: Make sure the computer is plugged in and turned on.
  - **Solution 4**: If you're using a desktop, make sure the monitor cable is properly connected to the computer tower and the monitor.

5.3. Tools to speedup computer systems

Competencies:

At the end of this section, learners will be able to:

- Understand basic system tools for computer maintenance
- Explain system restore and its steps
- Explain built-in help features for applications

This topic is expected to be covered in 2 periods.

Instructional Strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of software troubleshooting using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are

students with hearing difficulties.

2. **Audio Visual Resources**

- If you have access to a projector, show learners selected and recommended videos from Internet that can help the learners grasp the concept better
- Please use appropriate audio to accommodate visually impaired learners.

3. **Discussion**

- Use the activities given in this section to facilitate discussions on issues about tools to speedup computer system in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- computer with windows operating system
- internet connection
- maintenance tools
- projector or display screen
- software (web browsers, selected application software's)
- textbook

Assessment Strategies:

1. **Portfolio**

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples and your comments
  - Assigned projects
  - Saved documents
  - Activity diary.

2. Question and answer

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises/ Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork for Activity 5.5 as class work and use 5.6 as individual home work.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

- Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs.

Direction to brainstorming 5.3.

#1.

- Encourage the students to form a group and practice windows operating system built-in system tools including disk defragmentation, disk clean up to remove unwanted programs/files in their computer laboratory. Before students conduct the activity, please demonstrate how students can get built-in system tools including disk defragmentation and disk clean up, window update and more.

Answer to Activity 5.5

- Encourage students to refer to their textbook section 5.3. about the most common system tools. Students can also search for other system tools that can be used to speed up computer systems**.** Let the students present their findings to their peers and exchange the new findings with one another.

Answer to Activity 5.6

- Encourage students to refer to their textbook section 5.3. about tools to speedup computer systems. Students can also search for other system tools that can be used to speed up computer systems. Ask students to present their findings to their peers and exchange the new findings with one another.

5.4. Network Troubleshooting

Learning Competencies:

At the end of this section, learners will be able to:

- Understand basics of network troubleshooting and common troubleshooting steps
- Explain network troubleshooting tools
- Explain network troubleshooting applications

This topic is expected to be covered in 3 periods.

Instructional Strategies:

You are advised to use the following instructional strategies for this section:

1. **Interactive Lecture**

- Before the interactive lecture, assess students' level of understanding of network troubleshooting using brainstorming question.
- Using the textbook, lecture the class based on your assessment of the students' prior knowledge and understanding of the topic.
- Please make sure you face the students during the lecture in case there are students with hearing difficulties.

2. **Audio Visual Resources**

- If you have access to a projector, show learners selected and recommended videos that can help the learners grasp the concept better.
- Please use appropriate audio to accommodate visually impaired learners.

3. Discussion

- Use the activities given in this section to facilitate discussions on issues related to network troubleshooting in the textbook among learners.
- As you see fit, use small groups for the discussions and let a member of each group report the result of their discussions to the class.
- Carefully observe the discussions to identify areas where learners need support.

Resources

- computer
- internet connection
- projector or display screen
- software (web browsers, selected application software's)
- textbook

Assessment Strategies:

1. Portfolio

- Produce a portfolio (electronic or hard copy) showing evidence of students' learning progress. The portfolio might include:
  - Rough notes and drafts
  - Work samples
  - Assigned projects
  - Saved documents
  - Activity diary.

2. Question and answer

- Please ask students about their understanding of the topics at the beginning. Make clarifications and corrections if the students have any misconceptions or misunderstandings.
- Please also make sure you ask questions in the middle and at the end of each topic to assess students' grasp of the concepts.

3. Exercises/ Assessment Activity (homework, classwork, assignment)

- You are advised to facilitate classwork group activity for Activity 5.7. and 5.8.
- Please make sure that students get feedback on their work as early as possible.

4. Observation

Please make sure that all students are actively participating and contributing to the class activities. Encourage those who are lagging behind to do better, and provide support to those with special needs

Answer to Activity 5.7.

- Local network referee to our network infrastructure designed and managed by ourselves. Our school computer laboratory network can be considered as good example of local network. On the other side, outside network is a network designed and managed by outsider or 3rd party or service provider in which we don't have control on it. Outside networks will be managed by service providers who designed the infrastructure.
- Telecom network can be a good example of outside network. If we need to access the outside network, we need to get permission from our service providers and we need to subscribe their service packages to get access for outside networks.

Answer to Activity 5.8.

Encourage students to practice the most common network troubleshooting tools.

Please support students to get their IP address and other network information using command line as required. Ask students to record and show their practical work in their laboratory.

Answers to Review Questions

Part I: Answer keys to Multiple Choice Questions

1. **A**
2. **D**
3. **A**
4. **A**
5. **B**

Part II. Answer keys to Discussion Questions

#1.

- Preventive Maintenance is a regular and systematic inspection, cleaning, and replacement of worn parts, materials, and systems. Preventive maintenance helps to prevent the failure of parts, materials, and systems by ensuring that they are in good working order.

#2.

- Download from trusted sources and software hubs
- Purchased from software companies and online stores
- From friends / school intranet software repositories

#3.

- Consider the following basic issues before downloading software from Internet sources
  - First, check the website address
  - Use active virus and malware scanners. ...
  - If you don't trust the site, look for the software elsewhere.
  - Check that the download link is really the link you're looking for.
  - Avoid download programs and installers.

#4.

- **ipconfig, ping, tracert/traceroute**, netstat and nslookup etc

#5.

- **A wire crimper** (sometimes called a cable crimper) is a tool that attaches media connectors to the ends of cables. You can use it to make or modify network cables.
- **Cable Tester** — A cable tester (sometimes called a line tester) is a tool that verifies if a signal is transmitted by a given cable. You can use one to find out whether the cables in your network are functioning properly when diagnosing connectivity issues.

Part III. Answer key to Case Study

- Let students assess the most common software problems they face in their computer laboratory and prepare a summary of common software related problems and their counter solution alternatives.
- Keep in mind that most computer problems have simple solutions, although it may take some time to find them. For difficult problems, a more drastic solution may be required, like reformatting your hard drive or reinstalling your operating system. It is also noted that if we are not a computer expert, it's possible that attempting these solutions could make the situation worse.

UNIT 6

FUNDAMENTALS OF PROGRAMMING

Unit Overview

This unit introduces the basics of python program. It covers program flow controls such as conditional (branching) and iteration (looping) mechanisms, compilation process in python and testing and debugging a python program. Besides, commenting in python program is covered in detail.

This unit is expected to be covered in 25 periods.

Sub units	Number of periods allotted
Program flow controls and Syntax in python	1
Conditionals Program flow controls	8
Loop or iteration Program flow controls	8
Comments in Python	1
Python interpreter	3
Testing and debugging a program	4

Learning Outcomes

At the end of this unit, students will be able to:

- Explain program flow controls
- Describe conditionals program flow control
- Describe iteration program flow control
- Construct program statements using control statements
- Appreciate program compilation and running using python IDE
- Analyze program statements in debugging mode.

The topics covered in the unit are:

- Program flow controls and Syntax in python
  - Conditionals Program flow controls
    - Conditional expression and if statements (if, if..else, if..elif.. else).
  - Looping or iteration program flow controls
    - For loop and while loop
- Comments in Python
- Python Compilation Process
- Testing and debugging program

Instructional strategies:

1. **Interactive Lecture:** is an active learning strategy in which the teacher employs activities to enhance students' engagement during the lecture.

2. **Demonstration:** is a practical exhibition and explanation of how something works or is performed.

3. **Discussion:** is the action or process of exchanging ideas on issues, topics or concepts in order to reach at a common understanding.

Required instructional resources:

- Computer
- Internet connection
- Projector or Display Screen
- Textbook

Assessment strategies:

1. **Portfolio:** is a compilation of academic works and other forms of educational

evidences assembled for the purpose of evaluating work quality, learning progress and academic achievement of students.

2. **Question and Answer:** is a teaching method that allows direct communication or two way traffic between the teacher and students

3. **Exercises:** are activities designed to help students develop knowledge, skills and positive values.

- **Homework**: is a work or an activity that is done by students at home.
- **Classwork**: is an activity which is done in the classroom.
- **Assignment**: activities given by teachers for students to be done relatively over an extended period of time.

4. **Observation:** is a systematic watching of events and behaviors in educational settings**.**

6.1. Program flow controls and Syntax in python

Learning competencies:

At the end of this section, students will be able to:

- Describe expression in python.
- Explain syntax and semantics of a programming language.
- List three types of programing language constructs.
- Associate program logic to real world problems.

This topic is expected to be covered in 1 period.

Instructional strategies:

1. **Interactive lecture**

- This unit is the continuation of Python programming learnt in grade 11, start the class with a brief brainstorming session on syntax, semantics and expression in Python program. This will give the students a foundation to easily understand and to relate the topics to be discussed.

- Relate the topic in the textbook to what they have learnt in grade 11. Discuss the three types of programing constructs that are used to implement sequences, decisions and looping logic. As the student already started writing statements in grade 11, it is important to relate that the order of execution of such statements (variable declaration, input/output) is sequential. You can also use real-world problems that relate to decisions (e.g. determine students pass or fall in subject or grade level). Tell students that we make many decision in our day-to-day lives related to many issues. Looping is also another important logic to repeat something a number of times and a typical example is a counting problem. Later in the unit students will learn more syntax and semantics of the language. At this point you may remind students about basic definitions and give (or ask students) examples from what they have learnt in grade 11. For example, use syntax to declare variable, print output, read input, etc.
- During your lecture, please stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. Demonstration

- In this first class you may not need demonstration. Interactive lecturing and discussion are enough to meet the learning outcomes for this topic. For this you may use chalkboard or whiteboard.

3. Discussion

- Use brainstorming questions and Activity 6.1 question to facilitate discussions among students.
- Based on the size of the class, let students form small groups for the discussions and present their report through each group representative.
- While students discuss, observe the discussions carefully to notice areas where the students need support. Particularly, students need a clear understanding of expression, syntax and semantics. Give attention to how students relate program logic with real-world problems, such as sequence of action, an action that requires decision at some point, and an action that requires repetition.

Required instructional resources:

- Projector
- Textbook

Assessment strategies:

1. **Question and answer**

- Please ask students questions related to expression, syntax and semantics, the three types of programing constructs and their application in the real-world to get to know the students' level of understanding of the topics. You may ask questions at the beginning, in the middle and end of the session. Make clarifications and corrections if the students have any misconception or misunderstanding.

2. **Exercises**

- You can use brainstorming question for class discussion. Activity 6.1 can be used for classwork.
- Please make sure that students get feedbacks of their works timely.

3. **Observation**

- Make sure that all students are participating and contributing to the discussion and class activities. Support and encourage low performing students by providing additional explanation or resources for better performance, and those with special needs.

Direction to Brainstorming 6.1:

Direction - Syntax is set of rules that govern the writing of instructions/statements in that specific programming language, whereas semantics is meaning attached to language construct.

- For example, in Python the syntax to print some text the command is 'print("text")' or 'print('text')'. If you write print "text" or print 'text', it is

not in line with the language rules so it will generate a syntax error, because you do not follow the language's rules.

- The semantics of the above command print("text") is to output/ display anything that appears inside the quotes on the screen. So in our example we see it as output text without quotes.

- You can also make the concept clear using grammar rules in English. i.e. any English statement must end with full stop.
  - Expression is a statement that evaluate to some value, or true/ false. E.g. a==b, a=10, b>a. All expressions are statement, but all statements are not necessarily expressions as they might not evaluate to some value.
    - There are different types of expressions.
      - Logical expression – use 'or', 'not', 'and' operators.
        - E.g. a or b
      - Comparisons (use Mathematical signs) - >, <, == operators
        - E.g. a>b, a==b

Additional Tips for Teachers: See the following website for more details on the different types of expressions and their meaning.

https://www.mygreatlearning.com/blog/python-tutorial-for-beginners-a-complete-guide/#logicaloperators

Answer to Activity 6.1:

- Most programming languages use three types of programing constructs: sequential, decision (branching) and looping (iteration) logic.
- There are various real-world problems that can relate to the three types of program logic.
- If you think of the procedures that you follow before going to school such as: wake up early, got to toilet, wash your face, eat breakfast, brush your

teeth, etc. are typical examples of sequential logic, where you perform things one after the other. Compare this concept to the sequence of grades that a student passes through from Kindergarten to grade 1, grade 2, .. through to university, which can serve as a good example of sequential logic.

- Determining student rankings is example of conditional logic (using conditional statements), like when a student scores 60 or above she will be promoted to the next class, otherwise she will repeat the class.
- Counting a sequence of numbers from 0 to 100 – is an example of looping logic (using loop statements).

6.1.1 Conditionals Program Flow Controls

Competencies:

At the end of this section, students will be able to:

- Describe branching or conditionals flow controls.
- Write python conditional expressions for a given simple problem statement.
- Understand the general syntax of the three branching statements.
- Learn conditionals and block if statements.
- Use the various versions of conditional statements (such as simple 'if, if… else, if…elif…else', and, 'or', 'in' with 'if…' statements).
- Describe syntax rules such as indentation, colon, keywords, and block statements while writing conditional statements.
- Apply conditional statements to solve real-world problems.
- Use python IDE to write and run the output of conditional statements.

This topic is expected to be covered in 8 periods.

Instructional strategies:

1. **Interactive lecture**

- This topic is expected to be completed in six periods. Therefore, before starting every new session review the previous session discussion (focusing on expression, syntax and semantics, and conditional statements). This will help students to easily link each concepts discussed in different sessions and

understand the use of conditional expressions and the three versions of 'if' statement to be discussed.

- Provide basic definitions of branching flow control, giving examples in the real-world; explain expressions by relating them to mathematical equations and the similarities and differences between expressions in Python and maths; explain the three types of 'if' statement to implement a problem that involves decisions or branching; discuss the syntax of each version of 'if' statement and how one is selected for a particular problem based on the options or branching available. Demonstrate the application of each based on examples presented in the textbook. Discuss syntax rules related to indentation, colon, and blocks in writing the if statements. Explain optional rules such as the use of brackets and semicolons. Also demonstrate the use of logical operators 'AND', and 'OR' to combine two conditions in the 'if' statement.
- During your lecture, don't forget to stand in-front of the class and face to the students to help students with hearing difficulties. Speak with appropriate loud to ensure students at all distance in the room hear your voice. Provide oral presentation for all demonstration to address students with visual impairment.

2. Demonstration

- Use Python Integrated Development Environment(IDE) (such as IDLE or you can use online Python editor if you have internet access) to demonstrate conditional expressions, if, if..else, if…elif…else, and the use of 'in', 'and', and 'or' in if statement. Show how to write and organize conditions and block statements. Demonstrate errors related to indentation, colon, etc. Demonstrate different scenarios(changing input, comparison signs, etc.) that change the output.
- If you have access to a projector, you can use it to demonstrate the above lesson. In the absence of projector and computer, you can use a blackboard or whiteboard to write the program and predict the output.
- Please consider zooming in the demo to assist low vision students.

3. Discussion

- Use questions in Activity 6.2 to Activity 6.8 to develop skills in writing, testing, and running programs that apply branching statements. The questions also help students to facilitate understanding of the branching flow control by discussing on the syntax, programs output and errors.
- Form small groups based on the size of the class for practicing the writing a program with branching statements and present their report through each group representative.
- While students discuss, observe how they write expressions, if statements, block statement, and syntax rule they apply to notice areas where the group/ students need support. Support low performing students by providing additional explanation and examples.

Required instructional resources:

- Computer
- Internet connection
- Python IDLE
- Projector
- Textbook

Assessment strategies:

1. Portfolio

- Make the students produce a portfolio (electronic or hard copy) showing evidence of their learning progress. Please give clear instructions and guidelines as to what the portfolio should contain. The portfolio might include:
  - Rough notes and drafts
  - work samples with comments written by the teacher
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students questions related to conditional expressions, if statements, and syntaxes rules to determine the level of their understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.

3. **Exercises (Homework, classwork, assignment)**

- You are recommended to use variations of all the activities in this topic for home take assignments.
- Provide feedbacks to students' work timely.

4. **Observation**

- As the topic require students to practically engage in writing program using branching statements, please walk around and observe the students work. Encourage those who lag behind to do better, and provide support to those with special needs.

Direction to Brainstorming 6.2

- In English, students are very familiar with conditional statements. A conditional statement has two parts: the 'if ..' that describes the condition and the 'then..' that describes the action taken if the condition is met. Therefore, similar conditional logic is used in programing to implement instructions that need decisions. The statement in the brainstorming is a conditional statement.

Answers to Activity 6.2

#1

a. In Python it is 21 != 21 and the output is False

b. In Python it is 97 >= 99 and the output is False

c. In Python it is Price == 135 and the output depends on Price value

The result of any conditional statements such as: a==b, 10>5 are true/false. Students are familiar with these type of expression or inequalities in mathematics, which can be related to this topic.

#2

a. Age < 12

b. Mark == 95

c. Weight <= 45.5

#3

```
>>> 19 !=20
True
>>> age=22
>>> age == 22
True
>>> 'zenash' == 'zehara'
False
>>>
```

#4

In Python, the equals sign '=' is the assignment operator. It is not a comparison sign. But the double equals sign '==' is a comparison sign in python. So, height = 2.5 assigns the value 2.5 to the variable height, and height == 2.5 means that height has a value of 2.5, which is either true or false.

Answers to Activity 6.3:

#1

Answer

A) When you run the program, it will prompt How old are you? and if you write 15 you will get the below output.

```
How old are you? 15
You are 15 years old
Thank you, nice to meet you.
>>>
```

B)If you write 0, the condition age >0 return false because zero is not greater than zero. Since the condition has not satisfied the block will not be executed, so the output will be nothing.

```
How old are you?0
>>>
```

Answers to Activity 6.4:

#1

Answer

If age is assigned 20 as you can see on the figure below the output will be You are an Adult.

If zero is stored in age, the out put will be: You are a Child.

Any integer less than 18, such as 17, 16…..0, -1 will output You are a Child.

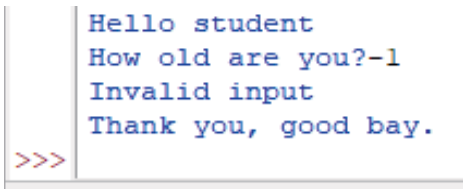
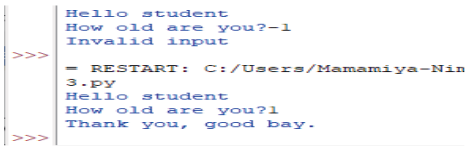
Python script	Output on IDLE Shell

File Edit Format Run Options Windc
`age=20`
`if(age > 18):`
`  print("You are Adult')`
`else:`
`  print("You are Child")`
	You are Adult
	>>>

#2

The cause of the error is indentation. The two statements following the if clause are not properly indented. As a syntax rule there must be one indented statement following an if clause.

#3

	The output when input is -1
	The output when input is 1

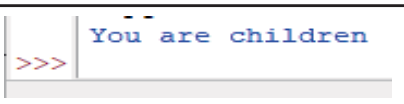
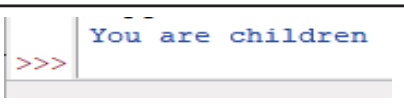
The first two statements and the last statement are not part of the if clause. So, irrespective of whether the condition age < 0 is satisfied or not, the last print statement will be executed. If the condition is satisfied as you can see in the first row, the statement "Invalid input" will be executed.

Answers to Activity 6.5:

a. What is the output if age is 20?

b. What if the number 0 is stored in age?

c. When will "You are children" be output?

a. Age is 20	
b. Age is 0	
c. When age is 18, 17,16, 15, …	

Answers to Activity 6.6:

#1

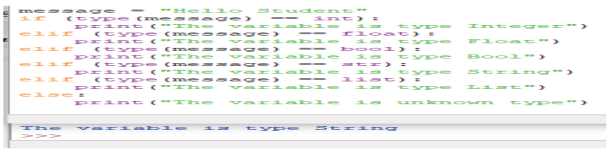
Answer

Python script

```
message = "Hello Student"
if (type(message) == int):
    print("The variable is type Integer")
elif (type(message) == float):
    print("The variable is type Float")
elif (type(message) == bool):
    print("The variable is type Bool")
elif (type(message) == str):
    print("The variable is type String")
elif (type(message) == list):
    print("The variable is type List")
else:
    print("The variable is unknown type")
```

```
The variable is type String
>>>
```

Output on IDLE Shell



- In the discussion, it is important to ask first what the output is, then which alternative (expression) results in the output. And why that has happened. Link also the different data types students have learnt in grade 11. The possible explanation could be the content of the variable message is a string type. Therefore, the first, second and third expressions cannot evaluate to true because they are not all string type. 'The fourth expression, type(message) == str,gives str == str, that evaluates to true'.

#2

Answer

Python script

```
average_mark = input('Please enter your average mark? ')
#convert to numeric type - float
average_mark = int(average_mark)
if average_mark > 90:
    print('Your average mark is Excellent')
elif average_mark > 80:
    print('Your average mark is Very Good')
elif average_mark > 65:
    print('Your average mark is Good')
elif average_mark > 50:
    print('Your average mark is Satisfactory')
else:
    print('Your average mark is Fail')
```

#3

Answer

Python script

```
operator = ''
operator = input('Enter arthimetic operator[+, -, *, /]?')
number1 = int(input('Enter the first integer number? '))
number2 = int(input('Enter the second integer number? '))

if operator == '+':
    print('Sum = ', number1 + number2)
elif operator == '-':
    print('Difference = ', number1 - number2)
elif operator == '*':
    print('Product = ', number1 * number2)
elif operator == '/':
    print('Division = ', number1 / number2)
else:
    print('Your input is invalid')
```

Answers to Activity 6.7:

#1

Answer

First discuss the four possible combinations: 'True and True', 'True and False', 'False and True', and 'False and False'. Students have learned in mathematics that 'logical and' will return True only if the two expressions evaluate to True, otherwise in all the other cases the expressions evaluate to False.

#2

Answer

Python script

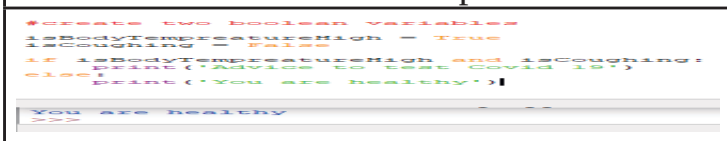
```
#create two boolean variables

isBodyTempreatureHigh = True
isCoughing = False

if isBodyTempreatureHigh and isCoughing:
    print('Advice to test Covid 19')
else:
    print('You are healthy')
```

```
You are healthy
>>>
```

Output on IDLE Shell



#3

Answer

When you replace the ‘and’ by ‘or’ the output will be as follows:

Python script

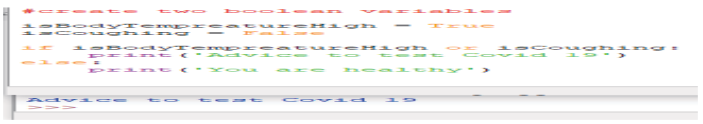
```
#create two boolean variables

isBodyTempreatureHigh = True
isCoughing = False

if isBodyTempreatureHigh or isCoughing:
    print('Advice to test Covid 19')
else:
    print('You are healthy')
```

```
Advice to test Covid 19
>>>
```

Output on IDLE Shell



Evaluation of the ‘logical or’ will be False if only if both operands are False. Otherwise in all other case it is True. See the result in the figure above.

Answers to Activity 6.8:

#1

Python script

```
#create a string
mySubject = 'IT'
#create a list
subject = ['Physics', 'Chemistry', 'Geography', 'Economics']

# in operator is used to replace or operator
if mySubject in subject:
    print(mySubject + ' subject is in the list')
else:
    print(mySubject + ' subject is not in the list')

#Alternate if statement with or operator
if mySubject == 'Physics' or mySubject == 'Chemistry' or mySubject == 'Geograpy':
     print(mySubject + ' subject is in the list')
else:
     print(mySubject + ' subject is not in the list')
```

```
IT subject is not in the list
IT subject is not in the list
>>>
```

Output on IDLE Shell

6.1.2 Loops or Iteration Program Flow Controls

Competencies:

At the end of this section, students will be able to:

- Describe looping or iteration program flow controls.
- Explain syntax for ‘for’ loop and ‘while’ loop statements.
- Tell the purpose of break and continue keywords in ‘for loop’ and ‘while loop’.
- Apply ‘range()’ function with for loop.
- Analyze a loop statement to predict their output.
- Write simple code using loop statements.

- Run a loop-based program and test the output.

Additional Tips for Teachers: See the following website for details on range() function**.**

https://www.w3schools.com/python/ref_func_range.asp

This topic is expected to be covered in 8 periods.

Instructional strategies:

1. **Interactive lecture**

- This topic is expected to be covered in six periods (six session if a session is one period). So, before starting the interactive lecture a short review in the form of brainstorming is advisable in each new session. Based on the topic for the daily lesson plan, for example in the first two sessions you can review the basic concept of looping mechanisms, what they mean in the real-world and relating them to real-world cases such as counting, determining average for each student in the class, and the two types of conditions: count-controlled vs. condition-controlled. In the third and fourth session, you may review for loop syntax, different applications of for loop (counting and condition controlled). In the fifth and sixth sessions, you may review syntax for while loop. This will help students to easily understand the looping program flow controls.
- Please organize your lecture for each sessions based on topics in the textbook. Your lecture should focus on: a definition (basic) of looping mechanism, examples in the real-world, types of looping in python, the general syntax of 'for' loop and 'while' loop, implementation of 'for' loop and 'while' loop with adequate examples and exercises presented in the textbook, how to determine output, and write and test using IDE (offline such as IDLE or python online editor). As you lecture relate the topic in textbook to mathematics (such as expressions and signs or operators used for comparisons) and what they have learnt in grade 11 (such as expressions, data types, etc.).
- During your lecture, make sure you stand in-front of the students and around the center of the class. Use blackboard or white board to write (focus) main point in the lecture. This will help you to catch up the students' attention and help students with hearing difficulties. Verbally describe everything to help

students with visual impairments. Encourage or make sure female students are participating in discussions, brainstorming, questions and answers, etc.

2. Demonstration

- For demonstration, you need to pre install python IDE (recommended IDLE) or use online python editor (if you have internet access).
- Prepare and test codes for demonstration. You have various examples presented in the textbook on for loop and while loop. So, write the source code and test their result before class.
- If you have access to a projector, please demonstrate examples on for loop and while loop using python IDE.
- Please consider zooming in the demo to assist low vision students.
- In the absence of internet and computer, you can write the code on blackboard or white board for demonstration. Demonstrate each processes, flows and outputs.

3. Discussion

- There are nine activities (Activity 6.9 to Activity 6.17) that contains various questions to facilitate understanding and skills in writing a program using looping statements.
- Based on the size of the class, let students form small groups. Each group can be assigned to write for loop or while loop based programs based on the activities presented. You can also advise them to discuss the input, output, syntax rules, and analysis of the programs and present their report through each group representative.
- While students discuss, observe how they apply the implementation of for loop and while loop, the use of correct keywords, statement, structure, symbols, etc. and check all students are participating in the work. Encourage and support students who need special attention. Provide appropriate support in areas where the group understands incorrectly or wrongly.

Required instructional resources:

- Computer
- Internet connection
- Python IDLE
- Projector
- Textbook

Assessment strategies:

1. **Portfolio**

- Make the students produce a portfolio (electronic or hard copy) showing evidence of their learning progress. Please give clear instructions and guidelines as to what the portfolio should contain. The portfolio might include:
  - Rough notes and drafts
  - Work samples with comments written by the teacher
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- To make sure that students understand the topics, you can ask various questions based on textbook and your lecture. The questions could be asked the beginning, in the middle and end of the sessions, or before ending the topics or beginning the new topics. Make clarifications and corrections if the students have any misconception or misunderstanding of branching flow controls (such as definition, syntax rules, for loop, while loop, range, break, continue, etc.).

3. **Exercises (Homework, classwork, assignment)**

- You can use variations of questions in Activity 6.9 to Activity 6.17 in this topic for classwork and homework. Up on the completion of this topic you can give assignment to be done in groups. For this, you can use questions in

Part V: Program writing (Review question part).

- Provide feedbacks to students work timely.

4. Observation

- As the topic require students to practically engage in writing program using for loop and while loop statements, please walk around and observe the students work. Encourage those who lag behind to do better, and provide support to those with special needs.

Direction to Brainstorming 6.3

Direction – counting is a real world problem that can be addressed through iteration or looping logic. We start from 1 and to get the next number we add 1 to the current value. This order will continue or iterate until we reach 100. Ask students to, try to relate a looping logic in program writing to solve a problem that requires repetition.

Answers to Activity 6.9

#1

Because range by default starts from 0 to 1 less than the value in parameter. Since the expression in range(5) is five it starts from 0 and end at 4.

#2

Note that any input from the keyboard treated as a string. So you need to cast/change to string first as indicated in the figure below using int() operator. Then the resulting integer type variable **number** is passed as parameter to range function.

Python script	Output on IDLE Shell

File Edit Format Run Options Window Help
`number = int(input("enter any +ve integer "))`
`for x in range(number):`
`  print(x)`
	`===== RESTART: C:\Users\`
	`enter any +ve integer 4`
	`0`
	`1`
	`2`
	`3`
	`>>>`

Answers to Activity 6.10

#1

Note that the start is set to 5. So it starts from 5 and increments by 1 until 8.

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options
`for x in range(5, 9):`
`  print(x)`
	`===== RESTART:`
	`5`
	`6`
	`7`
	`8`
	`>>>`

#2

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options Window
`print("Count from 51 to 100");`
`for a in range(51, 70):`
`  print(a)`
	`= RESTART: C:/Users/M`
	`Count from 51 to 100`
	`51`
	`52`
	`53`
	`54`
	`55`
	`56`
	`57`
	`58`
	`59`
	`60`
	`61`
	`62`
	`63`
	`64`
	`65`
	`66`
	`67`
	`68`
	`69`
	`>>>`

Answers to Activity 6.11

#1

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options Window
`for x in range(10, 100, 10):`
`  print(x)`
	`===== RESTART:`
	`10`
	`20`
	`30`
	`40`
	`50`
	`60`
	`70`
	`80`
	`90`
	`>>>`

#2

Answer

Python script

File Edit Format Run Options Window Help

```
print("Count from 1 to 22, increment by 3");
for a in range(1,23,3):
    print(a)
```

Output on IDLE Shell

```
Count from 1 to 22, increment by 3
1
4
7
10
13
16
19
22
```

Answers to Activity 6.12:

#1

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options Window Help
`#list to store fruits`
`fruits = ["Mango", "Orange", "Banana",`
`"Pineapple", "Papaya" ];`
`for fruit in fruits:`
`print(fruit);`
	`===== RESTART:`
	`Mango`
	`Orange`
	`Banana`
	`Pineapple`
	`Papaya`
	`>>>`

Answers to Activity 6.13

#1

Answer

Python script

File Edit Format Run Options Window Help
`your_name = input("type your name, please ")`
`for char in your_name:`
`print(char)`

Output on IDLE Shell

`===== RESTART: C:\Users\Dag\`
`type your name, please muna`
`m`
`u`
`n`
`a`
`>>>`

Answers to Activity 6.14

#1

Python script	Output on IDLE Shell

`for letter in "Renaissance Dam":`
`  if letter==' ':`
`  break;`
`  print(letter)`
	`===== RESTART:`
	`R`
	`e`
	`n`
	`a`
	`i`
	`s`
	`s`
	`a`
	`n`
	`c`
	`e`
	`>>>`

#2

Answer

Python script

```
File  Edit  Format  Run  Options  Window  Help
programming_language = ["Java", "Python", "C++", "C Sharp", "Java Script"]
for language in programming_language:
    print(language)
    if language == "HTML":
        break
```

Output on IDLE Shell

```
===== RESTART: (
Java
Python
C++
C Sharp
Java Script
>>>
```

All in the list will be printed because the loop will not encounter case to break.

Answers to Activity 6.15

#1

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options Window Help
`programming_language =["Java", "Python", "C++",`
`"C Sharp", "Java Script"]`
`for language in programming_language:`
`  if language == "Java" or language == "C++":`
`  continue`
`  print(language)`
	`===== RESTART:`
	`Python`
	`C Sharp`
	`Java Script`
	`>>>`

Answers to Activity 6.16

#1

Answer - note that the output of this activity and Activity 6.11 are the same. They are the same problem solved in different ways using for and while loops. Brief the students that in programming, different programmers can approach the same problem in different ways. This is because problem solving in programing requires creative thinking to address the problem, but note that the output is the same for Activity 6.16 and Activity 6.11.

Python script	Output on IDLE Shell

File Edit Format Run
`count = 10`
`while count < 100:`
`  print(count)`
`  count += 10`
	`===== RESTART:`
	`10`
	`20`
	`30`
	`40`
	`50`
	`60`
	`70`
	`80`
	`90`
	`>>>`

Answer to Activity 6.17

#1

Answer

Python script	Output on IDLE Shell

File Edit Format Run Options Window Help
`# read input from the user`
`escape = int(input("Enter iteration to escape"))`
`count = 1`
`while count < 10:`
`  count += 1`
`  if count == escape:`
`  continue`
`  print(count)`
	`===== RESTART: C:\Users\Dag`
	`Enter iteration to escape 8`
	`2`
	`3`
	`4`
	`5`
	`6`
	`7`
	`9`
	`10`
	`>>>`

6.2. Comments in Python

Competencies:

At the end of this section, students will be able to:

- Describe the purpose of comments in programs.
- Use IDLE commenting features to comment and uncomment parts of code.
- Differentiate comments and executable statements in the programing.

This topic is expected to be covered in 1 period.

Instructional strategies:

1. **Interactive lecture**

- Remind students about what they have noticed in a program so far (something that starts with a hash symbol). This can be done in a brainstorming mode before you begin the interactive lecture.
- Lecture the content as per topic in the textbook. Focus by describing the need and purpose of comments in a program, what happens when Python interpreter encounters commented statements (python statements and

anything we write), how to comment or uncomment a line or part of code, and how to write comments to describe our program. As you lecture, relate comments used so far in example programs presented in the textbook.

- During your lecture, stand in front of the students, speak with an appropriate tone to help students with hearing difficulties and visual impairment.

2. Demonstration

- Use python IDE (e.g. IDLE) to demonstrate comments. Show that the commented line has not executed or produce output. Demonstrate how to comment or uncomment a line or part of code in the program. Show also where we can write comments in a program.
- Please consider zooming in the demo to assist low vision students.

3. Discussion

- Use questions in Activity 6.18 to facilitate understanding and skills in writing and describing comments in python program.
- Based on the size of the class, let students form small groups and work on questions in Activity 6.18, and finally present their report through each group representative.
- While students are discussing, observe the students understanding of comments in program, purpose of comment and how to differentiate comment from executable statement. Provide appropriate support for low performing student in the group. Make clarifications if the group has misconception in the concept of comments in python program.

Required instructional resources:

- Computer
- Internet connection
- Python IDLE
- Projector
- Textbook

Assessment strategies:

1. **Portfolio**

- Make the students produce a portfolio (electronic or hard copy) showing evidence of their learning progress. Please give clear instructions and guidelines as to what the portfolio should contain. The portfolio might include:
  - Rough notes and drafts
  - work samples with comments written by the teacher
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students randomly to check the level of their understanding on comments at the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.

3. **Exercises (classwork)**

- You are recommended to use questions in this activity for classwork.
- Provide feedbacks to students work timely.

4. **Observation**

- Please walk around and observe the students work in comments in python program. Encourage those who lag behind to do better, and provide support to those with special needs.

Direction to Brainstorming 6.4

Direction – while discussing the earlier topics in this unit the students might have noticed comments in a program. For example programs in Figure 6.16 and Figure 6.23 contain comments. Therefore, asking this question will show the students differentiate the executable part of the program from the non-executable part of the program, like comments.

Answers to Activity 6.18

#1

Answer - Note that all codes in the program are commented out. Running this program will output nothing, because there is not executable statement.

Python script	Output on IDLE Shell

File Edit Format Run Options Window Help

```
### read input from the user
##escape = int(input("Enter iteration to escape"))
##count = 1
##while count < 10:
##  count += 1
##  if count == escape:
##    continue
##  print(count)


####count=1
##while count< 10:
##  print(count)
##  if count == 5:
##    break
##  count += 1
```

```
===== RESTART:
>>>
```

#2

Answer - note that only the uncommented part of the code is executed and generates output.

Python script	Output on IDLE Shell

```
File  Edit  Format  Run  Options  Window  Help
# read input from the user
escape = int(input("Enter iteration to escape"))
count = 1
while count < 10:
  count += 1
  if count == escape:
    continue
  print(count)


####count=1
##while count< 10:
##  print(count)
##  if count == 5:
##    break
##  count += 1
```

```
===== RESTART: C:\Users\Dag\
Enter iteration to escape 6
2
3
4
5
7
8
9
10
>>>
```

#3

Answer - Tell students to first to point the cursor at the beginning of the second fragment of code, then use 'Alt+3' to insert comment symbol. Students explanations should be concise and clear, as the purpose of comment is to provide additional information as to what the program can do or output.

- Example - '## print 1 up to 5, then exit the loop'

6.3. Python Interpreter

Competencies:

At the end of this section, students will be able to:

- Describe Python program compilation processes.
- Run a Python program using IDLE

This topic is expected to be covered in 3 periods.

Instructional strategies:

1. **Interactive lecture**

- Let the students have a short brainstorming session on the writing process in python before you begin gap lecture.
- As you lecture, relate the topic in textbook to what they have learnt in prior lessons.
- During your lecture, don't forget to stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. **Demonstration**

- If you have access to a projector, please demonstrate Python the compilation process using python IDLE.
- Please consider zooming in the demo to assist low vision students.

3. **Discussion**

- Use Activity 6.19 to facilitate skills in python program interpreter processes.
- Based on the size of the class, let students form small groups to discuss compilation processes in program and present their report through each group representative.
- While students discuss, observe how they understand python program compilation to notice areas where the students need support.

Required instructional resources:

- Computer
- Internet connection
- Python IDLE
- Projector
- Textbook

Assessment strategies:

1. **Portfolio**

- Make the students produce a portfolio (electronic or hard copy) showing evidence of their learning progress. Please give clear instructions and guidelines as to what the portfolio should contain. The portfolio might include:
  - Rough notes and drafts
  - Work samples with comments written by the teacher
  - Assigned projects
  - Activity diary.

2. **Question and answer**

- Please ask students to determine whether students have acquired the required level of understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.

3. **Exercises (Homework, classwork)**

- You are recommended to use variations of all the activities in this topic for homework and classwork.
- Provide feedbacks to students work timely.

4. **Observation**

- As the students discuss the python interpreter process, please walk around and observe the students work. Encourage those who lag behind to do better, and provide support to those with special needs.

Direction to Brainstorming 6.5

#1

Direction - let the student describe what is involved in writing a simple program in python which they have covered in this unit and in grade 11 as well.

Answer to Activity 6.19

#1

Direction - observe students to see whether they understood a python interpreter process while discussing steps in running a python program.

6.4. Testing and Debugging Program

Competencies:

At the end of this section, students will be able to:

- Describe program testing and debugging techniques.
- Practice Python IDLE debugging features and tools.
- Use python debugging tools for testing and debugging a program.

Additional Tips for Teachers: See the following website for details on requirements for a good python coding environment. https://realpython.com/python-ides-code-editors-guide/

This topic is expected to be covered in 4 period.

Instructional strategies:

1. **Interactive lecture**

- Let the students brainstorm the different types of errors encountered while running and testing their python source code.
- Lecture on testing and debugging relate the topic to what students have learnt in prior lessons. In your lecture focus on the various types of bug that could be encountered while running and testing a program. Discuss the python debugging features.
- During your lecture, don't forget to stand in-front of the students and around the center of the class to help students with hearing difficulties.

2. **Demonstration**

- Prepare examples for demonstration from the textbook. Demonstrate the python debugging features by debugging and fixing a bug in a program.
- For demonstration you can use a projector if you have access to it, otherwise you can demonstrate using blackboard or whiteboard.
- Please consider zooming in the demo to assist low vision students.

3. **Discussion**

- Use Activity 6.20 to facilitate skills in debugging and testing a python source code.
- Based on the size of the class, let students form small groups to discuss debugging and testing processes in python and present their report through each group representative.
- While students discuss, observe how they conceptualize program debugging and testing in python. Provide appropriate support in areas where the group/ students need assistance.

Required instructional resources:

- Computer
- Internet connection
- Python IDLE
- Projector
- Textbook

Assessment strategies:

1. **Portfolio**

- Make the students produce a portfolio (electronic or hard copy) showing evidence of their learning progress. Please give clear instructions and guidelines as to what the portfolio should contain. The portfolio might include:

- Rough notes and drafts
- Work samples with comments written by the teacher
- Assigned projects
- Activity diary.

2. Question and answer

- Please ask questions to students to determine whether students have acquired the required level of understanding of the topics at the beginning, in the middle and end of the sessions. Make clarifications and corrections if the students have any misconception or misunderstanding.

3. Exercises (Homework, classwork)

- You are recommended to use variations of all the activities in this topic for homework and classwork.
- Provide feedbacks to students work timely.

4. Observation

- As the students discuss debugging and testing a python program, please walk around and observe the students work. Encourage those who lag behind to do better, and provide support to those with special needs.

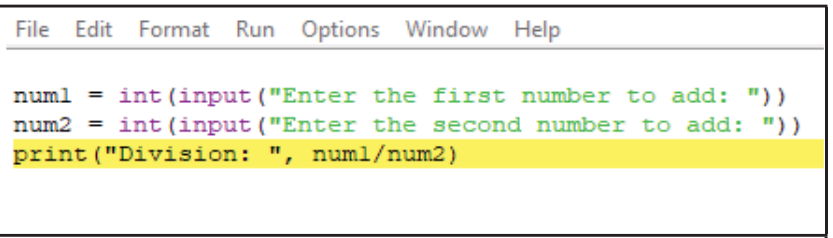
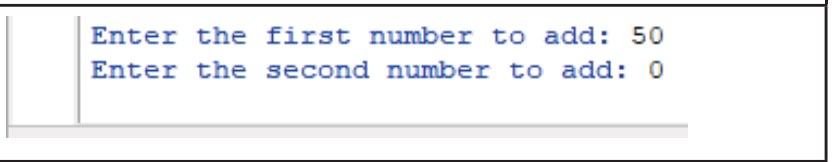
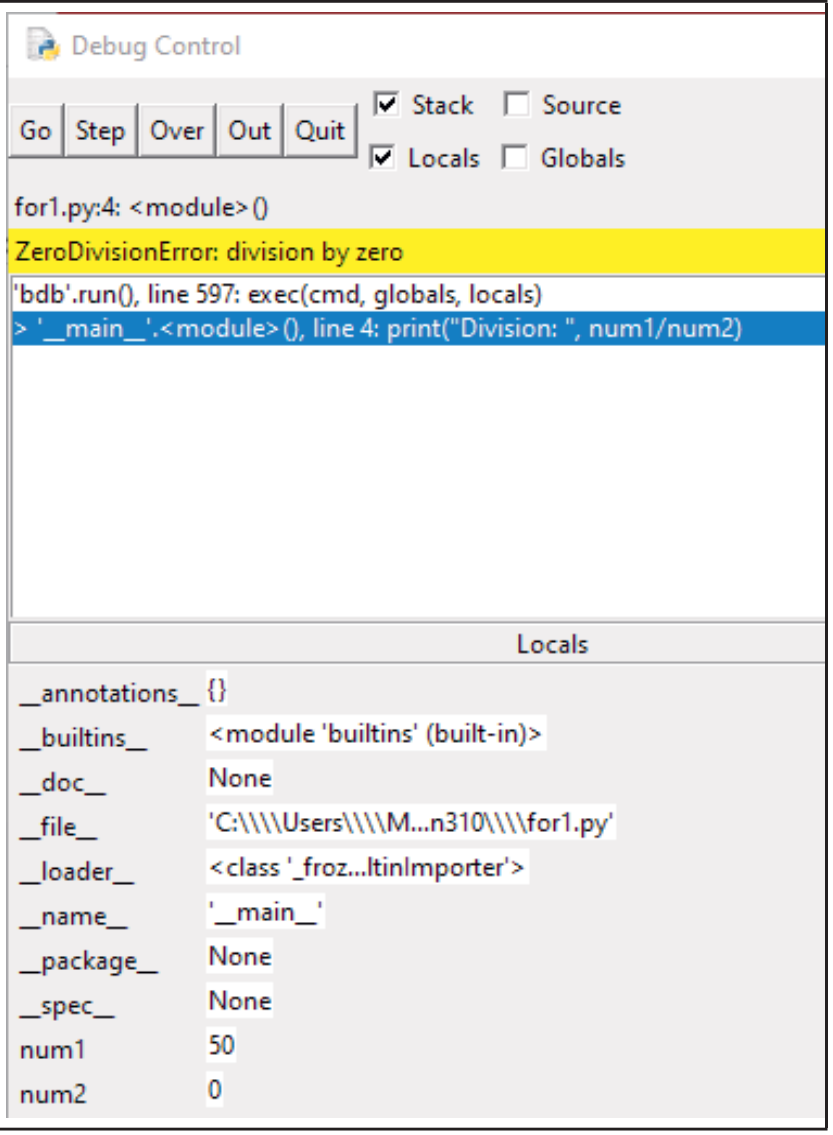
Direction to Brainstorming 6.6

Direction – Testing is important in programming to make sure the program is error free and produces the desired output. Students can relate the importance of testing in various scenario such as in education, products, etc. In all these cases, testing is important to get quality output or products. It is just as important in programming to teste to debug errors.

Answers to Activity 6.20

#1

Answer

The error is likely to occur while dividing a number by zero. So set the break-point on the third print statement.	
Press 'Go' from DE-BUG control. Enter 50 for num1 and 0 for num2	
Then press 'Step', you will get error message.	

Answers to Review Questions

Part I: Answer Keys

1. True
2. False – indentation is very important in python; unlike other programming language, Python uses indentation to indicate a block of code.
3. True
4. True - see section 6.1
5. False – in a python program you should apply consistent indentation, otherwise it will result in error.
6. True – expressions in branching statement evaluate true or false.
7. True
8. False – comment is line of statement ignored by python interpreter.
9. True – see section 6.3
10. False – bug is any undesirable situation in our program. It could be syntax or semantics error.

Part II: Answer Keys

1. G
2. J
3. E
4. H
5. A
6. F
7. C
8. D
9. B
10. I

Part III: Answer Keys

1. D
2. C
3. A
4. B
5. A

Part IV: Answer Keys

1	mark = int(input('enter your mark'))
	if mark > 50:
	  print('pass')
	else:
	  print('fail')

2a	letters = "ABCDEFGHIJKLMNOPQRSTUVWXYZ" for letter in letters: print(letter)
2b	letters = "ABCDEFGHIJKLMNOPQRSTUVWXYZ" for letter in letters: print(letter, end=' ')
3	user_input = int(input('enter your any integer to print')) for x in range(1, user_input): print(x)

4	operation = int(input('enter 1 for +, 2 for -, 3 for * and 4 for /'))
	first_number = int(input('enter the first number'))
	second_number = int(input('enter the second number'))
	if operation ==1:
	  print("Sum: ", first_number + second_number)
	elif operation == 2:
	  print("Difference: ", first_number - second_number)
	elif operation == 3:
	  print("Product: ", first_number * second_number)
	elif operation == 4:
	  print("Division: ", first_number / second_number)
	else:
	  print("Invalid operation")