



آغا خان یونیورسٹی ایگزامینیشن بورڈ  
AGA KHAN UNIVERSITY EXAMINATION BOARD

## Pacing Guide for Teachers

# Computer Science

Grade XI

Theory and Practical

Number of weeks: 28

Number of periods per week: 6

Key Textbook: Textbook of Computer Science Grade 11, National Book Foundation, Islamabad

Teacher Developer(s): Syed Manzoor Mehmood and Riffat Jahan

Institution(s): Aga Khan Higher Secondary School, Karachi and Nasra Higher Secondary School (Malir Campus) Karachi

<b>Topic</b>	<b>Total Periods</b>
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1. Basic Concepts of a Computer System	15
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Sub-Topic	Range of SLOs	Periods (40 mins)
1.1 Introduction to Computer	1.1.1-1.1.2	1
	1.1.3	2
1.2 Computer Software	1.2.1-1.2.3	2
	1.2.4	1
1.3 Computer Hardware	1.3.1-1.3.2	3
	1.3.3	2
	1.3.4	4

## Learning Resources

- Book: Cambridge IGCSE Information and Communication Technology 3rd by Graham Brown | David Watson
- Book: Fundamental Concepts of Computer System Asiya Sultan Ali

# **Web Resources**

- <https://www.khanacademy.org/computing/computers-and-internet/xcae6f4a7ff015e7d:computers/xcae6f4a7ff015e7d:introducing-computers/a/what-is-a-computer>
- <https://revision.co.zw/o-level-computer-science-hardware-software-introduction/>
- <https://turbofuture.com/computers/Classification-Of-Computers-According-To-Size>
- <https://www.indeed.com/career-advice/career-development/system-software-vs-application-software>
- <https://turbofuture.com/computers/The-Five-Types-of-System-Software>
- <https://www.unilab.eu/articles/coffee-break/shareware-freeware-open-source/>
- <https://dzone.com/articles/free-software-vs-open-source-vs-freeware-whats-the>
- <https://www.indeed.com/career-advice/career-development/example-of-output-device>

## **Suggested Activities and/or Formative Assessment**

### **Activity 1**

#### **Classroom Activities**

Draw touch screen which clarifies the capacitive and resistive technologies.

### **Activity 2**

#### **Group Activities**

- a. Make a group of students and assign daily life tasks to complete it. After completion ask them to find out input, process, output and storage in it.
- b. Ask groups to visit different departments of your school and make a list of the different input, process, storage and output devices used there.

### **Activity 3**

#### **Think-Pair-Share**

Allow students to search types of computers according to processing speed, size and uses. Then, students can pair up with a partner to discuss their ideas and come up with a solution. Finally, each pair can share their ideas with the class.

## **Activity 4**

### **Formative Assessments**

- a. Write the correct input devices, output devices, storage devices or processing device in the columns to match the description.
- b. Identify the sensor according to their sensing capability.
- c. Label the shortcut keys of keyboard for the given functions.
- d. Classify the devices into input, process, output and storage.
- e. Differentiate between touch screen technologies.

### **Puzzles**

Give puzzles of crosswords to find out input, process, output and storage devices in it.

## **Activity 5**

### **Collaborative Learning**

Use Computer Supported Collaborative Learning (CSCL) to understand technologies of different computer types. Make small groups of 3 to 5 students to solve this problem and design a project to demonstrate types of computers.

## **Activity 6**

### **Whiteboard Exercise**

Draw a keyboard and label its parts.

## **Activity 7**

### **Online Interactive Activities**

Search online quizzes of i/o devices and assign students to solve it online.

## **Activity 8**

### **Visual Aids**

Use visual aids such as pictures, diagrams, and 3D models to explain the concepts of computing devices. This will make it easier for students to visualize and understand the concepts.

## **Activity 9**

### **Gaming Exercises**

Gaming exercises can improve proficiency in using gamepads and joysticks. Games involving racing, shooting, and platformers can help with control and reaction time.

## **Activity 10**

### **Microphone Exercises**

Microphone exercises involve recording audio, dictating text, and using voice communication applications. These exercises can improve proficiency in using audio input devices and improve pronunciation and speech clarity.

## **Activity 11**

### **Classroom Activities**

- Draw a chart having columns of different system software and fill the features of each system software type.
- Draw hierarchical structure of types of system software with their examples.

## **Activity 12**

### **Collaborative Document Editing**

There are many internet applications that allow multiple users to edit the same document simultaneously. Group members can work together in real-time to create and edit documents, presentations, spreadsheets, and other types of content.

## **Activity 13**

### **Video Conferencing**

Video conferencing applications allow groups of people to have face-to-face conversations regardless of their location. This can be useful for remote team meetings, online classes, or connecting with friends and family.

## **Activity 14**

### **Online White Boarding**

Online white boarding applications allow group members to draw, sketch, and brainstorm ideas together in real-time. This can be useful for creative projects or brainstorming sessions.

## **Activity 15**

### **Social Media Groups**

Social media platforms allow users to create groups where they can share information, discuss topics, and collaborate on projects. This can be useful for community building or project collaboration.

## **Activity 16**

### **Online Gaming**

Multiplayer online games allow groups of people to play games together regardless of their location. This can be useful for team-building activities or just for fun.

## **Activity 17**

### **Online Surveys and Polls**

Online survey and poll tools can be used to gather feedback and opinions from group members. This can be useful for decision-making or to get input on projects.

## **Activity 18**

### **Virtual Events**

Many internet applications allow groups to host virtual events such as webinars, conferences, and workshops. This can be useful for sharing information, networking, or learning new skills.

## **Activity 19**

By using internet applications for group activities, users can collaborate and communicate more effectively and efficiently, regardless of their location.

## **Activity 20**

### **Practice Exercises**

Many software applications have practice exercises built-in that can help users improve their proficiency. These exercises can include creating documents, spreadsheets, presentations, or other types of content.

## **Activity 21**

### **Collaboration Tools**

Many applications have collaboration features that can help users work with others more efficiently. Practicing with these features can improve proficiency in working with teams.

## **Activity 22**

### **Types of Application Software**

Discuss the different types of application software, including productivity software, communication software, educational software, entertainment software, and creative expression software. Give examples of each type and how they are used.

### **Open-Source Software**

Discuss the concept of open-source software and its benefits and drawbacks. Discuss how open-source software is different from proprietary software, and how it is used in different industries.

## **Activity 23**

### **a. Speed Typing Competition**

Divide the group into teams and have them compete to see who can type the fastest and most accurately. You can use typing tests or create your own custom data entry forms for this activity.

### **b. Data Entry Relay Race**

Similar to a speed typing competition, this activity involves teams racing to see who can complete a data entry task the fastest. Each team member must complete a section of the task before passing it on to the next team member.

### **c. Data Entry Accuracy Challenge**

Challenge the group to see who can enter data with the fewest errors. Provide a set of data entry tasks with varying levels of difficulty and have each member attempt to complete them as accurately as possible.

## **Activity 24**

Here are some group discussion topics for automatic data entry devices:

### **a. Advantages and Disadvantages**

Discuss the advantages and disadvantages of using automatic data entry devices. What are the benefits and drawbacks of each device, and how do they compare to manual data entry methods?

### **b. Implementation Strategies**

Discuss the best practices for implementing automatic data entry devices in a business or organization. What factors should be considered, such as cost, training requirements, and compatibility with existing systems?

### **c. Integration with other Systems**

Discuss how automatic data entry devices can be integrated with other systems such as inventory management, customer relationship management (CRM), and enterprise resource planning (ERP) systems. What are the benefits of integration, and what challenges may arise?

### **d. Data Security**

Discuss the importance of data security when using automatic data entry devices. What measures can be taken to ensure that sensitive data is protected, and how can data breaches be prevented?

### **e. Future Trends**

Discuss the future of automatic data entry devices, including emerging technologies such as artificial intelligence (AI) and machine learning. How might these technologies impact the way data is collected and entered in the future?

## **Activity 25**

### **a. Poster Presentations**

Assign students to research different output devices such as printers, projectors, and speakers, and create posters that describe how each device works, their features, and common uses. Have students present their posters to the class and encourage discussion about the advantages and disadvantages of each device.

### **b. Product Review Videos**

Divide the class into small groups and assign each group an output device to review. Have them create short videos that showcase the device's features, demonstrate how it works, and provide an evaluation of its performance. Encourage discussion and debate among the groups about the strengths and weaknesses of each device.

### **c. Sound Experiments**

Use speakers or headphones to conduct experiments on sound quality.

#### **d. Printing Projects**

Assign students to create print materials such as posters, flyers, or brochures using a variety of printers, including inkjet, laser, and 3D printers.

#### **e. Digital Presentations**

Use projectors or other display devices to have students create and present digital presentations. Encourage them to use a variety of visual aids such as graphics, videos, and animations to make their presentations engaging and informative. Have students discuss the advantages and disadvantages of different display devices and presentation software.

### **Activity 26**

#### **a. Cognitive Load Assessment**

Use a cognitive load assessment to measure the mental effort required to complete a data entry task. This can be done through self-report surveys or by measuring physiological responses such as heart rate or skin conductance. Use this information to identify tasks that may be more cognitively demanding and to provide strategies to reduce mental workload.

#### **b. Training Evaluation**

Evaluate the effectiveness of training programs for manual data entry devices by measuring improvements in speed and accuracy over time. Compare performance before and after training to determine the impact of the training program. Use this information to adjust training methods or to provide additional training if necessary.

### **Activity 27**

#### **a. Accuracy Test**

Conduct an accuracy test to measure the accuracy of automatic data entry devices such as barcode scanners, RFID readers, and optical character recognition (OCR) systems. Provide a set of test data and compare the accuracy of the device to manual data entry. This assessment can help to identify the accuracy of the device and potential areas for improvement.

#### **b. Compatibility Assessment**

Conduct a compatibility assessment to determine if the automatic data entry device is compatible with existing systems such as inventory management or CRM systems. This

assessment can help identify potential integration issues and compatibility problems before implementation.

**c. User Acceptance Test**

Conduct a user acceptance test to gather feedback from end-users on the ease of use and effectiveness of the automatic data entry device. This assessment can help identify areas for improvement and potential user training needs.

**d. Performance Benchmarking**

Conduct performance benchmarking to measure the performance of the automatic data entry device against industry standards or competitors. This assessment can help identify areas for improvement and potential competitive advantages.

## **Activity 28**

### **Quizzes and Assessments**

Use quizzes and assessments to evaluate students' knowledge and understanding of input devices. Use a variety of question types such as multiple-choice, short-answer, and scenario-based questions to assess their understanding of different input devices and their functions.

### **Performance-Based Tasks**

Assign performance-based tasks that require students to use different input devices to complete a task. For example, have students create a multimedia presentation using a combination of a keyboard, mouse, and touchscreen. Evaluate their performance based on their ability to effectively use the devices to complete the task.

### **Comparative Analysis**

Assign students to compare and analyze the output generated using different devices. Encourage them to identify similarities and differences in the quality and characteristics of output and to consider how these differences impact their effectiveness in different contexts.

### **Performance-Based Tasks**

Assign performance-based tasks that require students to use different output devices to complete a task, such as creating a poster, designing a website or creating a video. Evaluate their performance based on the quality and effectiveness of their output and their ability to effectively use the devices to complete the task.

<b>Topic</b>	<b>Total Periods</b>
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2. Computer Memory and Storage Devices	16
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Sub-Topic	Range of SLOs	Periods (40 mins)
2.1 Introduction	2.1.1 - 2.1.2	3
2.2 Main Memory	2.2.1 -2.2.2	1
	2.2.3	1
	2.2.4	1
	2.2.5	1
	2.2.6	1
2.3 Secondary Memory	2.3.1 - 2.3.2	2
	2.3.3	2

	2.3.4	1
	2.3.5	2
	2.3.6	1

## Learning Resource

- An Introduction to Direct Access Storage Devices by Hugh M Sierra

## Web Resources

<https://www.khanacademy.org/computing/computers-and-internet/xcae6f4a7ff015e7d:computers/xcae6f4a7ff015e7d:computer-components/a/computer-memory>

<https://www.britannica.com/technology/operating-system>

<https://www.bbc.co.uk/bitesize/guides/zdqmsg/revision/2>

<https://learnlearn.uk/igcsecs/magnetic-optical-solid-state-storage/>

<https://www.britannica.com/technology/optical-storage>

<https://www.britannica.com/technology/compact-disc>

<https://www.ibm.com/topics/solid-state-drives>

<https://insights.samsung.com/2021/12/22/the-evolution-of-solid-state-drives-ssds/>

# **Suggested Activities and/or Formative Assessment**

## **Activity 1**

### **Group Activities**

Here are some group activities for computer memory devices:

#### **1. Memory Game:**

Organize a memory game where students work in pairs or small groups to match different types of computer memory devices with their descriptions and characteristics. This activity can help students learn about different types of computer memory devices and their functions.

#### **2. Memory Scavenger Hunt**

Create a scavenger hunt activity where students need to find different computer memory devices in the classroom or around the school. This activity can help students develop their observation and problem-solving skills while learning about different types of memory devices.

#### **3. Memory Device Sorting**

Assign students to sort different types of computer memory devices based on their characteristics, such as their capacity, speed, or type of storage. This activity can help students develop their analytical skills and understanding of the different features of memory devices.

#### **4. Memory Device Comparison**

Assign students to work in pairs or small groups to compare and contrast different types of computer memory devices. Encourage them to identify the similarities and differences between the devices and to consider their respective advantages and disadvantages.

## **Activity 2**

### **Discussion**

Here are some group discussion topics for memory measuring units:

#### **1. Bit vs Byte**

Discuss the difference between bits and bytes, and the significance of each in computer memory. Encourage students to explain how bits and bytes are used to measure the amount of data stored in a computer.

## **2. Discuss Memory Capacity**

Discuss the different memory capacity units, such as kilobytes, megabytes, gigabytes, and terabytes. Encourage students to explain how these units are used to measure the amount of data stored in a computer, and to give examples of how much data can be stored at different capacity levels.

## **Activity 3**

### **Classroom Activities**

Here are some classroom activities for teaching about computer memory measuring units:

#### **1. Memory Conversion Game**

Create a game where students need to convert different memory units, such as converting kilobytes to megabytes, or gigabytes to terabytes. This activity can help students develop their mental math skills and understanding of the different memory measuring units.

#### **2. Memory Chart Creation**

Assign students to create a memory chart that shows the different memory measuring units and their equivalent values. Encourage them to use visual aids, such as graphics or colors, to make the chart more visually appealing and easier to understand.

## **Activity 4**

### **Memory Unit Comparison**

Assign students to work in pairs or small groups to compare and contrast different memory measuring units. Encourage them to identify the similarities and differences between the units and to consider their respective advantages and disadvantages.

## **Activity 5**

#### **1. Memory Unit Conversion Quiz**

Create a quiz that tests students' ability to convert memory units, such as converting kilobytes to megabytes or gigabytes to terabytes. This quiz can help assess students' understanding of memory measuring units and their ability to perform basic conversions.

#### **2. Memory Unit Matching Game**

Create a matching game where students match different memory units with their equivalent values. This activity can help assess students' knowledge of memory measuring units and their ability to recognize and remember their values.

### **3. Memory Unit Application**

Provide students with a scenario that requires them to apply their knowledge of memory measuring units, such as determining how much storage space is needed to store a particular amount of data. This activity can help assess students' ability to apply their knowledge of memory measuring units to practical situations.

## **Activity 6**

### **Discussion**

1. Do group discussion in the class about Primary memory and Secondary memory. Give some Participants to share their views about Primary memory and some to share their views about Secondary Memory.
2. Make a group to find out the facts about Static Ram and another group about Dynamic Ram. Then allow them to discuss the similarities and differences
3. between these types of RAMS.

## **Activity 7**

### **Classroom Activities**

Classroom activities can be designed to help students understand and explore the different types of computer memory. Here are a few activities related to types of computer memory:

#### **1. Memory Sorting Game**

Prepare flashcards or small cards with different types of computer memory written on them (e.g., RAM, ROM, Cache, Virtual Memory). Divide the class into small groups and distribute the cards. Ask each group to sort the cards into categories based on the type of memory. Encourage discussions within the groups to explain their reasoning behind the sorting.

#### **2. Memory Comparison Chart**

Provide students with a blank chart or worksheet and ask them to create a comparison chart for different types of computer memory. The chart should include columns for characteristics such as volatility, speed, capacity, cost, and usage. Instruct students to research and fill in the information for each memory type. Discuss the completed charts as a class to compare and contrast the different types of memory.

#### **3. Memory Case Studies:**

Assign small groups of students to research and present case studies on real-world applications of different types of computer memory. Each group can choose a specific type of memory (e.g., Flash Memory, Magnetic Disk) and explore its use in various

industries or devices (e.g., smartphones, gaming consoles, medical devices). The groups should explain the advantages, limitations, and unique features of the selected memory type in their presentations.

## Activity 8

### Activities For Formative Assessments

#### 1. Memory Concept Mapping

Provide students with a blank concept map or graphic organizer. Instruct them to create a visual representation of the different types of computer memory. Ask students to label each type of memory and connect them with lines or arrows to indicate relationships or characteristics.

#### 2. Memory Quiz

Create a short quiz with multiple-choice or fill-in-the-blank questions about types of computer memory. Include questions that assess students' knowledge of the characteristics, functions, and examples of primary and secondary memory. This quiz can be administered online or on paper and can serve as a quick check for understanding.

#### 3. Memory Scenario Analysis

Provide students with different scenarios or real-world examples that involve the use of different types of memory. For each scenario, ask students to identify and explain the type of memory that would be most suitable. They should justify their choices based on the specific requirements of each situation. This activity helps students apply their knowledge of memory types to practical situations.

#### 4. Memory Comparison Chart

Distribute a pre-made comparison chart or ask students to create their own. The chart should have columns for different types of memory (e.g., RAM, ROM) and rows for characteristics such as speed, capacity, volatility, cost, and usage. Students should fill in the chart with information about each type of memory based on their understanding. This activity allows students to compare and contrast the different types of memory and demonstrate their knowledge of their respective features.

#### 5. Memory Reflection Journal

Assign students to maintain a reflection journal throughout the unit or lesson on computer memory. In the journal, students can write about their learning experiences, key concepts they have grasped, and any questions or areas they find challenging. This provides an opportunity for students to reflect on their understanding of types of memory and for you to gain insight into their comprehension.

## **Activity 9**

### **Group Activities**

Here are few ideas for group activities focused on cache memory:

#### **1. Cache Memory Sorting Game**

Prepare a set of cards with different types of cache memory. Divide the students into groups and distribute the cards among them. Instruct each group to sort the cards into categories based on the type of cache memory. Once they have completed the sorting, have each group present their categorization and explain the characteristics of each type.

#### **2. Cache Memory Comparison Chart**

Divide the students into groups and provide each group with a large poster paper or a digital whiteboard. Instruct each group to create a comparison chart that includes different types of cache memory as columns. Encourage students to collaborate and research to gather information for their comparison charts. After completion, have each group present their comparison charts to the class, fostering discussions and reflections on the similarities and differences between cache memory types.

#### **3. Group Discussion:**

Assign each group a specific type of cache memory and provide them with relevant information about that type. Instruct each group to create a short skit or role-play scenario that showcases the operations, advantages, and challenges of their assigned cache memory type. Encourage creativity and engagement during the role-play performances. After each group's presentation, facilitate a class discussion to highlight the unique aspects of each cache memory type.

## **Activity 10**

### **Classroom Activities**

Here are some classroom activities focused on cache memory:

#### **1. Cache Mapping Game**

Divide the class into groups and provide each group with a large grid or a floor space divided into blocks. Assign each group a specific type. Give them a set of memory addresses and ask them to map the addresses to the corresponding cache blocks on the grid. This activity helps students understand how different mapping techniques work and the impact they have on cache performance.

## **2. Cache Memory Design Project**

Divide the class into small groups and assign each group the task of designing a cache memory system for a specific computer architecture or application scenario. Provide guidelines on cache size, associativity, and replacement policies. Ask each group to present their design, explaining their rationale behind the choices made. This project encourages critical thinking, problem-solving, and understanding of cache memory design principles.

## **3. Cache Memory Discussion and Debate**

Assign student's various topics related to cache memory, such as the trade-offs between cache size and associativity, the impact of different replacement policies, or the benefits and limitations of different mapping techniques. Ask students to research and prepare arguments supporting their positions on the assigned topics. Hold a class discussion or debate where students present their arguments and engage in critical discussions. This activity promotes critical thinking, communication skills, and deeper understanding of cache memory concepts.

## **Activity 11**

### **Activities For Formative Assessments**

Here are some activities for formative assessments of cache memory:

#### **1.Cache Memory Diagram:**

Provide students with a partially completed cache memory diagram and ask them to fill in the missing components. This activity assesses students' ability to interpret and apply cache memory types of concepts.

## **Activity 12**

### **Formative Assessments**

#### **1. Multiple-Choice Questions**

Create a set of multiple-choice questions that assess students' understanding of cache memory concepts. Include questions about cache organization, mapping techniques, replacement policies, and cache performance. Provide options that address common misconceptions to test students' comprehension.

#### **Example question**

Which cache mapping technique provides the fastest access time but has a higher chance of conflicts?

#### **2.Error Spotting**

Provide a passage or a series of statements about cache memory and ask students to identify and correct any errors or misconceptions. This activity tests students' ability to identify inaccuracies and demonstrates their understanding of cache memory concepts.

## Activity 12

### Classroom Activities

#### 1. Sorting Activity

Provide students with a set of data records that need to be sorted based on a specific field (e.g., ID number or alphabetical order). Instruct students to organize the records in sequential order using a sequential access storage device, such as magnetic tape. Students can simulate the sequential access process by physically moving through the records to find the correct position for each one. This activity helps students understand the sequential nature of accessing data in storage devices like magnetic tape.

### Direct Access Activities

#### 1. Indexing Exercise:

Provide students with a set of data records and ask them to create an index for efficient direct access. Students can choose a key field from the data records and create an index table or structure that allows quick retrieval of specific records based on the key. This activity helps students understand the concept of indexing and how it enables direct access to data.

#### 2. Searching Algorithms:

Assign students different search algorithms, such as linear search, binary search, or hash-based search. Provide them with a dataset and ask them to implement the assigned algorithm to find specific records efficiently. Students can compare the performance of different search algorithms and analyse their suitability for different direct access storage devices. This activity helps students grasp the concept of direct access and the importance of efficient search algorithms. File Organization Analysis: Provide students with examples of different file organization techniques, such as sequential files, indexed sequential files. Students should consider factors such as storage efficiency, search speed, and ease of updating records.

## Activity 13

### Group Activities

#### 1. Sorting Activity

Prepare a set of cards or pictures representing different storage devices such as hard disk drives (HDDs), solid-state drives (SSDs), magnetic tapes, CDs/DVDs, and USB flash drives. Divide students into groups and provide them with a sorting task. Instruct each

group to categorize the storage devices into magnetic, optical, and solid-state categories. Encourage discussions within the groups to justify their categorization and discuss the characteristics of each storage device.

## **2. Comparison Chart**

Provide students with a blank comparison chart template or have them create one. Instruct them to compare magnetic, optical, and solid-state storage devices based on various criteria such as storage capacity, access speed, durability, portability, and cost. Students can research or use their existing knowledge to complete the chart. This activity promotes critical thinking and helps students understand the differences and similarities between different storage technologies.

## **3. Real-life Applications**

Assign students to different real-life scenarios or industries that rely on specific storage devices. For example, a scenario might involve a music production company choosing between using magnetic tape or solid-state storage for long-term archival of audio recordings. Students should research and present their findings, considering factors such as cost, longevity, and data transfer speed. This activity encourages students to analyze practical applications of storage devices and consider their advantages and limitations.

## **4. Advantages and Disadvantages**

Divide students into small groups and assign each group a specific type of optical storage media, such as CDs, DVDs, or Blu-ray discs. Instruct each group to create a list of advantages and disadvantages of their assigned media type. After completing their lists, each group present their findings to the class. This activity promotes critical thinking and helps students identify the strengths and weaknesses of different optical storage media.

## **5. Debate**

Organize a debate where students take on the role of advocates for magnetic, optical, or solid-state storage devices. Assign groups to represent each storage technology and provide them with time to research and gather evidence supporting their assigned technology. Students should present their arguments, highlighting the advantages and disadvantages of their chosen storage technology compared to the others.

# **Activity 14**

## **Activities For Formative Assessments for Optical Storage Media:**

### **1. Labeling Activity**

Provide students with a variety of optical storage media, such as CDs, DVDs, Blu-ray discs. Ask students to examine each type and label them with the correct name and

storage capacity. This activity tests students' recognition and understanding of different optical storage media.

## 2. Match the Format

Create a matching game where students match different types of optical storage media with their corresponding formats or characteristics. Provide a set of cards with descriptions or images of optical storage media, and another set of cards with the formats or characteristics. Students must match the media with their corresponding formats or characteristics. This activity assesses students' knowledge of the different formats used in optical storage.

## 3. Case Studies

Present students with case studies or scenarios that involve the use of optical storage media. For example, a scenario might involve a music production company deciding between using CDs or DVDs to distribute their music albums. Ask students to analyze the scenario and provide a rationale for their choice of optical storage media based on factors such as storage capacity, compatibility, durability, and cost. This activity tests students' ability to apply their understanding of optical storage media in real-world situations.

# Activity 15

## Formative Assessments for Solid-State Storage Devices:

### 1. Concept Mapping

Provide students with a concept map template related to solid-state storage devices. Ask them to fill in the map with different aspects of solid-state storage. This activity assesses students' understanding of the components and concepts related to solid-state storage.

### 2. Case Study Analysis

Present students with real-world case studies that involve the use of solid-state storage devices in different scenarios, such as enterprise storage systems, gaming consoles, or laptops. Ask students to analyze the advantages and disadvantages of using solid-state storage in each case study. They should also consider factors like performance, durability, power consumption, and cost. This activity assesses students' ability to apply their knowledge of solid-state storage to practical situations and evaluate its suitability for specific applications.

### 3. Comparison Chart:

Provide students with a blank comparison chart template or have them create one. Instruct them to compare solid-state storage devices with other types of storage, such as hard disk drives (HDDs) and optical storage. Students should consider factors like

speed, capacity, durability, reliability, and power consumption. This activity encourages students to analyze and contrast solid-state storage with other storage technologies, enabling them to identify its unique advantages.

#### **4. Virtual Lab Exploration:**

Use virtual lab software or online simulations to provide students with hands-on experience with solid-state storage devices. Students can record their observations and findings to demonstrate their understanding of solid-state storage behavior and optimization techniques.

<b>Topic</b>	<b>Total Periods</b>
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3. Architecture of CPU	15
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<b>Sub-Topic</b>	<b>Range of SLOs</b>	<b>Periods (40 mins)</b>
3.1 Components of Central Processing Unit (CPU)	3.1.1 - 3.1.2	3
	3.1.3	3
3.2 Various Operations Performed by CPU	3.2.1	2
	3.2.2	2
	3.2.3	1
	3.2.4	2
	3.2.5	2

## **Learning Resources**

- Computer Organization and Architecture 10th Edition by William Stallings
- The Elements of Computing Systems, second edition: Building a Modern Computer from First Principles 2nd Edition by Noam Nisan and Shimon Schocken

- Modern Computer Architecture and Organization: Learn x86, ARM, and RISC-V architectures and the design of smartphones, PCs, and cloud servers, 2<sup>nd</sup> Edition by Jim Ledin
- Essentials of Computer Organization and Architecture 5th Edition by Linda Null and Julia Lobur

## Web Resources

<https://www.redhat.com/sysadmin/cpu-components-functionality>

[https://en.wikibooks.org/wiki/X86\\_Assembly/X86\\_Architecture](https://en.wikibooks.org/wiki/X86_Assembly/X86_Architecture)

<https://www.bbc.co.uk/bitesize/guides/zhppfcw/revision/4>

<https://itigic.com/instruction-cycle-in-cpu-how-fetch-decode-and-execute-work/>

## Suggested Activities and/or Formative Assessment

### Activity 1

#### 1. CPU Component Matching

Create a set of cards or images representing various CPU components, such as the arithmetic logic unit (ALU), control unit, registers, cache, and bus interfaces. Distribute the cards among the students and ask them to match the components with their corresponding functions or descriptions. This activity helps students understand the roles and functionalities of different CPU components.

#### 2. CPU Assembly

Divide the class into small groups and provide each group with a CPU assembly task. Assign each group a specific CPU component and instruct them to create a physical representation or a diagram of the component using classroom materials or software tools. Students should present their assembly to the class and explain the purpose and function of their assigned CPU component. This activity promotes hands-on learning and deeper understanding of CPU components.

#### 3. Component Analysis

Assign each student or small group a specific CPU component and instruct them to research and create a presentation or infographic about that component. Students should describe the function, operation, and significance of their assigned component

within the CPU. They can include diagrams, flowcharts, or animations to visually represent the component's operation. This activity encourages independent research, information synthesis, and effective communication skills.

#### **4. CPU Role-Play**

Assign different students roles representing different CPU components, such as ALU, control unit, or cache. Provide a scenario or program execution sequence and ask students to simulate the interaction among the components to execute the program. This activity allows students to actively engage with CPU components and understand how they collaborate to perform computations.

#### **5. CPU Design Challenge**

Divide students into small groups and assign each group the task of designing a CPU architecture for a specific application or scenario. Provide guidelines on the required CPU components, performance goals, and constraints. Students should collaborate to design a CPU that meets the given requirements and present their design to the class, highlighting the purpose and functionality of each component. This activity promotes critical thinking, problem-solving, and understanding of CPU design principles.

## **Activity 2**

#### **1. Register Comparison:**

Divide the class into groups and assign each group a specific type of register. Instruct each group to research and prepare a comparison chart or presentation that highlights the purpose, size, function, and usage of their assigned register type. Afterward, have each group present their findings to the class, allowing for discussions and questions. This activity promotes research skills, collaboration, and a deeper understanding of register types.

#### **2. Register Role-Play**

Assign different students roles representing different types of registers. Provide a scenario or program execution sequence and ask students to simulate the interaction among the registers to execute the program. Students should actively engage in role-play, demonstrating how the registers store and manipulate data as the program progresses. This activity allows students to understand the purpose and functionality of different registers in a hands-on and interactive manner.

### **3. Register Circuit Construction**

Provide students with a hands-on activity where they build simple register circuits using electronic components or simulation software. Students should follow circuit diagrams or instructions to build the register, and then test its functionality by inputting data and observing the output. This activity provides a practical understanding of how registers are implemented and how they store and manipulate data.

### **4. Register Application Analysis**

Assign students different real-life applications or scenarios that rely on specific types of registers. For example, a scenario might involve a robotic arm control system that requires the use of specialized registers for joint angles or motor control. Students should research and analyze the requirements of the application, identify the appropriate register types, and explain their significance in the given context. This activity promotes critical thinking, research skills, and a deeper understanding of the practical applications of registers.

## **Activity 3**

### **1. Component Identification**

Provide students with a diagram or image of a CPU and ask them to label the different components, such as ALU, control unit, registers, cache, and bus interfaces. Alternatively, you can provide a list of CPU components and ask students to match each component with its corresponding function or description. This activity tests students' knowledge and understanding of CPU components.

### **2. Component Function Analysis**

Assign each student or small group a specific CPU component and ask them to research and create a presentation or report about that component's function and significance within the CPU. Students should explain how the component contributes to the overall operation of the CPU and provide examples of how it is used in real-world computing scenarios. This activity assesses students' ability to articulate the purpose and importance of CPU components.

### **3. Performance Impact Investigation**

Assign students the task of investigating how specific CPU components impact the performance of a computer system. For example, students can research how the cache size, ALU speed, or register count affects the overall performance of the CPU. Students

should gather data, conduct experiments, or analyze case studies to support their findings. This activity promotes critical thinking and allows students to explore the relationship between CPU components and system performance.

#### **4. CPU Design Challenge**

Ask students to design a CPU architecture that meets the given criteria. Students should justify their design choices, explaining how each component is selected or configured to achieve the desired outcomes. This activity assesses students' ability to apply their understanding of CPU components in a practical design context.

#### **5. Component Comparison and Debate**

Assign students' different CPU components and instruct them to research and compare alternative implementations or technologies for those components. For example, students can compare different cache organizations or different ALU architectures. Ask students to present their findings and engage in a class debate, discussing the advantages, disadvantages, and trade-offs of each component variation. This activity encourages critical thinking, research skills, and the ability to evaluate different CPU component options.

### **Activity 4**

#### **1. Component Role-Play**

Assign different CPU components to students such as the ALU, control unit, registers, cache, or bus interfaces. Instruct each student to research and prepare a short presentation or demonstration highlighting the purpose, function, and operation of their assigned component. Then, have students take turns acting out the role of their component in a simulated CPU operation, explaining how it interacts with other components. This activity assesses students' understanding of CPU components and their ability to explain their roles.

#### **2. Component Investigation Worksheet**

Provide students with a worksheet that includes a series of questions or prompts about specific CPU components. Students can research, answer questions, and provide examples or diagrams to support their responses. Questions could include how the ALU performs arithmetic operations, how registers store data, or how cache improves performance. This activity tests students' knowledge and comprehension of CPU components.

## **Activity 5**

### **1. Arithmetic Instruction Activity**

**Expression Evaluation:** Provide students with a set of arithmetic expressions, such as addition, subtraction, multiplication, or division operations. Instruct them to simulate the execution of these expressions step by step, using pencil and paper or a calculator. Students should identify the relevant registers, memory locations, and CPU instructions involved in evaluating each expression. This activity helps students understand the execution flow and the role of arithmetic instructions in performing mathematical operations.

### **2. Control Instruction Activity**

**Program Flow Simulation:** Assign students a simple program or a sequence of instructions that involve control instructions, such as conditional branches or loops. Instruct students to simulate the execution of the program step by step, keeping track of the program counter (PC), condition flags, and the control transfer based on the instructions. Students can use a flowchart or a diagram to visualize the program flow. This activity helps students grasp the concept of control instructions and how they affect the flow of program execution.

### **3. Data Transfer Instruction Activity**

**Memory Access Simulation:** Provide students with a set of memory addresses and instruct them to simulate the execution of data transfer instructions, such as load and store instructions. Students should identify the source and destination registers, memory locations, and the data being transferred. They can use a diagram or a memory table to track the changes in memory and registers during the execution. This activity reinforces the understanding of data transfer instructions and their impact on memory and register states.

## **Activity 6**

### **1. Zero Address Instruction Format**

**Instruction Identification Game:** Divide the class into groups and provide each group with a set of cards representing different zero address instructions. Instruct the groups to create a game where they take turns presenting an instruction card to the other groups, who must correctly identify the instruction and explain its purpose. This activity promotes engagement and understanding of zero address instructions.

**Assembly Language Translation:** Assign each group a set of high-level language statements or operations that can be represented using zero address instructions. Instruct the groups to translate the statements into corresponding zero address instructions using an assembly language of their choice. Each group should then present their translations to the class and explain the rationale behind their choices. This activity enhances understanding of how high-level language operations are represented in zero address instructions.

## **2. One Address Instruction Format**

**Instruction Coding Contest:** Divide the class into groups and provide each group with a set of high-level language statements or operations that can be represented using one address instructions. Instruct the groups to create a contest where they compete to encode the statements into one address instruction format with the fewest number of instructions. The group that achieves the most efficient encoding wins. This activity encourages creativity, critical thinking, and problem-solving skills.

**Program Execution Simulation:** Assign each group a simple program or a sequence of high-level language statements that can be represented using one address instruction. Instruct the groups to simulate the execution of the program, keeping track of the relevant registers, memory locations, and the execution flow of one address instructions. Each group should present their simulation to the class, explaining the steps taken and the results obtained. This activity promotes understanding of one address instructions and their impact on program execution.

## **3. Two Address Instruction Format**

**Instruction Design Challenge:** Divide the class into groups and assign each group the task of designing a set of high-level language statements or operations that can be represented using two address instructions. Instruct the groups to design a simple programming language and create a series of example programs using their two address instructions. Each group should present their language and programs to the class, explaining the rationale behind their design choices. This activity encourages creativity, problem-solving, and understanding of two address instructions.

# **Activity 7**

## **1. Instruction Coding Relay**

Create a relay-style coding activity where each group takes turns coding a high-level language statement into a two-address instruction format. The first group starts by coding one statement, then passes their code to the next group, who adds another statement, and so on. Each group should explain their coding decisions and ensure that

the instructions can be executed correctly in sequence. This activity promotes collaboration, critical thinking, and understanding of two address instructions.

## 2. Debate and Discussion

Divide the class into two groups, one representing CISC architecture advocates and the other representing RISC architecture advocates. Assign each group the task of researching and preparing arguments supporting their respective architectures. Conduct a debate or class discussion where students present their arguments, counterarguments, and engage in critical discussions about the strengths and weaknesses of CISC and RISC architectures. This activity encourages research skills, critical thinking, and the ability to articulate and defend viewpoints.

## 3. Architecture Design Project

Divide the class into small groups and assign each group the task of designing a simple computer architecture based on either CISC or RISC principles. Instruct the groups to justify their design choices, considering factors such as instruction set complexity, addressing modes, pipeline design, and performance optimization. Each group should present their architecture design, explaining how it aligns with the principles of either CISC or RISC. This project promotes problem-solving skills, critical thinking, and application of architectural concepts.

# Activity 8

## 1. Timeline Activity

Provide students with a set of instructions and ask them to create a timeline showing the different stages of the fetch-decode-execute cycle. They can use different colors to represent the different stages and add annotations to explain what is happening at each stage. This activity helps students visualize the flow of instructions through the CPU.

## 2. Trace Activity

Give students a program or set of instructions and ask them to trace the execution of the instructions by hand. They should write down the value of each register and memory location at each stage of the cycle. This activity helps students understand how instructions are executed in the CPU and the impact of different instructions on the state of the system.

### **3. Comparison Chart**

Assign students the task of creating a comparison chart or table that highlights the key differences between CISC and RISC architectures. Students should research and identify characteristics such as instruction set size, instruction formats, addressing modes, pipeline complexity, and performance trade-offs. They can use the chart to summarize their findings and present their understanding of the two architectures. This activity promotes research skills, critical thinking, and understanding of the distinct features of CISC and RISC architectures.

### **4. Instruction Analysis**

Provide students with a set of assembly language instructions from programs written for CISC and RISC architectures. Instruct them to analyze and compare the instructions, focusing on the complexity, number of operations performed, and memory access patterns. Students should discuss the advantages and disadvantages of each architecture based on their observations. This activity encourages critical thinking, observation skills, and understanding of the impact of different architectures on instruction execution.

### **5. Performance Evaluation:**

Assign students the task of evaluating the performance of CISC and RISC architectures for a specific computing task or benchmark. Students should research and gather data on execution time, power consumption, and other relevant performance metrics for both architectures. They should analyze the data and discuss the performance differences between CISC and RISC architectures, explaining the factors that contribute to the observed results. This activity promotes critical thinking, data analysis skills, and understanding of performance trade-offs in different architectures.

## **Topic** **Total Periods**

4. System Unit 8

Sub-Topic	Range of SLOs	Periods (40 mins)
4.1 Inside System Unit	4.1.1-4.1.2	2
4.2 Ports and Slots on the Motherboard	4.2.1	2
	4.2.2	2
	4.2.3	2

## Web Resources

<https://red-dot-geek.com/types-of-computer-expansion-cards/>

<https://www.lifewire.com/power-supply-unit-2618158>

<https://www.techtipages.com/what-is-simm-single-in-line-memory-module/>

# **Suggested Activities and/or Formative Assessment**

## **Activity 1**

### **Classroom Activities**

#### **1. Casing**

Casing Design Project: Assign students the task of designing a computer casing that meets specific requirements, such as size, cooling efficiency, and aesthetics. Students can create sketches, 3D models, or physical prototypes of their casing design. They should consider factors like airflow, cable management, and accessibility of components. This activity promotes creativity, problem-solving, and understanding of the importance of casing in protecting and organizing computer components.

#### **2. Power Supply**

Power Supply Specifications Analysis: Assign students the task of researching and analyzing different power supply specifications, such as wattage, efficiency ratings. Instruct them to explain the significance of each specification and how it affects system performance and power consumption. Students can present their findings in a report or a presentation, fostering research skills and understanding of power supply functionality.

Power Supply Troubleshooting: Provide students with a set of common power supply issues or scenarios, such as a system not powering on or frequent system crashes. Instruct them to identify and troubleshoot the potential causes related to the power supply. Students should explain their diagnostic process and propose solutions to resolve the issues.

#### **3. Motherboard**

Motherboard Component Identification: Provide students with images or physical examples of different motherboard components, such as the CPU socket, RAM slots, expansion slots, and chipset. Instruct them to identify and label the components, explaining their functions and interactions. This activity enhances knowledge of motherboard components and understanding of their roles in the system unit.

## **Activity 2**

### **Group Activities**

#### **1. Component Identification Game**

Create a game where students take turns identifying and describing different components of the CPU and system unit. Show pictures or provide physical examples of components, and students must correctly identify and explain their roles. This activity

tests students' knowledge of CPU-specific components and system unit components, enhancing their ability to differentiate between the two.

## **2. Diagram Creation**

Instruct students to create labeled diagrams that illustrate the CPU and system unit, highlighting their respective components. Students can use graphic design software, drawing tools, or paper and pencil to create their diagrams. They should include a legend or key explaining the function of each component. This activity encourages visual representation, research, and understanding of the distinct components within the CPU and system unit.

## **3. Function Comparison:**

Divide the class into small groups and assign each group a specific component of the CPU and a specific component of the system unit. Instruct the groups to research and compare the functions and roles of their assigned components. They should create presentations or posters highlighting the similarities and differences between the CPU component and the system unit component. Each group can then present their findings to the class, facilitating discussion and understanding of the unique functions of CPU and system unit components.

# **Activity 3**

## **1. Component Matching**

Provide students with a set of computer hardware components (e.g., CPU, motherboard, RAM, storage devices, expansion cards) and a list of functions or descriptions. Instruct students to match each component with its corresponding function or description. This activity tests students' knowledge of the various components within the system unit and their understanding of their roles and functions.

## **2. System Unit Disassembly and Reassembly**

In a supervised environment, students disassemble a computer system unit into its individual components and then reassemble it back to its original state. During the disassembly and reassembly process, students should identify each component, explain its function, and discuss how it connects to other components. This activity provides hands-on experience with the system unit, promotes observation and problem-solving skills, and deepens understanding of the internal components.

## **3. System Unit Troubleshooting**

Assign students a set of common system unit problems, such as a computer not powering on, random shutdowns, or abnormal noises. Students should research and identify potential causes for each problem and propose troubleshooting steps to diagnose and resolve the issues. They can present their findings and solutions in written reports,

presentations, or group discussions. This activity assesses students' ability to apply their knowledge of the system unit to real-world troubleshooting scenarios.

#### **4. Component Compatibility Analysis**

Divide students into small groups and assign each group a specific computer system configuration (e.g., CPU, motherboard, RAM, storage devices). Instruct the groups to research and analyze the compatibility between the components in their assigned configuration. They should consider factors such as socket compatibility, RAM speed compatibility, and power supply requirements. Each group can present their findings and discuss the potential issues or advantages of their selected components. This activity encourages critical thinking, research skills, and understanding of component compatibility within the system unit.

### **Activity 4**

#### **Classroom Activities**

##### **1. Port Identification**

Port Matching: Provide students with images or descriptions of different types of ports (serial port, parallel port, PS/2 port, USB port, FireWire port, HDMI port). Instruct them to match each port with its corresponding name or description. This activity tests students' ability to identify and differentiate between different types of ports based on their visual appearance or characteristics.

Port Labeling: Create a worksheet or diagram that includes different types of ports. Instruct students to label each port correctly with its name and provide a brief description of its function. Students can research or use their prior knowledge to complete the activity. This activity enhances students' knowledge of different ports and their functions.

##### **2. Port Comparison**

Advantages and Disadvantages: Assign students to research and compare the advantages and disadvantages of different types of ports. Instruct them to create a comparison chart or table that highlights the key features, data transfer rates, connection types, and common uses of each port. Students should discuss the strengths and limitations of each port and provide examples of devices that use each port. This activity promotes critical thinking, research skills, and understanding of the characteristics and applications of different ports.

#### **Real-World Scenarios**

Provide students with different scenarios or use cases that require specific ports. For each scenario, students must identify the appropriate port to use and explain their reasoning. They should consider factors such as data transfer speed, compatibility, and device requirements. This activity encourages problem-solving skills, critical thinking, and practical application of knowledge about different types of ports.

### **3. Port Connectivity**

#### **a. Device Connection Simulation**

Set up a hands-on activity where students have to connect different devices to a computer using various ports. Provide a variety of devices and corresponding cables, including devices that require serial ports, parallel ports, PS/2 ports, USB ports, FireWire ports, and HDMI ports. Students must correctly identify the type of port required for each device and connect them accordingly. This activity enhances understanding of port connectivity and reinforces practical skills.

#### **b. Port Compatibility Exercise**

Provide students with a list of devices and their corresponding port requirements. Instruct them to match each device with the appropriate port type (e.g., printer - parallel port, keyboard - PS/2 port, external hard drive - USB port). Students can work individually or in groups to complete the exercise, and then discuss their answers as a class. This activity assesses students' understanding of port compatibility and their ability to apply their knowledge to real-world examples.

## **Activity 5**

### **Port Scavenger Hunt:**

- a.** Divide the class into small groups and assign each group a specific type of port (serial port, parallel port, PS/2 port, USB port, FireWire port, HDMI port).
- b.** Provide a list of devices that commonly use each port type (e.g., mouse, keyboard, printer, external hard drive, digital camera, monitor).
- c.** Instruct each group to find and document examples of devices that use their assigned port type within a given time frame.
- d.** Once the scavenger hunt is complete, groups can present their findings to the class, explaining the function of their assigned port and providing real-world examples of devices that use it.

This activity encourages teamwork, research skills, and understanding of different port types and their associated devices.

### **2. Port Compatibility Challenge:**

- a.** Divide the class into small groups and provide each group with a set of devices and a list of available ports (serial port, parallel port, PS/2 port, USB port, FireWire port, HDMI port).
- b.** Instruct each group to match the devices with the appropriate port type based on compatibility. They should justify their choices and explain why a particular port is suitable for a specific device.

- c. Once the groups have completed the challenge, have them compare their answers and discuss any differences or discrepancies. Facilitate a class discussion to reinforce the concepts of port compatibility and device connectivity.

This activity promotes critical thinking, problem-solving, and collaborative learning.

### **3. Port Presentation and Comparison:**

#### **Port Simulation Game:**

- a. Create a simulation game where students take on different roles representing devices (e.g., mouse, keyboard, printer, external hard drive, digital camera) and ports (serial port, parallel port, PS/2 port, USB port, FireWire port, HDMI port).
- b. Instruct students to physically connect themselves (using props or designated spots) to the appropriate port based on compatibility and function.
- c. Facilitate a discussion after the game to reflect on the challenges faced, discuss the implication for the topic.

## **Activity 6**

### **Activities For Formative Assessments Focused on Expansion Cards:**

#### **1. Card Matching Game:**

- a. Prepare a set of expansion cards (e.g., graphics card, sound card, network card, USB card, Wi-Fi card) along with their descriptions or functions.
- b. Divide the class into small groups and distribute the cards randomly among the groups.
- c. Instruct the groups to match each expansion card with its corresponding description or function.
- d. Encourage discussions within the groups to justify their choices and ensure a correct match.

#### **2. Card Installation Simulation:**

- a. Set up a simulated computer system with empty expansion slots (e.g., using cardboard cutouts or a virtual simulation).
- b. Provide students with a variety of expansion cards and their corresponding documentation or installation guides.
- c. Assign each student or group a specific expansion card and instruct them to install the card into the appropriate expansion slot.
- d. Students should follow the installation instructions, ensuring proper alignment and connection.
- e. After the installation, students can present their process and discuss the purpose and functionality of their assigned expansion card.

This activity promotes hands-on learning, understanding of installation procedures, and reinforces knowledge of different types of expansion cards.

### **3. Expansion Card Research Project:**

- a. Divide students into small groups and assign each group a specific type of expansion card (e.g., graphics card, sound card, network card, USB card, Wi-Fi card).
- b. Instruct each group to research and create a presentation or report about their assigned expansion card.
- c. Students should cover topics such as the purpose and function of the card, its compatibility requirements, installation procedures, and common use cases.
- d. Encourage groups to include visuals, diagrams, or demonstrations to enhance their presentations.
- e. Each group can present their findings to the class, allowing for questions and discussions to deepen understanding.
- f. This activity promotes research skills, presentation skills, and a comprehensive understanding of different types of expansion cards.

### **4. Compatibility and Expansion Card Selection:**

- a. Provide students with a variety of computer system configurations and expansion card options.
- b. Instruct students to select the appropriate expansion card(s) for each system configuration based on compatibility and desired functionality.
- c. Students should research and consider factors such as the motherboard specifications, available slots, power requirements, and the purpose of the expansion card.
- d. Students can present their selections, explaining their reasoning and discussing the benefits of their chosen expansion card(s).

## **Activity 7**

### **Formative Assessments:**

#### **Memory Module Comparison Chart:**

1. Divide the class into small groups and provide each group with a chart or table template comparing SIMM and DIMM memory modules.
2. Instruct each group to research and fill out the chart with information about the key characteristics, features, advantages, and limitations of SIMM and DIMM modules.
3. The chart should include categories such as form factor, pin count, data transfer rate, maximum capacity, compatibility, and common uses.

<b>Topic</b>	<b>Total Periods</b>
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5. Network Communication and Protocols	28
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<b>Sub-Topic</b>	<b>Range of SLOs</b>	<b>Periods (40 mins)</b>
5.1 Introduction to Computer Networks	5.1.1-5.1.2	3
	5.1.3	1
	5.1.4	2
	5.1.5	3
	5.1.6	1
	5.1.7	1
	5.1.8	1
	5.1.9	2
	5.2.1	2

	5.2.2	2
	5.3.1	2
	5.3.2	1
	5.3.3	2
	5.3.4	2
	5.3.5	1
	5.3.6	2

5.3 TCP/ IP Protocol Architecture

## Learning Resources

- Data Networks (2nd Edition) by Dimitri P. Bertsekas and R G Gallager
- Modelling and Analysis of Computer Communication Networks by J.F. Hayes
- Data and Computer Communications by W Stallings
- Multiple Access Protocols by R Rom and M Sidi

# **Web Resources**

<https://www.indeed.com/career-advice/career-development/types-of-networks>

<https://www.lifewire.com/lans-wans-and-other-area-networks-817376>

[https://www.section.io/engineering-education/switch-vs-router-vs-hub/ .](https://www.section.io/engineering-education/switch-vs-router-vs-hub/)

<https://www.versitron.com/blog/a-comparison-of-parallel-data-transmission-and-serial-data-transmission>

<https://www.comparitech.com/net-admin/network-topologies-advantages-disadvantages/>

<https://linuxhint.com/tcp-ip-layers-and-functions/>

<https://docs.oracle.com/cd/E19683-01/806-4075/ipv-10/index.html>

# **Suggested Activities and/or Formative Assessment**

## **Activity 1**

### **1. Nano Network**

Research Assignment: Assign students to research and explore nano networks. They should investigate the concept, applications, and challenges associated with nano networks, including the use of nanoscale devices for communication and data transfer. Students can create a report or presentation summarizing their findings and present it to the class. This activity promotes research skills and understanding of the unique characteristics of Nano networks.

### **2. Body Area Network (BAN)**

Design Your BAN: Instruct students to design their own Body Area Network. They should identify the types of devices and sensors that can be used in a BAN, determine how these devices will communicate and exchange data, and discuss potential applications of BAN in healthcare or fitness monitoring. Students can present their BAN designs to the class, explaining their choices and the benefits of their proposed system. This activity fosters creativity, critical thinking, and understanding of BAN technology.

### **3. Personal Area Network (PAN)**

PAN Device Showcase: Ask students to bring in examples of devices that can be connected to a Personal Area Network. These devices can include smartphones, laptops, smartwatches, wireless headphones, or other IoT devices. Each student should present their device, explain its connection method (Bluetooth, Wi-Fi, etc.), and discuss how it

contributes to their personal network. This activity promotes hands-on exploration, presentation skills, and understanding of PAN devices.

#### **4. Near-me Area Network (NAN)**

NAN Scavenger Hunt: Organize a scavenger hunt activity where students need to identify and locate NAN devices in their immediate surroundings. Provide a checklist of potential NAN devices such as wireless printers, smart home devices, or beacons. Students should find and document the devices, noting their purpose and connection method. After the scavenger hunt, students can discuss their findings and reflect on the prevalence and impact of NAN in their daily lives. This activity encourages observation, critical thinking, and awareness of NAN technologies.

#### **5. Local Area Network (LAN)**

LAN Network Design: Assign students the task of designing a Local Area Network for a hypothetical scenario. They should consider factors such as the number of devices, network topology, network protocols, and security measures. Students can use software or drawing tools to create network diagrams and explain their design choices. They should also discuss the advantages and disadvantages of LAN compared to other network types. This activity promotes problem-solving skills, critical thinking, and understanding of LAN concepts.

#### **6. Wide Area Network (WAN)**

WAN Connection Simulation: Set up a simulation activity where students play the role of different locations in a WAN. Each student or group represents a different office or branch of an organization. They should establish connections between their locations using virtual links or simulation software. Students should consider factors such as distance, connectivity options (leased lines, VPN, etc.), and latency. After the simulation, students can discuss their experiences and challenges faced in establishing and managing the WAN connections. This activity fosters collaboration, understanding of WAN technologies, and practical application of network concepts.

#### **7. Metropolitan Area Network (MAN)**

MAN Case Study Analysis: Provide students with real-world case studies or examples of Metropolitan Area Networks. These can include examples of city-wide Wi-Fi networks, public transportation networks, or municipal networks. Instruct students to analyze the implementation, benefits, challenges, and potential future developments of the MAN in each case study. Students can present their analysis to the class, highlighting the impact of MAN on the local community or industry. This activity promotes critical thinking, research skills, and understanding of MAN technologies.

## **8. Internet Area Network (IAN)**

IAN Debate: Divide the class into two groups and assign one group to argue in favor of Internet Area Network.

### **Activity 2**

#### **Group Activities**

##### **1. Device Comparison Chart:**

- a. Divide the class into small groups and assign each group a communication device (hub, switch, router, or gateway).
- b. Instruct each group to create a comparison chart or table that includes the key characteristics, features, and functions of their assigned device.

The chart should cover aspects such as network connectivity, data transfer, addressing, traffic management, and security features.

##### **2. Device Role-Play:**

- a. Assign each group a specific communication device (hub, switch, router, or gateway).
- b. Instruct each group to prepare a short skit or role-play scenario demonstrating the operation and function of their assigned device.

Encourage groups to create a script that showcases how the device handles network traffic, manages connectivity, or provides security.

##### **3. Device Network Design:**

- a. Assign each group the task of designing a network layout or topology using a combination of communication devices (hub, switch, router, and gateway).
- b. Provide groups with a scenario or specific requirements (e.g., a small office network, a home network, or a campus network).
- c. Instruct each group to determine the placement and configuration of the communication devices to meet the network requirements.

### **Activity 3**

#### **Activities For Formative Assessments**

##### **1. Mode Comparison Discussion:**

- a. Divide the class into small groups and assign each group a specific mode of data transmission (such as simplex, half-duplex, and full duplex).
- b. Instruct each group to research and discuss their assigned mode, including its characteristics, advantages, and limitations. Groups should create a presentation

or poster summarizing their findings and highlighting the differences between the modes.

## **2. Real-Life Examples:**

Ask students to find real-life examples of different modes of data transmission.

Students can research and identify instances where simplex, half-duplex, and full-duplex modes are used in everyday life or in specific industries.

## **3. Role-Play Scenarios:**

- a. Assign each group a different mode of data transmission (simplex, half-duplex, or full-duplex).
- b. Instruct each group to create a role-play scenario that demonstrates the characteristics and use cases of their assigned mode.
- c. Groups should act out the scenario, showcasing how the mode of data transmission is employed and the benefits it provides.
- d. After each performance, the class can discuss and analyze the effectiveness and appropriateness of each mode in the given scenario.

## **4. Debate: Synchronous vs. Asynchronous:**

- a. Divide the class into two groups: one representing synchronous transmission and the other representing asynchronous transmission.
- b. Assign each group time to prepare arguments supporting the advantages and benefits of their assigned mode.
- c. Organize a debate session where each group presents their arguments, counters the opposing group's points, and defends their position.
- d. Encourage students to use evidence and examples to support their arguments.
- e. After the debate, facilitate a class discussion to reflect on the strengths and weaknesses of both modes of data transmission.

This activity assesses students' ability to articulate their understanding of synchronous and asynchronous transmission and engage in critical discussions.

## **FORMATIVE ASSESSMENTS:**

### **Quiz or Worksheet:**

Create a quiz or worksheet that includes questions or scenarios related to modes of data transmission.

Students can individually or in groups complete the quiz or worksheet, demonstrating their knowledge and understanding of the different modes.

## **Activity 4**

### **Classroom Activities**

#### **1. Layer Identification:**

- a. Provide students with a diagram or description of a network scenario.
- b. Instruct students to identify and label each layer of the OSI model that is involved in the given scenario.

#### **2. Layer Functions:**

- a. Assign each student a specific layer of the OSI model.
- b. Instruct students to research and create a presentation or infographic that explains the functions and responsibilities of their assigned layer.

#### **3. Protocol Match-Up:**

- a. Provide students with a list of protocols commonly associated with each layer of the OSI model.
- b. Instruct students to match each protocol with its corresponding layer by drawing lines or making connections.

#### **4. Model Comparison:**

- a. Assign students the task of comparing the OSI model with another network model, such as the TCP/IP model.
- b. Instruct students to research and write a comparative analysis that highlights the similarities and differences between the two models.

## **Activity 5**

### **Group Activities**

#### **1. Layer Protocol and Device Match-Up:**

- a. Divide the class into groups and assign each group a specific layer of the OSI model.
- b. Instruct each group to research and compile a list of protocols and devices commonly associated with their assigned layer.
- c. Groups should create a poster or presentation that includes the protocols and devices, along with brief explanations of their functions and interactions within the layer.

#### **a. 2. Layer Relay Race:**

- a. Divide the class into groups and assign each group a layer of the OSI model.
- b. Create a set of flashcards or information cards, each containing the name of a protocol, device, or function associated with a specific layer.
- c. Instruct each group to line up and provide the first student with a card.

### **3. Layer Scavenger Hunt:**

- a. Assign each group a different layer of the OSI model.
- b. Provide each group with a list of protocols, devices, or functions associated with their assigned layer.
- c. Instruct the groups to search for examples of these protocols, devices, or functions in real-life scenarios, such as network configurations, communication systems, or internet services.

## **Activity 5**

### **Activities For Formative Assessment**

#### **Formative Assessments**

##### **1. Layer Quiz**

- a. Prepare a set of questions, each focusing on a specific layer of the OSI model.
- b. Distribute the questions to the students and give them a specific amount of time to answer them individually.

##### **2. Layer Presentation**

- a. Assign each student or group a specific layer of the OSI model.
- b. Instruct them to research and create a presentation that explains the key concepts, functions, protocols, and examples associated with their assigned layer.
- c. Encourage students to use visuals, diagrams, and real-life examples to enhance their presentations.
- d. Allocate time for each student or group to present their findings to the class.
- e. After each presentation, engage the class in a discussion to further explore the layer's concepts and connections with other layers.

This activity assesses students' ability to research, summarize, and effectively communicate their understanding of the OSI model.

##### **3. Layer Diagram Construction:**

- a. Provide each student or group with a blank diagram representing the OSI model.
- b. Instruct them to label each layer and then add the relevant protocols, devices, and functions associated with each layer.

## **Activity 6**

## **Classroom Activities**

### **1. Protocol Analysis:**

- a. Assign each student a specific TCP/IP protocol (e.g., TCP, IP, ICMP, ARP, DNS) or a protocol suite (e.g., Application Layer, Transport Layer, Network Layer).
- b. Instruct students to research and analyze their assigned protocol, focusing on its purpose, functionality, and key features.

### **2. Packet Tracing:**

- a. Provide students with packet capture files or network trace data obtained from Wireshark or similar network analysis tools.
- b. Instruct students to analyze the captured packets and identify the protocols and layers involved in the communication.

### **3. TCP/IP Comparison:**

- a. Assign each student or group a different network protocol architecture (e.g., OSI model, TCP/IP model, Ethernet protocol suite).
- b. Instruct students to research and compare the assigned architecture with the TCP/IP architecture.
- c. Encourage students to discuss the strengths and weaknesses of the TCP/IP architecture and its widespread adoption.

### **4. TCP/IP Application Design:**

- a. Challenge students to design an application that utilizes the TCP/IP protocol suite.
- b. Instruct students to outline the functionality of the application, identify the protocols needed for communication, and describe the data exchange process.

## **Activity 7**

### **1. Layer Function Scenarios:**

- a. Divide the class into small groups and assign each group one layer of the TCP/IP protocol stack (e.g., Application Layer, Transport Layer, Network Layer, Link Layer).
- b. Provide each group with a set of scenarios or real-life examples related to network communication.

### **2. Layer Function Mapping:**

- a. Provide each group with a large poster or whiteboard divided into sections representing each layer of the TCP/IP protocol stack.

- b. Instruct the groups to research and identify the specific functions performed by their assigned layer.

### **3. Layer Puzzle Game:**

- a. Create a set of puzzle pieces, each representing a specific function performed by one of the TCP/IP layers.
- b. Divide the class into small groups and distribute the puzzle pieces randomly among the groups.
- c. Instruct the groups to work together to arrange the puzzle pieces in the correct order, representing the TCP/IP protocol stack.

## **Activity 8**

### **Activities For Formative Assessments of Circuit Switching and Packet Switching:**

#### **1. Case Study Analysis:**

- a. Provide students with real-world case studies that involve different communication scenarios, such as telephone networks, video streaming, or online gaming.
- b. Assign half of the students to analyze the case studies from the perspective of circuit switching and the other half from the perspective of packet switching.

#### **2. Simulation and Comparison:**

- a. Use online simulation tools or software that allow students to simulate and compare circuit switching and packet switching.
- b. Instruct students to set up different communication scenarios, such as voice calls, file transfers, or video streaming, using both switching methods.

#### **3. Debate and Argumentation:**

Divide the class into two groups: one representing circuit switching and the other representing packet switching.

#### **4. Design and Implementation:**

- a. Challenge students to design and implement a communication system.
- b. Instruct students to document their design choices, including the switching method used, protocols, network architecture, and addressing schemes.
- c. Facilitate a class discussion where students evaluate and compare the design choices and discuss the implications of using circuit switching or packet switching in the given scenario.

## **Activity 9**

### **Formative assessment of an IPv4 Address Based on its IP Range:**

## **1. IP Range Identification**

- a. Provide students with a list of IPv4 addresses along with their corresponding IP ranges (e.g., IP address: 192.168.0.1, IP range: 192.168.0.0/24).
- b. Instruct students to identify and classify each IPv4 address based on its IP range.
- c. Students can use their knowledge of sub netting, network masks, and IP range notation to determine the network address, subnet address, and host range of each IP address.

<b>Topic</b>	<b>Total Periods</b>
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6. Wireless Communications	15
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<b>Sub-Topic</b>	<b>Range of SLOs</b>	<b>Periods (40 mins)</b>
6.1 Introduction to Wireless Communication	6.1.1-6.1.2	2
	6.1.3	1
	6.1.4	1
6.2 Short Distance Wireless Communication	6.2.1	2
	6.3.1	1
	6.3.2	2
6.3 Long Distance Wireless Communication	6.3.3	1
	6.3.4	1
	6.3.5	2

	6.3.6	2
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## Learning Resources

- Wireless Communications and Networks by William Stallings
- LTE Communications and Networks Femtocells and Antenna Design Challenges by Masood Ur Rahman and Ghazanfar Ali Safdar
- Wireless Communication Networks and Internet of Things Select Proceedings of ICNETS2, Volume VI by Adamu Murtala Zungeru, S Subashini, and P Vetrivelan

## Web Resources

<https://www.quora.com/What-are-the-limitations-of-conventional-communication-system>

<https://www.geotab.com/blog/what-is-gps/>

<https://www.gps.gov/systems/gps/#:~:text=What%20is%20GPS%3F,segment%2C%20and%20the%20user%20segment>

[https://www.esa.int/Enabling\\_Support/Space\\_Transportation/Types\\_of\\_orbits](https://www.esa.int/Enabling_Support/Space_Transportation/Types_of_orbits)

<https://astroblog.cosmobc.com/difference-leo-meo-geo-satellites/>

<https://www.techtarget.com/searchmobilecomputing/definition/WAP>

<https://www.okta.com/identity-101/wep/>

## Suggested Activities and/or Formative Assessment

### Activity 1

Individual Activities to Explore Wireless Networks and Their Advantages and Disadvantages:

#### 1. Wireless Network Scavenger Hunt

- a. Assign students the task of conducting a scavenger hunt to find and identify different wireless networks in their surroundings.
- b. Instruct them to search for various types of wireless networks, such as Wi-Fi hotspots, Bluetooth connections, or cellular networks.

#### 2. Advantages and Disadvantages Debate:

- a. Divide the class into two groups: one representing the advantages of wireless networks, and the other representing the disadvantages.
- b. Assign each group specific advantages or disadvantages to research and prepare arguments supporting their assigned position.

### 3. Wireless Network Security Analysis:

- a. Provide students with scenarios involving wireless network security vulnerabilities, such as unauthorized access, eavesdropping, or data breaches.
- b. Instruct students to analyze and discuss the security risks and potential solutions associated with each scenario.
- c. Facilitate a class discussion where students can compare their findings and engage in critical thinking about wireless network security.

## Activity 2

### Group Activities

#### 1. Radio Signal Strength Experiment:

- Divide the class into groups and provide each group with a set of radio transceivers and measuring devices (such as signal strength meters or software tools).
- Instruct each group to set up a small-scale wireless network using the radio transceivers and access points.
- Students can then conduct experiments to measure the signal strength at different distances from the access point.
- Each group should record the data and create graphs or charts to illustrate the relationship between distance and signal strength.

#### 2. Designing a Wireless Network:

- Assign each group the task of designing a wireless network for a specific scenario, such as a home, office, or outdoor environment.
- Instruct the groups to consider factors such as coverage area, number of devices, interference sources, and line of sight requirements.
- Students should research and select appropriate access points, taking into account the capabilities and specifications of each device.

## Activity 3

### ACTIVITIES FOR FORMATIVE ASSESSMENTS:

#### 1. Long-Distance Wireless Communication Case Study:

- Provide students with a real-world scenario that requires long-distance wireless communication, such as connecting remote offices or providing internet access to rural areas.
- Instruct students to research and identify appropriate long-distance wireless communication technologies for the given scenario, considering factors such as range, bandwidth, interference, and cost.
- Students can create a case study report or presentation, explaining their chosen technologies, their advantages and disadvantages, and their suitability for the specific scenario.

## 2. Short-Distance Wireless Communication Demonstration:

- Divide the class into small groups and provide each group with different short-distance wireless communication devices, such as Bluetooth speakers, wireless printers, or wireless headphones.
- Instruct each group to demonstrate the functionality and features of their assigned device, highlighting its use of short-distance wireless communication.
- Students should explain the principles of operation, the range limitations, and the advantages of the specific short-distance wireless technology used.

## 3. Wireless Communication Comparison Chart:

- Provide students with a template or worksheet that includes a table for comparing different long-distance and short-distance wireless communication technologies.
- Instruct students to research and fill in the table with information about each wireless communication technology, including its range, data transfer rates, security features, applications, and any other relevant factors.

# ACTIVITY 4

## Formative Assessments

Here are some formative assessment activities for wireless networks:

### 1. Network Design Project:

- Divide students into small groups and assign each group the task of designing a wireless network for a specific scenario, such as a home, office, or school campus.
- Instruct students to consider factors such as coverage area, number of devices, security requirements, and network performance.
- Students should research and select appropriate wireless networking technologies, such as Wi-Fi standards, and plan the placement of access points.

- Classmates can provide feedback and engage in discussions to evaluate the effectiveness and feasibility of each network design.

## **2. Wireless Network Performance Testing:**

- Provide students with a set of performance testing tools or software applications that can measure the speed, latency, and signal strength of wireless networks.
- Instruct students to conduct performance tests on different wireless networks, such as their home network, school network, or public Wi-Fi networks.
- Classmates can provide feedback and engage in discussions on the factors that influence wireless network performance and the steps that can be taken to enhance it.

# **Activity 5**

## **Classroom Activities**

Short-distance wireless technologies can be utilized in various classroom activities to enhance learning and collaboration. Here are some examples:

### **1. Wi-Fi (Wireless Fidelity):**

- Online research: Students can use Wi-Fi to access the internet and conduct research on various topics related to their coursework.
- Digital content sharing: Teachers can share digital resources, such as presentations, documents, and websites, with students over the classroom Wi-Fi network.
- Collaborative projects: Wi-Fi enables students to collaborate on group projects by sharing files, conducting online discussions, and working together on shared documents or presentations.
- Online assessments and quizzes: Teachers can use Wi-Fi to administer online assessments and quizzes to gauge students' understanding of the material.

### **2. Bluetooth:**

- Wireless presentations: Bluetooth can be used to connect a teacher's device, such as a laptop or tablet, to a classroom projector or smartboard, eliminating the need for cables.
- Peer-to-peer file sharing: Students can use Bluetooth to share files, such as presentations or study materials, directly between their devices without relying on an internet connection.

### **3. Infrared (IR):**

- Interactive whiteboards: Infrared technology can be used in interactive whiteboards, allowing teachers and students to interact with the board using infrared pens or touch gestures.
- Classroom response systems: Infrared clickers or remotes can be used for interactive quizzes or polling, allowing students to respond to questions or participate in class discussions.

## Activity 6

### Group Activities

#### 1. Wi-Fi (Wireless Fidelity):

- Group projects and presentations: Students can form groups and use Wi-Fi to collaborate on projects, share documents and resources, and collectively create presentations.
- Virtual meetings and discussions: Wi-Fi enable students to connect their devices to a common network and engage in virtual meetings or discussions using video conferencing platforms or collaboration tools.
- Online brainstorming and mind mapping: Students can use Wi-Fi to access collaborative online platforms and tools for brainstorming ideas, creating mind maps, and organizing group thoughts.

#### 2. Bluetooth:

- Collaborative gaming: Bluetooth-enabled gaming devices can connect to each other, allowing group members to engage in multiplayer games and competitions.
- Shared audio experiences: Bluetooth headphones or earbuds can be used by group members to listen to audio content simultaneously, such as language lessons, podcasts, or audiobooks.

#### 3. Infrared (IR):

- Collaborative presentations: Infrared can be utilized in interactive whiteboards or displays where multiple students can interact simultaneously using infrared pens or touch gestures to contribute to a group presentation or discussion.
- Shared control of devices: Infrared remotes can be used in group settings where multiple users can control devices, such as projectors or media players, to facilitate interactive experiences or presentations.

## **Activity 7**

### **Activities For Formative Assessments**

#### **1. Online quizzes and polls:**

- Use a classroom response system or online quiz platform that utilizes Wi-Fi to administer quizzes or polls to students. Students can submit their answers using their own devices, and the teacher can instantly collect and analyze the responses.
- Bluetooth clickers or remotes can be used for multiple-choice questions, with students responding wirelessly to the questions posed by the teacher.

#### **2. Interactive discussions and debates:**

- Utilize Wi-Fi to engage students in online discussions or debates using collaboration tools or discussion platforms. Students can connect their devices and participate in real-time discussions, sharing their thoughts, ideas, and arguments.
- Bluetooth headsets or speakers can be used to facilitate group discussions or debates, where students can communicate wirelessly and engage in constructive conversations.

#### **3. Collaborative problem-solving:**

- Students can work in groups on problem-solving tasks using their own devices connected via Wi-Fi. They can collaborate using shared documents, online whiteboards, or collaborative project management tools to solve problems together.
- Bluetooth-enabled devices, such as tablets or smartphones, can be used for collaborative brainstorming sessions or data collection activities, where students wirelessly share their ideas or collect and analyze data collectively.

#### **4. Multimedia presentations and demonstrations:**

- Students can use Wi-Fi to create multimedia presentations or demonstrations on their own devices and wirelessly share their work with the class. This can include sharing videos, slideshows, or interactive multimedia content.
- Infrared technology can be used for interactive presentations, where students use infrared pens or touch gestures to annotate or interact with the presentation materials.

## **Activity 8**

### **Formative Assessments**

#### **1. Online quizzes and surveys**

- Utilize online quiz platforms or survey tools that students can access through Wi-Fi on their own devices. Teachers can create interactive quizzes or surveys with multiple-

choice, short answer, or matching questions to assess student knowledge and understanding.

- Students can submit their responses electronically, and teachers can instantly receive and review the results, providing immediate feedback or identifying areas of misconception.

## 2. Classroom response systems:

- Implement a classroom response system that utilizes Wi-Fi or Bluetooth technology. Students can use their own devices or dedicated clickers to respond to questions posed by the teacher.
- The system allows for real-time data collection, enabling teachers to monitor student responses, assess comprehension, and adjust instruction accordingly.

## 3. Digital assignments and projects:

- Assign digital tasks or projects that require students to utilize short-distance wireless technologies. For example, students can collaborate on a shared document or presentation using Wi-Fi, demonstrating their understanding of a topic or concept.
- Teachers can assess the quality of the work, provide feedback, and guide students towards improvement using collaborative tools or platforms.

## 4. Peer assessments and feedback:

- Facilitate peer assessments using short-distance wireless technologies. Students can use Wi-Fi to share their work with peers for evaluation or provide feedback on their classmates' work through online platforms or shared documents.
- This fosters peer learning allows students to critically analyze and evaluate each other's work and promotes constructive feedback.

# Activity 9

## Classroom Activities

### 1. Mobile Phone

- Students can explore the features and functions of a mobile phone, such as making calls, sending text messages, accessing the internet, and using various apps.
- Students can simulate a call or text message exchange using multiple mobile phones to understand the communication process.

### 2. Base Station

- Students can act as base stations and form a network by establishing connections with their classmates (acting as mobile phones) to demonstrate signal transmission.

### **3. Switching Node**

- Students can role-play as switching nodes, routing calls or messages between different "networks" (represented by groups of students).

## **Activity 10**

### **Group Activities**

#### **1. GPS Scavenger Hunt:**

- Divide the group into teams and provide each team with a GPS device or smartphone with GPS capabilities.
- Create a list of coordinates or specific locations for the teams to find using the GPS.
- Teams navigate to each location using the GPS coordinates and mark their progress.
- The team that finds all the locations in the shortest time or with the highest accuracy wins the scavenger hunt.

#### **2. Geocaching:**

- Divide the group into teams and provide them with GPS devices or smartphones with GPS capabilities.
- Provide a set of geocache coordinates and descriptions for each team to locate.
- Teams use the GPS to navigate to the geocache coordinates and search for the hidden containers.
- Each team can document their findings and share their experiences with the group.

#### **3. GPS Mapping Project:**

- Assign the group a specific area or location to map using GPS.
- Provide GPS devices or smartphones with GPS capabilities to each participant.
- Instruct the participants to walk or drive around the assigned area, recording GPS coordinates at regular intervals.
- After gathering the data, bring the group together to compile and analyze the GPS data.
- Create a collective map using the recorded GPS coordinates, showcasing the group's mapping project.

#### **4. GPS Navigation Challenge:**

- Create a simulated navigation challenge where participants need to navigate from one point to another using GPS.
- Assign a starting point and a destination for each participant or team.
- Provide GPS devices or smartphones with GPS capabilities.
- Participants use the GPS to plan and execute their navigation, selecting the best routes and waypoints to reach the destination.
- The participant or team that reaches the destination first or with the most efficient route wins the challenge.

## Activity 11

### Activities For Formative Assessments

#### 1. Satellite Comparison Chart

- Provide students with a chart or table that includes columns for GEO, MEO, and LEO satellites.
- Ask students to fill in the chart with relevant information about each type of satellite, such as altitude, orbital period, coverage area, and applications.
- Discuss the completed charts as a class, highlighting the similarities and differences among the satellite types.

#### 2. Orbit Identification Activity:

- Prepare a set of satellite orbit diagrams that include examples of GEO, MEO, and LEO orbits.
- Provide the diagrams to students and ask them to label each orbit type correctly.

#### 3. Satellite Applications Match-Up:

- Create a list of satellite applications or use pre-prepared cards with different applications written on them (e.g., weather monitoring, global positioning, telecommunications).
- Give each student or group a set of satellite orbits (GEO, MEO, and LEO) and ask them to match the satellite orbits with the appropriate applications.

#### 4. Research and Presentation:

- Assign each student or group one type of satellite orbit (GEO, MEO, or LEO).
- Ask them to conduct research on their assigned orbit type, focusing on its characteristics, advantages, disadvantages, and typical applications.

## **Activity 12**

### **Formative Assessments:**

- Explain the concept of a base station and its role in establishing wireless connections.
- Discuss the different communication technologies supported by mobile phones, such as GSM, CDMA, and LTE.
- Discuss the coverage area of a base station and how multiple base stations create a network for seamless mobile communication.
- Introduce the concept of a switching node and its role in routing calls and data between different networks.
- Explain how switching nodes enable communication between mobile phones, landline phones, and other networks.
- Discuss the traditional landline telephone network and its integration with mobile communication.
- Explain the process of connecting a mobile call to a landline phone and vice versa through the network.
- Explain the concept of geocaching, which involves using GPS coordinates to find hidden containers or "caches".

<b>Topic</b>	<b>Total Periods</b>
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7. Database Fundamentals	24
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Sub-Topic	Range of SLOs	Periods (40 mins)
7.1 Introduction to Database	7.1.1 - 7.1.2	1
	7.1.3	1
	7.1.4	2
	7.1.5 - 7.1.6	2
7.2 Basic Database Terminologies	7.2.1	2
	7.2.2	1
	7.2.3	2
7.3 Planning a Database	7.3.1	2
7.4 Data Modelling and ERDs	7.4.1	1

	7.4.2	2
	7.4.3	2
	7.4.4	2
	7.4.5	2
	7.4.6	2

## Learning Resources

- Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design 2nd Edition by Michael J. Hernandez
- Beginning Database Design Solutions: Understanding and Implementing Database Design Concepts for the Cloud and Beyond 2nd Edition by Rod Stephens
- A PRAGMATIC APPROACH TO Database Programming with JDBC and MySQL: A programmer's guide to building high-performance MySQL database solutions by Vivian Siahaan, Rismon Hasiholan Sianipar

## Web Resources

- <https://www.oracle.com/pk/database/what-is-database/>  
<https://www.educative.io/answers/what-are-the-roles-of-a-database-administrator>  
<https://www.bmc.com/blogs/dba-database-administrator/>  
[https://www.w3schools.com/sql/sql\\_intro.asp](https://www.w3schools.com/sql/sql_intro.asp)  
<https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-sql/>  
[https://www.w3schools.com/sql/sql\\_intro.asp](https://www.w3schools.com/sql/sql_intro.asp)  
<https://www.spiceworks.com/tech/artificial-intelligence/articles/what-is-sql/>  
<https://www.businessnewsdaily.com/5804-what-is-sql.html>

# **Suggested Activities and/or Formative Assessment**

## **Activity 1**

### **Classroom Activities**

#### **1. Data Retrieval Comparison:**

- Divide the class into two groups: one representing DBMS users and the other representing FMS users.
- Provide each group with a set of sample data and a task to retrieve specific information from the data.
- The DBMS group can use a query language (e.g., SQL) to write a query and retrieve the data, while the FMS group has to manually search through files and write code to retrieve the data.

#### **2. Data Integrity Exercise:**

- Provide the class with a dataset containing related information across multiple tables, such as student records, course information, and grades.
- Ask the students to manually update the data in an FMS, allowing them to make changes directly to the files.
- Then, provide the same dataset to another group using a DBMS and guide them to define relationships, enforce constraints, and ensure data integrity.

#### **3. Security and Access Control Simulation:**

- Assign different roles to students, such as administrator, teacher, and student, each with specific access permissions to the data.

#### **4. Scalability and Performance Exercise:**

- Provide a large dataset to the class and ask them to perform complex queries, aggregations, or data manipulations using an FMS.
- Discuss the challenges they face in terms of performance, response time, and resource utilization.

## **Activity 2**

### **Group Activities:**

#### **1. Database Design and Optimization:**

- Divide the group into smaller teams and assign each team a scenario or case study that requires designing a database for a specific application (e.g., online shopping, student management system).
- Each team acts as a DBA and works together to analyze the requirements, design the database schema, and optimize it for efficiency and performance.
- Teams present their designs to the rest of the group, explaining their decisions and justifying their optimization techniques.
- Encourage discussions and feedback among the teams to promote collaboration and a deeper understanding of database design principles.

#### **2. Security and Access Control Workshop:**

- Assign different aspects of database security and access control to each group (e.g., user authentication, encryption, role-based access control).
- Instruct each group to research their assigned topic and prepare a workshop or presentation on best practices and strategies for implementing security measures in a database.
- Each group presents their workshop to the rest of the class, providing practical examples and demonstrations.
- Promote group discussions on security challenges and solutions, allowing students to share their insights and learn from one another's expertise.

#### **3. Backup and Recovery Simulation:**

- Create a scenario where a database experiences a critical failure or data loss, such as a hardware failure or accidental deletion.
- Divide the group into teams, with each team representing a DBA responsible for recovering the database.
- Instruct each team to develop a backup and recovery plan, including strategies for data backup, restoration, and disaster recovery.
- Teams present their plans and discuss the advantages and disadvantages of different backup and recovery methods.
- Facilitate a group discussion on the importance of backup and recovery, highlighting the role of a DBA in ensuring data availability and continuity.

## **Activity 3**

### **Activities For Formative Assessments**

#### **1. Concept Mapping**

Ask students to create a concept map that illustrates the key concepts and components of various database models, such as hierarchical, network, relational, and object-oriented models. This activity will help them visualize the relationships and hierarchies within each model.

#### **2. Venn Diagram Comparison:**

Provide students with a Venn diagram template and ask them to compare and contrast different database models. They can identify the similarities and differences between hierarchical, network, and relational models and map them in the diagram.

#### **3. Model Design Exercise:**

Assign students a task to design a database schema for a given problem statement using a specific database model, such as hierarchical or relational. They should identify the entities, attributes, and relationships involved, and create an appropriate structure. You can evaluate their design choices and the effectiveness of their chosen model.

#### **4. Quiz or Multiple-Choice Questions:**

Create a quiz or multiple-choice questions that assess students' knowledge of the different database models. Include questions about the key concepts, advantages, and disadvantages of each model. This format allows for quick assessment and feedback.

#### **5. Group Discussions or Debates:**

Divide students into groups and assign each group a different database model.

## **Activity 4**

### **Formative Assessments:**

- **Syntax Matching Exercise:** Provide students with a list of SQL commands for each type of SQL language, such as MySQL, Oracle, or PostgreSQL. Then, give them a set of queries or statements in different languages and ask them to match the queries with the appropriate language commands. This activity will help students develop their understanding of the syntax of different SQL languages.
- **Query Writing Exercise:** Ask students to write a SQL query that retrieves data from a database using a specific SQL language, such as SELECT, FROM, WHERE, and JOIN commands. You can provide them with a sample database and ask them to retrieve specific data. This activity will assess their understanding of the structure and syntax of different SQL languages.

- Error Correction: Give students a set of SQL queries or statements written in different languages that contain syntax errors. Ask them to identify and correct the errors in the code. This exercise will help them develop their ability to debug and troubleshoot code in different SQL languages.
- Multiple-Choice Questions: Create a quiz or multiple-choice questions that assess students' knowledge of the different SQL languages. Include questions about the syntax, commands, and features of each language. This format allows for quick assessment and feedback.
- Discuss the differences in maintaining data integrity and consistency between the two approaches, emphasizing the benefits of a DBMS in managing complex data relationships.
- Discuss the importance of user authentication, role-based access control, and data encryption in ensuring data security.
- Compare this approach to an FMS where implementing similar security measures would be more challenging and less effective.
- Using a DBMS, demonstrate how access control mechanisms can be implemented to restrict unauthorized access to sensitive data.
- Compare the time, effort, and accuracy of data retrieval highlighting the efficiency of DBMS in handling complex queries.
- Introduce the concept of indexing and demonstrate how a DBMS can significantly improve query performance by creating appropriate indexes.
- Compare the performance of the DBMS with the FMS approach, highlighting the scalability and optimization advantages of a DBMS.

## Activity 5

### Classroom Activities

#### 1. Vocabulary Match-Up

Provide students with a list of terms related to relational databases, such as tables, rows, columns, primary key, foreign key, normalization, and indexes. Ask them to match each term with its corresponding definition. This activity will help reinforce their understanding of key concepts.

#### 2. Table Design Exercise

Divide students into small groups and assign each group a specific scenario, such as designing a database for a school, a library, or an online store. Ask them to identify the entities involved and design a relational database schema with appropriate tables,

columns, and relationships. They can present their designs to the class, explaining their choices and justifying the relationships established.

## Activity 6

### Group Activities

#### 1. Data Type Scavenger Hunt:

Divide students into groups and provide each group with a list of data types commonly used in relational databases, such as INTEGER, VARCHAR, DATE, BOOLEAN, and FLOAT. Ask each group to find real-life examples of data that would be stored using each data type. They can search for examples in different domains like finance, healthcare, or e-commerce. The groups can then present their findings to the class, discussing the appropriateness of each data type for the given examples.

#### 2. Data Type Comparison Chart:

Assign each group a specific data type commonly used in relational databases, such as INTEGER, VARCHAR, or DECIMAL. Ask each group to create a comparison chart that includes the characteristics, storage requirements, and common use cases for their assigned data type. Once the groups have completed their charts, they can present their findings to the class, facilitating a discussion on the different data types and their implications in database design.

#### 3. Data Type Puzzle:

Create a puzzle or crossword activity that involves clues related to different data types used in a relational database. Divide students into groups and provide them with the puzzle. They must work together to solve the puzzle by correctly identifying the data types corresponding to the given clues.

## Activity 7

### Activities For Formative Assessments

#### 1. Key Identification Exercise:

Provide students with a set of tables representing different entities in a database. Ask them to identify and label the primary key, candidate keys, alternate keys, secondary keys, and foreign keys for each table. This activity will assess their understanding of the different types of keys and their application in database design.

#### 2. Key Comparison Chart:

Divide students into groups and assign each group a specific type of key (e.g., primary key, candidate key, etc.). Ask them to create a comparison chart that includes the definition, characteristics, and examples of their assigned key type. They can also

discuss the differences and similarities between the various types of keys. Each group can present their chart to the class, facilitating a discussion on the different key types.

### **3. Quiz or Short-Answer Questions:**

Create a quiz or provide short-answer questions that assess students' knowledge of primary keys, candidate keys, alternate keys, secondary keys, and foreign keys. Include questions about their definitions, characteristics, and usage in a relational database. This format allows for quick assessment and feedback.

## **Activity 8**

### **Formative Assessments**

**Quiz or Short-Answer Questions:** Create a quiz or provide short-answer questions that assess students' knowledge of primary keys, candidate keys, alternate keys, secondary keys, and foreign keys. Include questions about their definitions, characteristics, and usage in a relational database. This format allows for quick assessment and feedback.

## **Activity 9**

### **Classroom Activities**

#### **1. Entity Identification:**

Choose a real-life scenario or problem and identify the entities involved. Create a list of entities that need to be represented in the database. Describe the attributes and relationships of each entity, considering their purpose and how they relate to other entities.

#### **2. Entity-Relationship Diagram (ERD) Creation:**

Use a tool or software to create an ERD for the database design. Start by identifying the entities, their attributes, and the relationships between them. Sketch or diagram the ERD, ensuring that cardinality and participation constraints are represented accurately.

#### **3. Schema Design:**

Define the tables and their attributes based on the entities and relationships identified earlier. Assign appropriate data types to each attribute, considering the nature and range of the data. Determine primary keys, candidate keys, and any alternate or secondary keys required.

#### **4. Index Design:**

Identify the attributes that are frequently used for querying and consider creating indexes on those attributes. Analyze the access patterns and data retrieval requirements to

determine which attributes would benefit from indexing. Decide on the appropriate indexing techniques (e.g., B-tree, hash, bitmap) for efficient data access.

## Activity 10

### Group Activities

#### 1. Entity Identification and Relationship Exploration:

Divide students into groups and provide them with a scenario or problem statement. Ask each group to identify the entities involved and brainstorm the potential relationships between the entities.

#### 2. Collaborative ERD Creation:

Assign each group a different scenario or domain, such as a university, e-commerce platform, or healthcare system. Ask them to collaboratively create an ERD for their assigned scenario. Each group member can contribute by identifying entities, defining attributes, and establishing relationships.

#### 3. Entity-Relationship Game:

Create a game where students work in teams to match entities, attributes, and relationships. Prepare cards with different entities, attributes, and relationship types written on them. Shuffle the cards and distribute them among the teams. Each team must match the entities with their corresponding attributes and establish appropriate relationships. The team that successfully matches the most pairs wins the game.

## Activity 11

### Activities For Formative Assessments

#### 1. Cardinality and Modality Sorting:

Provide students with a set of relationship scenarios or descriptions. Ask them to categorize each scenario or description based on its cardinality (one-to-one, one-to-many, many-to-many) and modality (mandatory or optional). Students can work individually or in groups to sort the scenarios into the appropriate categories.

#### 2. Relationship Mapping Exercise:

Provide students with a sample ERD or database schema containing relationships between entities. Ask them to analyze and map out the cardinality and modality of each relationship. They should identify the minimum and maximum participation of each entity in the relationship and determine whether the relationship is one-to-one, one-to-many, or many-to-many.

## **Activity 12**

### **Formative Assessments**

#### **1. Cardinality and Modality Quiz:**

Create a quiz with multiple-choice or true/false questions related to cardinality and modality. Include questions that test students' understanding of the definitions, symbols, and implications of different cardinality and modality types. This format allows for quick assessment and provides immediate feedback.

#### **2. Data Set Normalization:**

Provide students with a sample data set that is not normalized and ask them to normalize it. Instruct them to identify the functional dependencies and normalize the data set to third normal form (3NF). They should determine the appropriate table structures and attribute dependencies, ensuring that each table satisfies the normalization rules.

#### **3. Normalization Evaluation:**

Give students a set of tables representing a database schema and ask them to evaluate its normalization level. They should identify any normalization violations, such as partial dependencies or transitive dependencies, and suggest improvements to achieve higher normal forms.

#### **4. Normalization Quiz:**

Create a quiz with multiple-choice or short-answer questions that test students' knowledge of normalization concepts. Include questions about functional dependencies, normal forms, and normalization rules. This format allows for quick assessment and provides immediate feedback.

**Topic** **Total Periods**

8. Database Development  
(MS Access 2007 or Above) 47

Sub-Topic	Range of SLOs	Periods (40 mins)
8.1 Introduction	8.1.1	1
	8.1.2	1
8.2 Working with Tables	8.1.3 - 8.2.2	3
	8.2.3	1
	8.2.4	1
	8.2.5	2
	8.2.6	1
	8.2.7-8.2.11	3

	8.2.12	2
	8.3.1	2
	8.3.2	3
8.3 Working With Forms	8.3.3	3
	8.3.4	1
	8.3.5-8.3.8	3
8.4 Queries in Design View	8.4.1	1
	8.4.2	4
	8.4.3	1
	8.4.4	1
	8.4.5	1

8.5 SQL Queries	8.5.1	5
	8.5.2	2
8.6 Generating Reports	8.6.1	2
	8.6.2	2
	8.6.3-8.6.4	2

## Learning Resources

- Database Design for Mere Mortals: A Hands-On Guide to Relational Database Design 2nd Edition by Michael J. Hernandez
- Access in easy steps: Illustrated using Access 2019 by Mike McGrath
- Exploring Microsoft Office Access 2019 Comprehensive 1st Edition by Mary Poatsy Jerri Williams and Amy Rutledge

## Web Resources

<https://support.microsoft.com/en-us/office/introduction-to-data-types-and-field-properties-30ad644f-946c-442e-8bd2-be067361987c>

<https://support.microsoft.com/en-us/office/modify-or-change-the-data-type-setting-for-a-field-1334e8b4-ee5c-48df-9ba1-8d0e1e9c114c>

<https://support.microsoft.com/en-us/office/add-a-primary-key-to-a-table-in-access-c6055b7f-4dfe-4516-901c-95272d74a6ff>

[https://www.w3schools.com/sql/sql\\_primarykey.ASP](https://www.w3schools.com/sql/sql_primarykey.ASP)

<https://learn.microsoft.com/en-us/sql/relational-databases/tables/create-primary-keys?view=sql-server-ver16>

<https://learn.microsoft.com/en-us/office/troubleshoot/access/define-table-relationships>

[https://launchschool.com/books/sql/read/table\\_relationships](https://launchschool.com/books/sql/read/table_relationships)

<https://support.microsoft.com/en-us/office/create-edit-or-delete-a-relationship-dfa453a7-0b6d-4c34-a128-fdebc7e686aff#:~:text=%2Dor%2D,On%20the%20Design%20tab%2C%20in%20the%20Tools%20group%2C%20click%20Edit,to%20change%20a%20table%20relationship.>

<https://support.microsoft.com/en-us/office/guide-to-table-relationships-30446197-4fbe-457b-b992-2f6fb812b58f>

<https://support.microsoft.com/en-us/office/ways-to-add-edit-and-delete-records-5e90a80c-106d-4c55-996e-07d7200980ce>

<https://support.microsoft.com/en-us/office/ways-to-add-edit-and-delete-records-5e90a80c-106d-4c55-996e-07d7200980ce>

<https://support.microsoft.com/en-us/office/ways-to-add-edit-and-delete-records-5e90a80c-106d-4c55-996e-07d7200980ce>

<https://edu.gcfglobal.org/en/access2007/entering-and-editing-data-in-tables/1/#>

<https://edu.gcfglobal.org/en/access/working-with-tables/1/#>

<https://support.microsoft.com/en-us/office/create-a-form-by-using-the-form-wizard-2786d31a-7241-4c11-9747-1ecf88b4d04b>

<https://edu.gcfglobal.org/en/access/creating-forms/1/#>

<https://www.lifewire.com/group-by-clause-sql-query-results-1019766>

## Suggested Activities and/or Formative Assessment

### Activity 1

#### Classroom Activities

##### 1. Introduction to MS-Access

Provide a brief introduction to MS-Access and its features, including database creation, tables, queries, forms, and reports. Demonstrate the basic functions of MS-Access and provide hands-on practice.

##### 2. Table Creation

Instruct students to create a simple database table using MS-Access. They should define field names, data types, and constraints such as primary keys, foreign keys, and data validation rules.

### **3. Table Relationship Exercise**

Divide students into pairs or small groups and provide each group with a set of tables and their attributes. Instruct them to analyze the tables and identify the primary key in each table. Then, ask them to determine the appropriate foreign keys to establish relationships between the tables. Students should discuss their choices and justify their decisions.

### **4. Hands-on Database Design**

Assign each student or group a specific scenario or problem that requires designing a database schema with multiple tables and relationships. Instruct them to create tables, define primary keys, and establish appropriate foreign keys to represent the relationships between the tables.

### **5. Database Relationship Game**

Create a game where students work in teams to match tables with their corresponding primary and foreign keys. Prepare cards with table names, primary keys, and foreign keys written on them. Shuffle the cards and distribute them among the teams. Each team must match the tables with their respective primary and foreign keys. The team that matches the most pairs correctly wins the game.

## **Activity 2**

### **Group Activities**

#### **1. Database CRUD Challenge**

Divide students into small groups and provide each group with a sample MS Access database containing tables and records. Assign each group a specific task, such as adding new records, modifying existing records, or deleting records based on certain criteria. Each group should work collaboratively to accomplish their task within a given time frame.

#### **2. Data Entry Simulation**

Create a simulated data entry scenario where each group is given a specific set of records to enter into a designated table in MS Access. The records can be based on a real-world scenario relevant to the course topic. The groups should work together to accurately enter the data, ensuring data integrity and adherence to any specified validation rules.

#### **3. Record Modification Exercise**

Provide each group with a pre-existing database table in MS Access containing records. Assign each group a specific modification task, such as updating certain fields, correcting errors, or applying consistent formatting. The groups should collaboratively modify the records, ensuring data consistency and accuracy.

#### **4. Record Deletion Challenge**

Give each group a sample MS Access database table with records and specific criteria for record deletion. Instruct them to identify and delete the records that meet the given criteria while preserving the integrity of the database.

#### **5. MS Access Task Relay**

Divide students into groups and create a relay-style activity where each group member performs a specific task related to adding, modifying, deleting, or navigating records in MS Access. For example, one member might add a new record, the next member modifies an existing record, and so on. Each group member passes the task to the next member until all tasks are completed. The first group to finish all the tasks wins the relay.

### **Activity 3**

#### **Activities For Formative Assessments**

##### **1. Field Data Type Matching**

Provide students with a set of field descriptions or scenarios and ask them to match each field with the appropriate data type. You can provide a list of data types, such as text, number, date/time, boolean, etc. Students can work individually or in groups to match the field descriptions with the most suitable data type.

##### **2. Data Type Justification**

Give students a set of table schemas or field definitions and ask them to justify their choice of data types for each field. Students should explain why they selected a particular data type based on the characteristics and requirements of the field. They can provide examples or scenarios to support their reasoning.

##### **3. Data Type Conversion Exercise**

Provide students with a sample data set and ask them to create a table with appropriate data types for each field to accommodate the data. Then, challenge them to convert the data set to a different format, such as importing data from a CSV file into MS Access.

##### **4. Data Type Comparison and Discussion**

Assign each student or group a specific data type and ask them to research and compare it to other similar data types.

## **Activity 4**

### **Formative Assessments**

#### **1. Data Type Quiz**

Create a quiz with questions about data types and their appropriate usage. Include scenarios or examples where students must select the correct data type for a given field requirement.

#### **2. Field Data Type Correction**

Provide students with a table schema containing fields with incorrect data types. Ask them to identify the errors and suggest the appropriate data types for each field.

## **Activity 5**

### **Classroom Activities**

#### **1. Form Creation Using Wizard**

Guide students through the process of creating a form using the Form Wizard in MS Access. Provide them with a sample table and ask them to create a form that displays the fields from the table. They should choose the appropriate layout, select the desired fields, and customize the form's appearance.

#### **2. Form Creation in Design View**

Instruct students to create a form from scratch using Design View in MS Access. Provide them with a specific table or set of tables with related fields. Ask them to design a form layout, add controls, and arrange the fields on the form. Students should customize the form's appearance, apply formatting, and set properties for each control.

#### **3. Form Design Challenge**

Divide students into groups and assign each group a scenario that requires the creation of a form for related tables. Provide them with a database schema consisting of multiple related tables. Ask each group to design a form that displays fields from different tables, capturing the relationships between the tables.

#### **4. Form Customization Exercise**

Provide students with a pre-designed form in MS Access and ask them to customize it according to specific requirements. They should modify the layout, add or remove controls, and apply formatting and styling to match a given scenario or branding guidelines. Students should also add functionality such as buttons or navigation elements to enhance the form's usability.

## **Activity 6**

### **Group Activities**

#### **1. Data Entry Relay:**

Divide students into groups and create a relay-style activity where each group member performs a specific data entry task using forms in MS Access. For example, one member adds a new record, the next member modifies an existing record, another member navigates to a specific record, and so on. Each group member passes the task to the next member until all tasks are completed. The first group to finish all the tasks wins the relay. This activity promotes collaboration, time management, and hands-on practice of various record management tasks using forms.

#### **2. Record Navigation Challenge**

Provide each group with a form and a set of records in MS Access. Assign each group a specific record to find using the form's navigation controls. The groups compete to navigate through the records and locate the assigned record within the shortest amount of time. They should use form navigation techniques such as searching, filtering, and sorting to find the record efficiently.

#### **3. Record Deletion Challenge**

Give each group a form in MS Access with a set of records. Assign each group a specific criteria or condition for record deletion. The groups should collaboratively identify and delete the records that meet the given criteria while preserving the integrity of the database.

#### **4. Form Customization and Data Entry**

Provide each group with a partially designed form in MS Access and a set of records to enter. Assign each group a specific task to customize and complete the form layout and controls. They should add any necessary validation rules, apply formatting, and make the form user-friendly. The groups then enter the assigned records into the form, ensuring data accuracy and consistency.

## **Activity 7**

### **Activities For Formative Assessments**

#### **Form Interaction and Data Entry Simulation**

Create a simulation exercise where students work with forms to enter data into a database. Provide them with a set of forms representing different data entry scenarios or tasks. Each student or group should interact with the forms, entering data and validating it according to specified rules. They should navigate between related forms and ensure data integrity and consistency.

## **Formative Assessments**

### **1. Form Design and Layout Evaluation:**

Provide students with sample forms created in MS Access and ask them to evaluate the design and layout aspects. Instruct them to identify any usability issues, such as inconsistent formatting, overcrowded fields, or unclear labels. Students should provide constructive feedback on how the form design can be improved to enhance user experience and data entry efficiency.

### **1. Form Navigation and Filtering Tasks:**

Assign students various form navigation and filtering tasks using MS Access. Provide them with a form and a set of records, and ask them to perform specific navigation actions, such as finding a specific record, filtering data based on certain criteria, or sorting records in a particular order. Assess their proficiency in using form navigation features and their ability to retrieve and manipulate data effectively.

## **Activity 8**

### **Classroom Activities:**

#### **1. Query Wizard Challenge:**

Divide students into small groups and provide each group with a sample database containing multiple tables. Assign each group a specific query requirement, such as finding records that meet certain criteria, calculating aggregate values, or creating a cross-tab query. Instruct them to use the query wizard to design and execute the query. Each group should present their query results and explain their approach to the class.

## **Activity 9**

### **GROUP ACTIVITIES:**

#### **1. Query Design Challenge:**

Divide students into groups and provide each group with a specific query requirement or question. For example, they might need to retrieve all customers who made a purchase in a specific month or find the top-selling products in a certain category. Instruct each group to use the query design view in MS Access to design and execute the query that fulfills the given requirement.

#### **2. Query Optimization Competition**

Assign each group a complex database scenario with multiple tables and relationships. Instruct them to design and execute a SELECT query using the query design view that retrieves specific information efficiently. The groups compete to create the most

optimized query in terms of performance and readability. They should consider factors such as table joins, field selection, and criteria optimization.

### **3. Query Design Collaboration**

Divide students into pairs or small groups and assign each group a set of related tables. Instruct them to collaboratively design and execute a SELECT query using the query design view that combines data from multiple tables and presents the desired information. Each group member should contribute to the design process, discussing table joins, field selection, and criteria selection. They present their collaborative query to the class and explain their collaboration process.

## **Activity 10**

### **Activities For Formative Assessments**

#### **1. Query Design Challenge**

Provide students with a sample database and ask them to design and execute different types of queries using the query design view in MS Access. Assign specific tasks to each student, such as creating a SELECT query to retrieve specific information, an UPDATE query to modify records, a DELETE query to remove specific records, and an APPEND query to add new records.

#### **2. Query Modification Exercise**

Provide students with pre-existing queries created using the query design view in MS Access. Ask them to modify the queries to meet specific requirements or criteria. For example, they may need to add additional fields to a SELECT query, change the criteria of an UPDATE query, specify different records to delete in a DELETE query, or append records from a different table in an APPEND query. Evaluate their ability to modify the queries accurately while maintaining the desired functionality.

## **Activity 11**

### **Formative Assessments**

#### **1. Query Wizard Challenge**

Present students with a sample database and a specific query requirement. Instruct them to use the query wizard in MS Access to create a query that retrieves the desired information based on the given requirement. Assess their ability to navigate through the query wizard, select appropriate tables, define criteria, and sort the query results. Evaluate the accuracy and completeness of their queries and the effectiveness of their use of the query wizard.

#### **2. Query Comparison Exercise:**

Assign students a query requirement and ask them to create two queries: one using the query wizard and the other using SQL code directly. Instruct them to compare and contrast the two approaches, considering factors such as ease of use, flexibility, and query performance. Students should explain their choices, highlighting the advantages and disadvantages of each method. Assess their understanding of query creation techniques and their ability to evaluate different query approaches.

## Activity 12

### Classroom Activities

#### 1. SQL Query Challenge

Divide students into small groups and provide each group with a set of table structures in MS Access. Instruct them to write SQL queries using Data Definition Language (DDL) statements to create tables, modify table structures, and define relationships between tables. Each group should present their queries and explain the purpose and functionality of each DDL statement. This activity promotes teamwork, problem-solving, and hands-on practice of SQL queries using DDL.

#### 2. Table Design and Modification Exercise

Provide students with a sample database or a specific scenario that requires table creation and modification. Instruct them to design and create tables using SQL queries in MS Access. They should define table structures, specify field data types, set primary keys, establish relationships, and modify table attributes if needed. Students can present their table designs and discuss their rationale for the choices made. This activity tests their understanding of table design principles, SQL syntax, and the ability to apply DDL statements effectively.

## Activity 13

### Group Activities

#### 1. Query Design Challenge

Divide students into groups and provide each group with a specific query requirement or question. Instruct them to write SQL queries using Data Manipulation Language (DML) statements to retrieve, modify, or delete data from the tables in MS Access. Each group should present their queries, explain the purpose of each DML statement, and discuss the results with the class. This activity promotes teamwork, problem-solving, and practical application of SQL (DML) queries.

#### 2. Data Manipulation Scenario

Assign each group a dataset or a scenario that requires data manipulation. Instruct them to write SQL queries using DML statements in MS Access to insert, update, or delete

data based on the given scenario. The groups should present their queries, explain the logic behind their DML statements, and discuss the outcomes with the class.

## Activity 14

### Activities For Formative Assessments

#### 1. Data Insertion Challenge

Provide students with a sample table structure in MS Access and ask them to insert a set of predefined records into the table. Assign specific tasks to each student, such as inserting records with specific values, ensuring data integrity by handling primary key constraints, and properly formatting data based on field data types.

#### 2. Real-World Data Insertion Exercise

Present students with a real-world scenario that requires inserting data into a table. Provide them with the table structure and a set of records to be inserted. Instruct them to analyze the data and determine the appropriate field values for each record. Students should write SQL statements in MS Access to insert the data into the table, considering data validation and adherence to data integrity rules.

## Activity 15

### 1. Query Building Exercise

Provide students with a set of tables and ask them to write SELECT queries in MS Access that retrieve specific information from the tables. Instruct them to incorporate the ORDER BY clause to sort the results in ascending or descending order based on a particular field. Assess their ability to construct accurate SELECT queries, apply the ORDER BY clause correctly, and interpret the query results.

#### 2. Result Set Analysis

Give students a sample database with pre-existing tables and records. Ask them to write SELECT queries with WHERE clauses in MS Access to retrieve specific subsets of data from the tables. Instruct them to analyze the query results and identify any patterns or trends based on the specified conditions. Evaluate their ability to effectively use the WHERE clause to filter data and their understanding of result set analysis.

#### 3. Complex Query Creation

Provide students with a complex query requirement that involves multiple tables, filtering conditions, sorting, and grouping. Instruct them to write SELECT queries in MS Access that fulfill the given requirement. Students should demonstrate their understanding of combining WHERE, ORDER BY, and GROUP BY clauses effectively to achieve the desired results. Assess their ability to design and construct complex queries and their understanding of query optimization techniques.

## **Activity 16**

### **Classroom Activities**

#### **1. Report Wizard Exploration**

Introduce students to the Report Wizard in MS Access and provide them with a sample database or dataset. Instruct them to use the Report Wizard to create a report based on a specific set of fields and grouping options. Students should customize the report layout, apply formatting, and select appropriate grouping and sorting options.

#### **2. Query-Based Report Creation**

Assign each student or group a specific query that retrieves data from multiple tables. Instruct them to create a report in MS Access based on the query results. Students should design the report layout, apply grouping and sorting options, and include relevant fields from the query.

## **Activity 17**

### **Group Activities**

#### **1. Comparative Report Design**

Divide students into small groups and assign each group a specific type of report layout, such as tabular, columnar, justified, or outline. Instruct each group to design a report using their assigned layout in MS Access. They should choose appropriate fields, apply formatting, and arrange the data in a visually appealing manner.

#### **2. Interactive Dashboard Creation**

Assign each group a set of data that can be visualized through an interactive dashboard. Instruct them to design a report in MS Access that resembles a dashboard layout, incorporating charts, graphs, and summary information. Students should use grouping, calculations, and visual elements to present the data in an interactive and visually engaging manner.

## **Activity 18**

### **Report Evaluation Exercise**

Provide students with sample reports created in MS Access. Instruct them to analyze the reports and evaluate their effectiveness in presenting the data. Students should assess the report's layout, organization, clarity, and overall visual appeal. They can identify any areas for improvement or suggest modifications to enhance the report.

## **Activity 19**

### **1. Dataset Selection:**

Provide students with a sample database or dataset containing multiple tables. Instruct them to select a specific dataset or a scenario for which they will create a report.

### **2. Query Creation:**

Ask students to design a query in MS Access that retrieves the necessary data for the report. They should consider the required fields, filtering criteria, sorting options, and any necessary calculations or aggregations. Students should ensure that the query accurately retrieves the data needed for the report.

### **3. Report Design:**

Instruct students to create a report in MS Access using the query they created in the previous step as the data source. They should design the report layout, including appropriate headers, footers, sections, and grouping options if applicable. Students should consider the visual presentation, formatting, and any additional elements such as charts, sub reports, or summary sections.

**Note:** This teacher-led pacing guide has been developed for AKU-EB affiliated schools to facilitate them by

- ensuring smooth transition of a school's academic year.
- ensuring curricular continuity in schools.
- predicting the time and pace of syllabi implementation.

This document also contains **suggested activities and/or formative assessments** that may enhance the learning experience. Please note that these activities are meant to serve as suggestions. As educators, you have the flexibility and autonomy to adapt and modify them to best suit the needs of your students and the dynamics of your classroom.

You are advised to use an ad-blocker while accessing the websites and web resources. In case any website is not functional for any reason, you may inform us at [examination.board@aku.edu](mailto:examination.board@aku.edu) for an alternative or search material via any search engine.