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# Table of Contents

# Questions

## Topic 1: Algorithms

### Chapter 1: Understanding Algorithms

▼ What is meant by an algorithm? [1 mark]

An algorithm is a precise step-by-step method for solving a problem or completing a task.

## Chapter 3: Sorting and Searching Algorithms

▼ How does Linear search work? [3 marks]

- Starts at the first item of the list
- Compare the current item with the searching item
- If they are same then stop, else move to the next item until the end of list is reached or the value is found

▼ How does Binary search work? [4 marks]

- Select the median item of the list
- If median is equal then stops
- If median is higher, selects the left side of the list and repeat the first two steps
- If median is lower, selects the right side of the list and repeat the first two steps
- Repeat these steps until the search is found or all median items have been checked

▼ How does bubble sort work (ascending order) [3 marks]

- Start at the beginning of the list
- Compare two adjacent values, if they are not in ascending order then swap
- if they are in ascending order then move on to next value
- Repeat these steps until there are no swaps in the whole pass

▼ Define recursion [1 mark]

A process that is repeated again and again until the condition is met

▼ Define bruteforce [2 marks]

An algorithm that doesn't have any techniques to improve performance, but relies on computing power to try all possibilities until the solution is reached.

▼ Define divide and conqueror [2 marks]

An algorithm design that works by dividing a problem into smaller and smaller sub-problems, until they are easy to solve. The solutions are then combined to complete problem

## Chapter 4: Decomposition and Abstractions

▼ Define abstraction [1 mark]

The process of removing or hiding unnecessary detail and highlighting only main points

▼ Define decomposition [1 mark]

Breaking a problem down into smaller and more managable parts, which are then easier to solve

# Topic 2: Programming

## Chapter 5: Developing Code

▼ Implement Linear Search

```
numbers = [1, 2, 3, 4, 5, 6, 7]
found = False
target = int(input("Enter a number:"))
while index < len(numbers) and not found:
  if num == target:
    found = True
if found:
  print("Found")
else:
  print("Not found")
```

▼ Implement Binary Search

```
numbers = [1, 2, 3, 4, 5, 6, 7]
low = 0
high = len(numbers) - 1
found = False
while low < high and not found:
  mid = (low + high) // 2
  if numbers[mid] > high:
    high = mid - 1
  else if numbers[mid] < low:
    low = mid + 1
  else:
    found = True
if found:
  print("Found")
else:
  print("Not Found")
```

## Chapter 6: Making Programs Easier To Read

▼ 4 Techniques

| Technique | Description |
| --- | --- |
| Comments | Comments should be used to explain what each part of the program does. |
| Descriptive Names | Using descriptive identifiers for variables, constants, and subprograms helps make their purpose clear. |
| Indentation | Indentations make it easier to see where code starts and finishes. |
| White Space | Adding blank lines between different blocks of code makes them stand out. |

## Chapter 9: Input/Output

▼ Implement Range Check (case: make sure the number is between 1 and 10)

```
num = int(input("Enter a number"))
while num < 1 or num > 10:
  num = int(input("Enter a number again because number isn't
between 1 and 10"))
print("You have entered", num)
```

## Implement Presence Check (case: check whether username is empty or not)

```
username = ''
while username == '':
  username = input("Please enter username:")
print("Hello", username)
```

## Implement Look up Check (case: check whether an item is in array)

```
arrayForms = ['7AXB', '7PDB', '7ARL', '7JEH']
form = input("Enter a form:")
valid = False
index = 0
length = len(arrayForms)
while valid = False and index < length:
  if form = arrayForms[index]:
    valid = True
  index = index + 1
if valid == True:
  print("Valid Form")
else:
  print("The form you have entered doesn't exist")
```

## Implement Length Check (Case: Enter a string of length 8)

```
binaryString = input("Enter a string of 8 bit binary: ")
while len(binaryString) != 8:
  binaryString = input("You must enter a length of 8 binary
string: ")
print("Valid")
```

▼ Testing Validation Rules (Normal, Boundary, Erroneous datas)

| Data | Description |
|---|---|
| Normal Data | Data that is within the limits of what is accepted by program. Example 7 chars password for validation rules that states password must be between 6 and 8 digits |
| Boundary Data | Data that is at the extreme limits of what is **accepted** by the program. Example if a rule is >= 75 and <= 100 for accepted values, boundary data are 75 and 100 (both accepted) |
| Erroneous | Data that will not be accepted. If validation rules state number is > 0 then erroneous data is -1 |

## Chapter 10: Subprograms

▼ What is meant by built in functions [1 mark]

Functions that are provided by programming languages to perform common tasks

## Chapter 11: Testing and Evaluation

▼ What is trace table and why do we use it? [2 marks]

- A technique used to identify logic errors in algorithms
- As we work through all the steps, we can see what values variables hold at a specific step.

▼ Three types of errors

| Type of Error | Description |
|---|---|
| Logic Error | An error in algorithm that results in unexpected behaviour |
| Runtime Error | An error that occurs while the program is running. Common Example is ZeroDivisonError |
| Syntax Error | An error that occurs when the computer tries to run code that it cannot execute. Example is forgetting to close parenthesis |

# Topic 3: Binary

## Chapter 12: Binary

## Chapter 13: Data Representation

▼ Give the impacts of increasing the sampling frequency. [2 marks]

- The analogue sound wave will be represented more accurately, and the fidelity/ quality of the recording will be improved
- The file size will increase/ more data stored (as each sample takes up disk space)

▼ Explain why Unicode was developed [2 marks]

- Before Unicode, there were hundreds of different encoding systems, and no single encoding system could contain enough characters to represent all major languages
- Standard ASCII only provides 128 different patterns, which can't represent all major languages
- Unicode uses a minimum of 16 bits, so it can represent at least 2^16 characters.
- Unicode has a very large number of characters that can represent all languages/ ASCII was developed for English

▼ Describe the steps taken to convert the analogue sound to a digital sound file [3 marks]

- set the sample rate/parameters/bit-depth (1)
- sample (the analogue sound) (1)
- measure the sound amplitude/volume/frequency (1)
- give a (binary) value/number for each measurement (1)
- store data as sample rate and values / digital signals (1)

**Chapter 14: Data Storage and Compression**

**Chapter 15: Encryption**

## Topic 4: Computers

**Chapter 16: Machine And Computational Models**

**Chapter 17: Hardware**

▼ Two types of items stored in Von Neumann Architecture [2 marks]

- Data
- Instructions

▼ Explain how virtual memory works [2 marks]

- Virtual memory (VM) is used when RAM becomes full (1) (to hold all programs and data).
- Virtual memory is used as (an extension to) main memory/RAM / works like RAM. (1)
- Virtual memory is stored/created on (internal) secondary storage/HDD/SSD. (1)
- Virtual memory is used as temporary storage. (1)
- Instructions and data not currently being used are transferred from RAM to VM/HDD. (1)
- When needed again, instructions and data are transferred back to RAM. (1)

▼ how does HDD work? [3 marks]

- Made up of several metal discs coated with magnetic materials (Platters)
- Platter is divided into sector and tracks
- Each iron particles on platter are magnetized to represent 1 or 0 using read/write head

▼ How does SSD work? [3 marks]

- Uses electronic circuits that can store binary values (1 or 0) **(1 mark)**
- Uses NAND/NOR flash memory to persistently control electron flow **(1 mark)**
- Applies high voltage to trap electrons in the floating gate (data storage) **(1 mark)**

▼ How does an optical drive work? [2 marks]

- Uses a disc with a polycarbonate surface layer **(1 mark)**
- A laser beam reads/writes data by targeting the disc surface **(1 mark)**
- Creates physical pits (indentations) and lands (flat areas) on the disc **(1 mark)**
- Pits represent binary 0, lands represent binary 1**(1 mark)**

▼ What is the function of the Program Counter (PC)? [1 mark]

Stores the address of the next instruction to be fetched.

▼ What does the Memory Address Register (MAR) hold? [1 mark]

Stores the address of the instruction/data to be fetched from memory.

▼ Describe the role of the Memory Data Register (MDR). [2 marks]

- Stores the data fetched from memory **(1 mark)**.
- Transfers this data to the Arithmetic Logic Unit (ALU) for execution **(1 mark)**.

▼ What is the purpose of the Current Instruction Register (CIR)? [1 mark]

Stores the instruction currently being decoded by the CPU.

▼ Explain the function of the Accumulator. [1 mark]

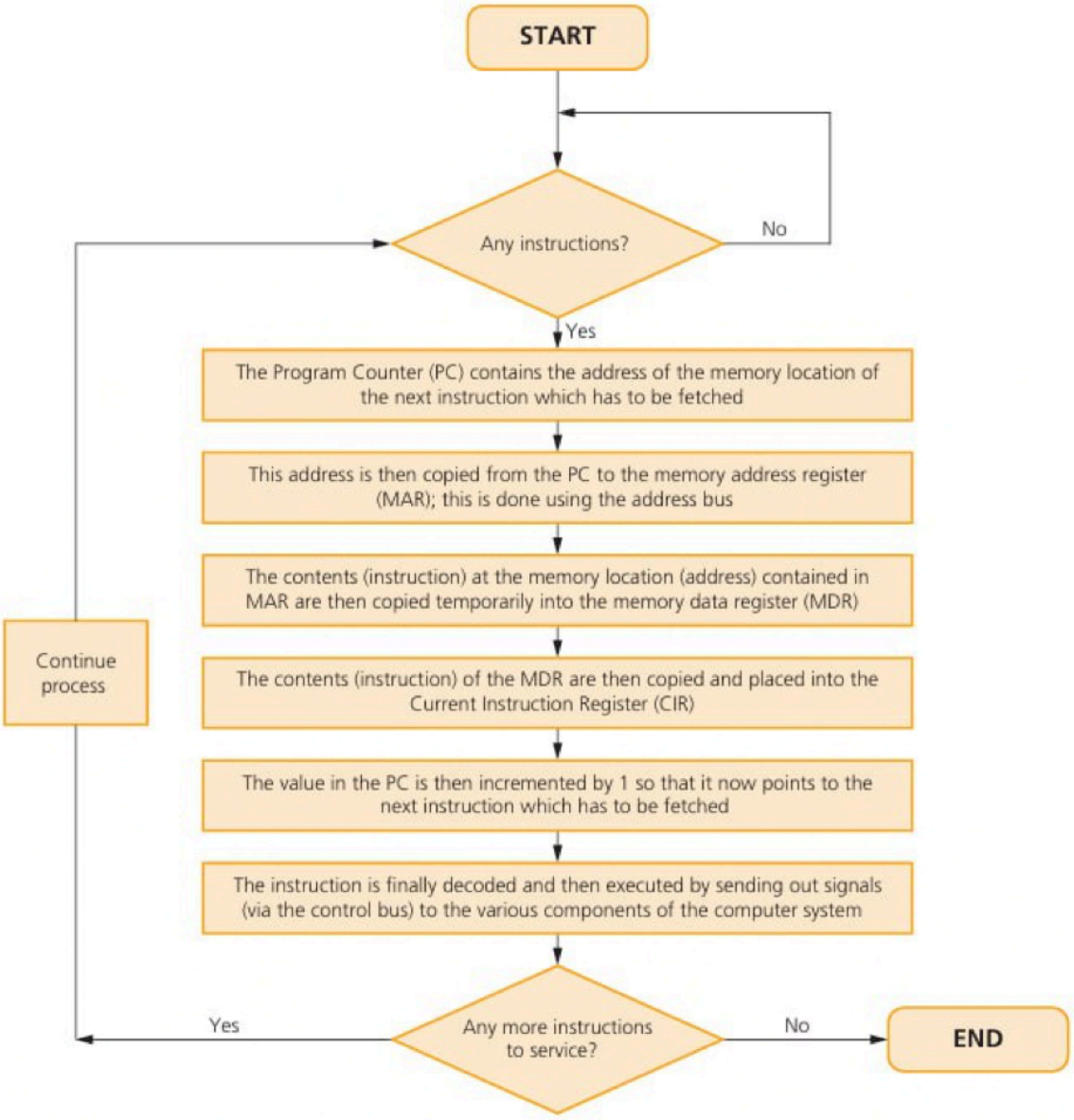
Temporarily holds the results of calculations performed by the ALU.

▼ Explain how increasing the size of the cache improves the CPU's performance. [2 marks]

Caches store frequently used data or instructions to reduce the need to access slower RAM. Since cache is faster and closer to the processor, it speeds up processing by minimizing wait times.

▼ Describe the fetch-decode-execute cycle. [6 marks]

- **Fetch Stage (3 marks)**
  - Memory Address Register (MAR) holds the address of the next instruction, sent via the *address bus* **(1 mark)**.
  - Instruction/data is fetched from memory to the Memory Data Register (MDR) via the *data bus* **(1 mark)**.
  - Instruction is copied to the Current Instruction Register (CIR); Program Counter (PC) increments **(1 mark)**.
- **Decode Stage (1 mark)**
  - Control Unit decodes the instruction in CIR into *opcode* (operation) and *operand* (data) **(1 mark)**.
- **Execute Stage (2 marks)**
  - Arithmetic Logic Unit (ALU) performs the operation (opcode) on the operand **(1 mark)**.
  - Result is stored in the *accumulator* or written back to memory **(1 mark)**.




▲ **Figure 3.3** Fetch–Decode–Execute cycle flowchart

▼ Discuss the benefits and drawbacks of using cloud storage. [6 marks]

**Benefits**

- **Accessibility**:
  - Access files from any location with WAN connectivity
  - Collaborate in real-time with permission controls
  - Device-agnostic access (any internet-enabled device)
- **Scalability**:
  - Flexible storage capacity adjustments (pay-as-you-grow)
- **Reliability**:
  - Redundant server backups minimize data loss risks
- **Cost Efficiency**:
  - Reduces local hardware/staff costs (provider-managed IT)

**Drawbacks**

- **Security Risks**:
  - Potential for external breaches or unauthorized access
  - Jurisdictional challenges in data protection laws
- **Dependency**:
  - Requires consistent high-speed internet
  - Reliance on provider's service continuity
- **Hidden Costs**:
  - Recurring subscription fees
  - Potential overuse charges for bandwidth/storage
- **Environmental Impact**:
  - High energy consumption for servers and cooling

## Chapter 18: Logic

## Chapter 19: Software

▼ What is an application software? [2 marks]

Software that is designed to perform specific task for the user. For instance, word processing software, photo editing software, etc

▼ Describe how an operating system manages the storage of a file on random-access secondary storage. [4 marks]

- OS checks whether there is space on disk
- The file is broken into blocks
- Blocks are stored in any spaces that are large enough to store each block
- Blocks can reside anywhere on the storage
- Meta data about file is created and separately stored

▼ List at least 4 functions of Operating Systems [4 marks]

- Providing User Interface
- User management
- Hardware management
- File management
- Process management
- Resource management
- Memory management
- Print Spooling

▼ What is scheduling? [2 marks]

The algorithm that the OS uses to share a portion of CPU time to each programs which are currently running

## Chapter 20: Programming Languages

▼ What is a low level programming language? [1 mark]

The language that is closer to machine code (binary)

▼ Compare four features between a compiler and an interpreter. [4 marks]

| Feature | Compiler | Interpreter |
| --- | --- | --- |
| **Execution** *(1 mark)* | Translates entire code into machine language **before** execution. | Translates and executes code **line-by-line**. |
| **Speed** *(1 mark)* | Faster execution (pre-compiled). | Slower (translates during runtime). |
| **Error Handling** *(1 mark)* | Reports all errors after compilation. | Stops at the first error encountered. |
| **Portability** *(1 mark)* | Output is machine-specific (less portable). | Code can run on any machine with the interpreter (more portable). |

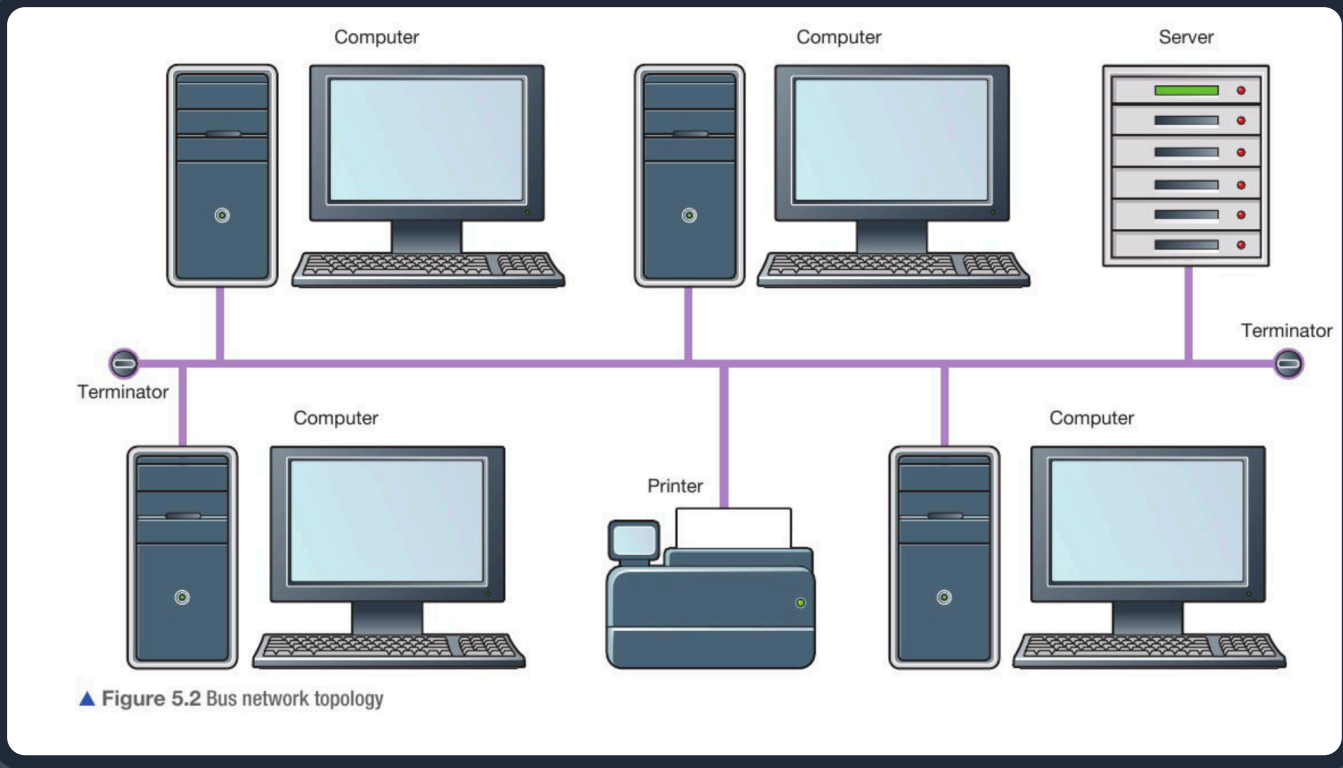
# Topic 5: Networking

## Chapter 21: Networks

▼ Why do people connect to network? [2 marks]

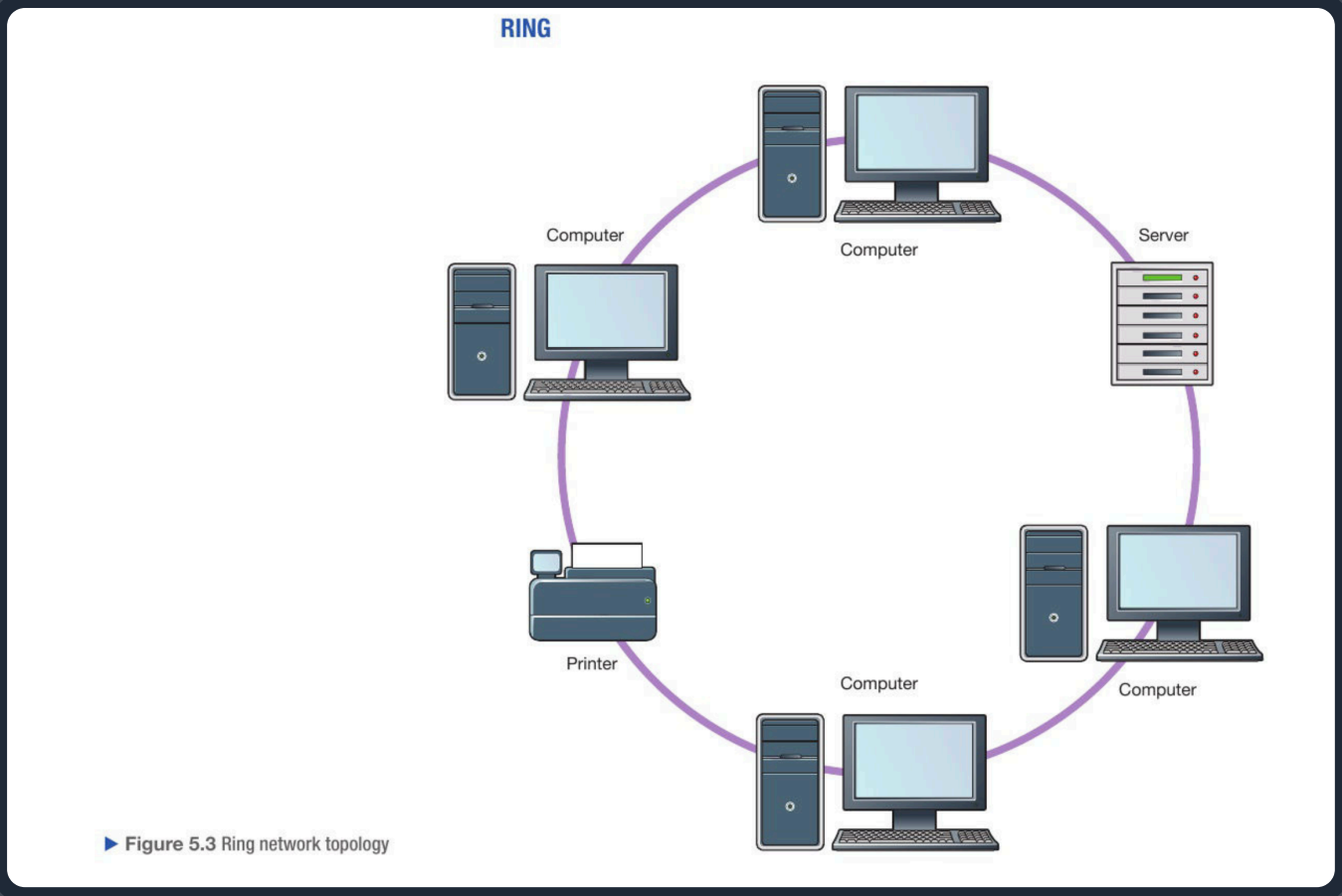
- To share access to the internet/WWW/broadband connection
- To enable internal communication using email, instant messaging, and calendar
- To share files/data across multiple devices
- To share peripherals like printers and other hardware

▼ Draw A Bus Topology [4 marks]



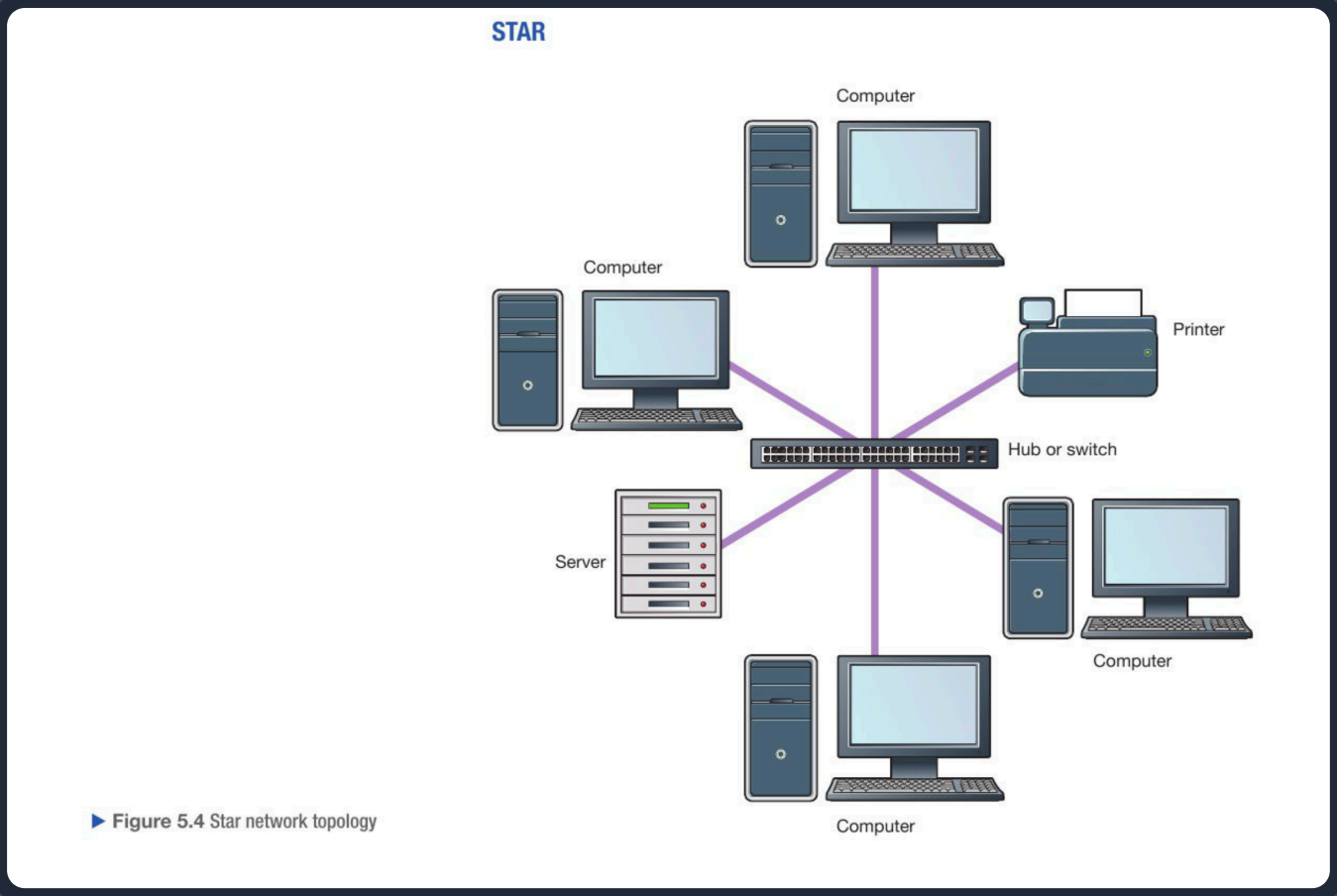

▲ **Figure 5.2** Bus network topology

## ▼ Draw A Ring Topology [4 marks]




▶ **Figure 5.3** Ring network topology

## ▼ Draw A Star Topology [4 marks]




▶ **Figure 5.4** Star network topology

## ▼ Describe advantages and disadvantages of Star Topology [3 marks]

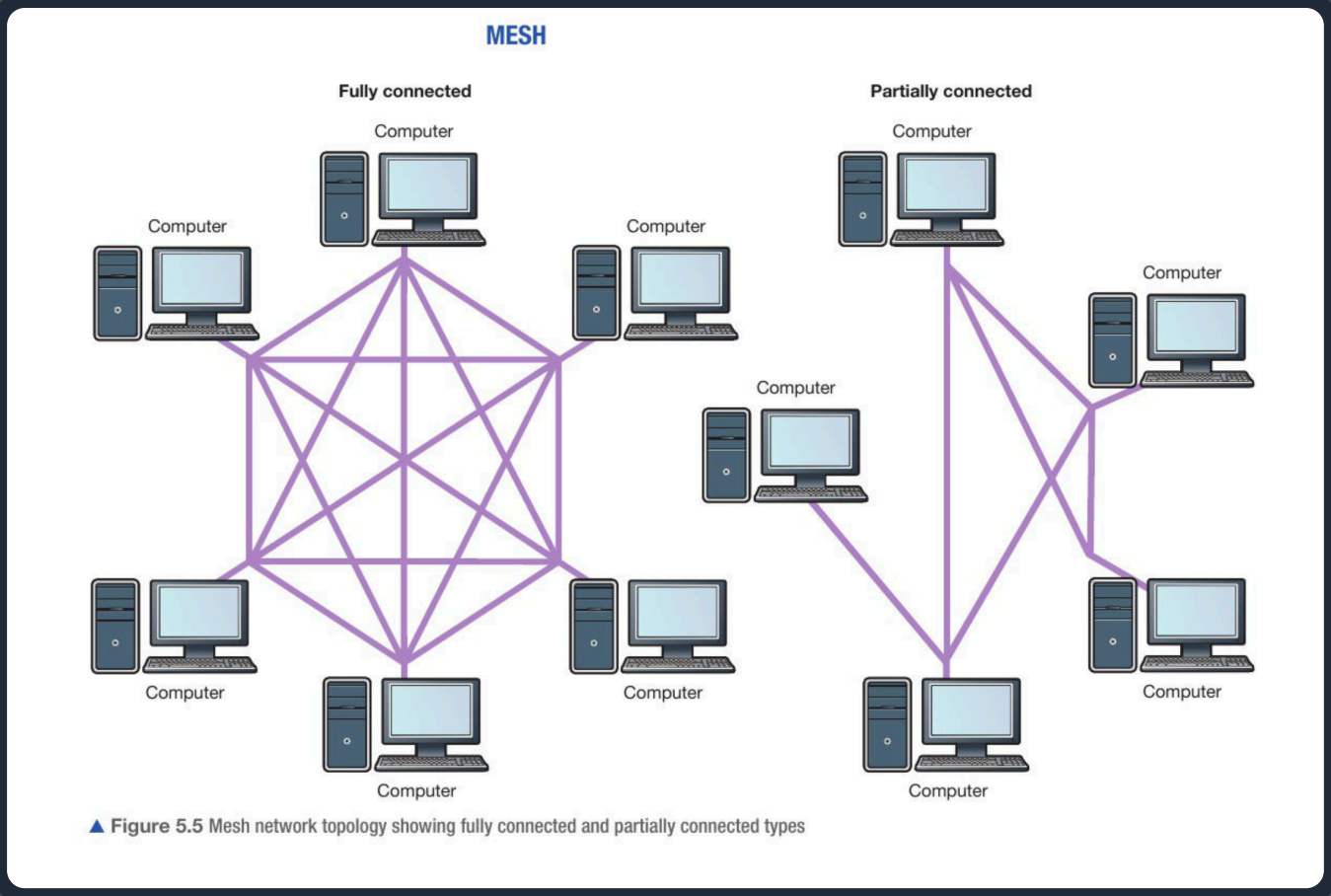
**Advantages**

- Easy to connect/ remove new nodes
- Failure of one node/link does not affect the rest of the network
- Easy to detect the failure of one node/link

**Disadvantages**

- If the central switch/hub fails, then the whole network fails
- Performance and the number of nodes that can be added depend on the capacity of the central switch/hub
- Can require more cable than some of the other topologies

▼ Draw A Mesh Topology [4 marks]




▲ Figure 5.5 Mesh network topology showing fully connected and partially connected types

▼ Compare three features between wired and wireless connectivity. [6 marks]

| Feature | Wired | Wireless |
|---|---|---|
| **Speed** | Faster data transmission (e.g., fiber optic cables) | Slower due to signal interference |
| **Security** | Harder to intercept (physical access required) | Requires encryption to prevent eavesdropping |
| **Installation** | Expensive/cumbersome (cables, ports) | Flexible but prone to interference (walls/devices) |

## Chapter 22: Network Security

▼ Describe what is meant by shoulder surfing [2 marks]

- A hacker/third party spies on/watches the user (of an electronic device) (1)
- In order to obtain their personal identification number/password/login information/sensitive information (1)

▼ Explain one way to prevent shoulder surfing [2 marks]

- shield your screen/keypad/keyboard when entering (sensitive/personal) information (1)
- to stop people seeing/memorising passwords/named sensitive item/sensitive/personal information (1)

▼ Explain why the delay of not updating software to latest version could pose a threat to the security of the network. [2 marks]

**One method**

- compromised/unpatched software is more vulnerable to attack (1)
- and may allow an attacker control of the whole network (1)

**Another method**

- unpatched software has known weaknesses (1)
- which can be exploited by a hacker(1)

## Chapter 23: The Internet And The World Wide Web

▼ Describe the difference between the Internet and the World Wide Web. [2 marks]

**Internet**

- The internet is a global network of networks
- The internet is the most well known WAN (Wide Area Network)
- The internet is a infrastructure used to provide connectivity to WWW

**World Wide Web**

- Collection of websites and web pages that are accessed using internet
- Web pages are accessed using a web browser, which communicates with web servers to retrieve and display the content.

▼ Explain why IPv6 addressing was introduced. [2 marks]

- IPv4 addresses are running out
- IPv6 can represent more devices using 128 bits per address compared to 32 bits per address

## Topic 6: The Bigger Picture

### Chapter 24: Computing And The Environmental impact of Technology

▼ List two positive impacts of using technology on the environment

### Chapter 25: Privacy

### Chapter 26: Digital Inclusion

### Chapter 27: Professionalism

### Chapter 28: Computing And The Legal Impact Of Technology

## Chapter 29: Current and Emerging Trends

▼ Describe what is meant by Artificial Intelligence [2 marks]

The ability of a digital computer or computer-controlled robot to perform tasks commonly associated with intelligent beings. Intelligent beings are those that can adapt to changing circumstances.

▼ Describe what is meant by Machine Learning [2 marks]

Machine learning is a form of artificial intelligence (AI) that allows computer systems to carry out complex processes by learning from data, rather than following pre-programmed rules.

▼ What is DNA? [1 mark]

DNA is the material that stores genetic information in all organisms.

▼ Describe differences between normal computer and DNA computers [2 marks]

- DNA computers use DNA rather than silicon like normal computers. DNA doesn't use two bits but four bits (A, T, G and C).Normal computers use binary which is two bits (0 and 1).
- Like modern storage devices, DNA is digital, but it is not binary. Binary encoding uses two bits (0 and 1) but DNA uses four possible bits named adenine (A), thymine (T), guanine (G) and cytosine (C) after their chemical structure.

▼ Describe the advantages of DNA computers over normal ones [2 marks]

- There will always be supply of DNA
- The large supply of DNA makes it cheap resource
- DNA biochips can be made cleanly unlike toxic materials used to make traditional processors
- DNA computers are many times smaller than today's computers.

▼ Why is DNA suitable for storing data? [2 marks]

Because DNA consists of 4 digits which are arranged in groups of 3, it can encode information represented by the bits and bytes of computer systems.

▼ Define what is meant by nanotechnology [1 mark]

The manipulation of matter with a size of from 1 to 100 nanometres.

▼ Describe a place where nanotechnology is used. [1 mark]

- Self cleaning windows
- Clothing
- Scratch-Resistant coating
- Medicine

▼ What is meant by quantum computing [2 marks]

Quantum computing is based on quantum mechanics. Quantum mechanics is the branch of physics that describes the behviour of very small subatomic particles, which can exist as both particles and waves. Quantum computers use qubits, which can represent both 1 and 0 at the same time.

▼ Define the term superposition [1 mark]

The ability of a quantum system to be in multiple states at the same time until it is measured.

▼ Define the term entanglement [1 mark]

Co-dependence of the quantum states of pairs or groups of particles.

▼ Define the term qubit [1 mark]

A quantum bit, the counterpart in quantum computing to the binary digit or bit of classical computing.

▼ How can quantum computers solve complex arithmetic problems far more rapidly than classical computers? [2 marks]

> Each qubit can be 1 and 0 at the same time and so can calculate a vast number of possible outcomes simultaneously.

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Contributions are welcome!

Submit a pull request on GitHub or contact me directly.