

3.3 Data storage (question bank, public)

1. Primary/secondary storage

Question

Explain why a computer needs RAM.

[3]

- To store data **temporarily**
- To store data **currently in use**
- To store software **currently in use**
- Data can be **accessed** faster than from secondary storage
- To speed up the fetch stage of the fetch-execute cycle

Question

Give two characteristics of primary storage.

[2]

- It is directly accessed by the CPU
- It is volatile (for RAM) // non-volatile (for ROM)
- It stores data/instructions currently in use or needed at startup

Question

State the purpose of secondary storage.

[1]

- To store data, files, or software **permanently**

Question

Explain why a computer needs secondary storage.

[3]

- RAM is volatile // data in RAM is lost when the power is off
- Secondary storage is non-volatile // data is retained when the power is off
- To store data/programs permanently // for long-term storage
- RAM has limited capacity // not enough room to store all files

Question

Explain why RAM is an example of primary storage and not secondary storage.

[3]

- Primary storage is directly accessed by the CPU // secondary storage is not directly accessed by the CPU
- RAM is volatile // data is lost when the power is turned off
- RAM stores data/programs currently in use
- Secondary storage is for more permanent storage of data

Question

Explain **two** differences between primary storage and secondary storage.

[4]

- Primary storage is directly accessible by the CPU
- ...whereas secondary storage is not
- **Some** primary storage is volatile, ...
- whereas secondary storage is non-volatile
- **Some** primary storage cannot be changed,
- ...whereas data in secondary storage can be edited
- Primary storage usually has smaller capacity,
- ...whereas secondary storage has larger capacity
- Primary storage has faster access speeds,
- ...whereas secondary storage is slower
- Primary storage stores data currently in use or required for booting,...
- whereas secondary storage stores user files, data, or software

2. Magnetic, optical, solid-state storage

Question

Give **two** features of magnetic storage.

[2]

- Data is stored on platters
- Platters are divided into tracks and sectors
- Has components that spin
- Data is read and written using a read-write arm
- Data is read and written using electromagnets
- Magnetic fields determine binary values
- It is non-volatile

Question

Give **one** example of each type of storage.

- Magnetic
- Solid-state
- Optical

[3]

Magnetic – HDD / Magnetic tape / Floppy disk / Magnetic strip

Solid-state – SSD / USB drive / SD card / RAM
Optical – CD / DVD / Blu-ray

Question

Give **three** features of solid-state storage.

[3]

Flashes data onto chips / Uses transistors / Uses NAND or NOR technology / Uses control gates / Uses flow gates / Controls the flow of electrons / Can be volatile or non-volatile

Question

One type of secondary storage is optical.

Circle three examples of optical storage.

read only memory (ROM) secure digital (SD) card compact disk (CD) hard disk drive (HDD) digital versatile disk (DVD) Blu-ray disk universal serial bus (USB) drive solid-state drive (SSD)

[3]

Compact disk (CD) / Digital versatile disk (DVD) / Blu-ray disk

Question

Users can store their data on optical storage media.

Explain how data is written to optical storage media.

[4]

- The disc is rotated or spun
- A laser beam is used
- The laser beam makes indentations (pits) and flat areas (lands) on the disc surface
- Data is written in a spiral
- Pits and lands represent binary values 1s and 0s
- The process is called “burning” data to the disc

Question

Give three features of optical storage.

[3]

- Give three features of optical storage.
- Uses lasers to read/write
- Uses pits and lands
- Portable/removable
- Lightweight
- No moving parts (in the disc itself)

Question

Give one example of each type of storage. Magnetic / Optical / Solid-state.

[3]

Magnetic: hard disk drive (HDD)
Optical: CD // DVD // Blu-ray
Solid-state: solid-state drive (SSD) // SD card // USB drive

Question

A sports events company uses a digital camera attached to a drone (small flying system) to record video footage of their events from the sky.

The video is stored as it is captured, on a device that is attached to the drone.

(a) Identify the most suitable type of storage to store the video.

Optical / Magnetic / Solid state

[1]

(b) Explain the reasons for your choice in part (a).

[2]

(a)
Solid state

- (b)
- It has no moving parts, so it is more durable
 - It is small and compact, so it easily fits onto the drone
 - It can store the large amount of data needed for video footage
 - It uses less power, so the drone's battery will last longer

Question

Below are some statements about secondary storage.

State the type of secondary storage that applies to each statement.

1. Uses platters divided into tracks and sectors
2. Uses lasers to create and read pits and lands
3. Uses NAND or NOR technology with transistors
4. Data is read and written using electromagnets
5. Examples include CD, DVD and Blu-ray
6. Examples include SSD, SD card and USB drive

[6]

Magnetic
Optical
Solid-state
Magnetic

Optical
Solid-state

Question

A home computer has a magnetic storage device, and the cloud storage uses solid-state (flash memory) storage.

(a) Describe how magnetic hard disk drives read and write data.

[2]

(b) Describe how solid-state drives read and write data.

[2]

Magnetic HDD: uses platters which are divided into tracks and sectors; data is read and written using electromagnet

Solid-state: uses NAND or NOR technology; transistors are used as control gates and floating gates

Question

The smartphone contains secondary storage.

Identify the most suitable type of secondary storage for the smartphone.

Explain your choice.

[5]

One mark for:

- Solid state

Any four from:

- It is small/thin in size
- ... so it would fit easily into the smartphone device
- It is lightweight
- ... so it wouldn't make the smartphone heavy to carry
- It has no moving parts
- ... so it would be durable/robust
- ... if the smartphone is dropped the data is less likely to be damaged/lost
- It has fast read/write speeds
- ... so it would be quick to load files/software
- It runs at a cool temperature
- ... so it wouldn't make the smartphone hot to hold for the user
- It doesn't make a lot of noise
- ... so it wouldn't ruin the user's experience of listening to music/watching videos
- It doesn't require much power
- ... so it won't drain the battery
- It can have a large storage capacity
- ... so can store files that are multimedia

Question

A company uses both solid-state and optical secondary storage.

Describe **three** differences between solid-state and optical storage.

[6]

- Solid-state has no moving parts
- ... optical does have moving parts
- Solid-state is faster to access data
- ... optical is slower to access data
- Solid-state uses less power to operate
- ... optical uses more power to operate
- Solid-state runs quietly
- ... optical makes more noise
- Solid state is more durable/robust
- ... optical is less durable/robust
- Solid state storage has a large storage capacity
- ... optical has a much smaller limit to its storage capacity
- Solid-state is more expensive per GB of data
- ... optical is cheaper per GB of data
- Solid-state stores data onto silicon chips/transistors using logic (floating/control/NAND/NOR) gates to control the movement of electrons
- ... optical stores data by using lasers to burning pits and lands onto a disk

3. Virtual memory

Question

Some computers make use of virtual memory.

State the purpose of virtual memory.

[1]

E.g.

- To run programs when there is insufficient RAM to run them
- To allow RAM to store more data when required

Question

A student is editing a large video file and during this process the RAM becomes full.

Describe how virtual memory could be used in this process to stop the computer crashing.

[3]

- Virtual memory can act as an extension to the RAM .
- The secondary storage device is **partitioned** to create the virtual memory.
- Pages can be **transferred** from the RAM to the **virtual memory** ...
- ... to stop the RAM getting full // ... when the RAM is full.

Question

A computer has pages A, B and C that are stored in RAM. Page D needs to be sent to the RAM but the RAM is full.

Page B is **not** needed immediately.

Explain how virtual memory can be used in this scenario.

[4]

- The secondary storage / hard drive can be partitioned to create the virtual memory
- ... and page B sent to the virtual memory ...
- ... which makes space for page D in RAM
- ... Once page A / C / D / another page is not required / has been processed
- ... page B can be sent from the virtual memory back to RAM when it is required

Question

(a) Draw a diagram to represent how virtual memory is created and used.

[4]

(b) A student is using software to create 3D models. This process often requires the use of virtual memory.

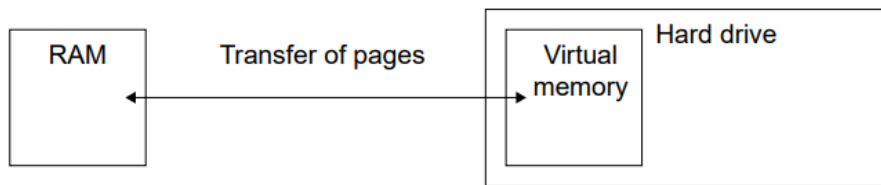
Explain why virtual memory is needed for this process.

[3]

(a) The diagram shows:

- a hard drive
- the hard drive portioned in some way to create virtual memory
- RAM
- an indication of pages transferred between the RAM and the virtual memory

For example:



(b)

- to extend the RAM capacity
- ... to stop the 3D modelling software from freezing/crashing when the physical RAM is full
- to allow the computer to process the large amount of data required for 3D modelling.

4. Cloud storage

Question

Describe what is meant by cloud storage.

[2]

- A collection of servers
- ... that store data in a remote location // that allows data to be accessed remotely
- ... that are (normally) accessed using an internet connection

Question

A company uses cloud storage to store its data.

(a) Explain **two** advantages for the owners of a company of storing its data in cloud storage.

[4]

(b) Describe the disadvantages to employees of the company storing data in the cloud.

[3]

(a) E.g.

- The data can be accessed from any location
- ... meaning that employees can work from anywhere with a connection
- The **hardware** is **owned/maintained** by a **third party**
- ... meaning that the company are not responsible for maintaining // meaning the company aren't responsible for its security
- Can increase the storage needed easily
- ... without needing to buy new hardware
- Do not need to house the hardware needed

- ... costs can be saved on the space saved for this
- Cloud system will back up the data
- ... meaning the company does not need to do this

(b) E.g.

- Internet connection is needed/needs to be stable ...
- ... and if this is not available/unstable the data cannot be accessed
- Employees could be pressured to work outside of hours ...
- ... as they can access the data from any location

Question

A user stores data using cloud storage.

(a) Give **two** advantages to the user of storing data in cloud storage instead of locally.

[2]

(b) Give **two** disadvantages to the user of storing data in cloud storage instead of locally.

[2]

(a)

- Can access data from anywhere // from any device with internet
- No need to carry a storage device
- Data is backed up by the cloud provider
- Can easily share data with others

(b)

- Requires an internet connection to access
- Data could be hacked/intercepted // security risk
- May need to pay a subscription fee
- Speed of access depends on internet speed/bandwidth
- Reliant on the cloud provider // if provider goes down, data is inaccessible

Question

A mobile device uses a text message application that receives data from cloud storage.

(a) Describe what is meant by cloud storage.

[3]

(b) Explain **three** benefits of the application using cloud storage.

[6]

(c) Explain **three** disadvantages of the application using cloud storage.

[6]

(d) State what physical equipment is required by the third-party provider to store the school's data in the cloud.

(a)

- A collection of servers
- Allows access to data remotely // Stores data in a remote location
- Hardware can be owned/managed by a third party
- Data storage that is stored/accessed using the internet

(b)

Award 1 mark for identifying a valid benefit and 1 mark for a linked explanation. Maximum of 2 marks per benefit group. Maximum of 3 groups (6 marks total).

Maintenance and security

- No need to maintain the hardware
- ... the third party is responsible for maintaining the hardware / security of the data

Scalability and hardware cost

- Resources can be increased / decreased (on demand) // Can have unlimited storage capacity
- ... no need to worry about running out of storage space
- ... can save cost of **purchase of hardware**

Local device optimisation

- Need less/no (secondary) storage space **on the device**
- ... device can remain/is small in size
- ... costs of device can be kept lower

Accessibility and redundancy

- Can access the data from **other/any devices**
- ... if the device breaks/is lost data is still available

(c)

Award 1 mark for identifying a valid benefit and 1 mark for a linked explanation. Maximum of 2 marks per benefit group. Maximum of 3 groups (6 marks total).

Internet dependency

- Requires a reliable/stable internet connection // Cannot access data offline
- ... if the internet goes down / there is no signal, the data cannot be retrieved/saved
- ... the application may not function correctly without a connection

Security and privacy

- Data is stored by a third party / on external servers // Loss of control over data
- ... increased risk of data interception / hacking / data breaches
- ... relies entirely on the third party's security measures being adequate

Ongoing costs

- Requires ongoing subscription / rental fees (for storage)
- ... which can be more expensive in the long term (than a one-off purchase of local

storage)

- ... if fees are not paid, access to the application's data could be lost

Transfer speeds / bandwidth

- Upload/download speeds are dependent on bandwidth/connection speed
- ... large files/data may take a long time to transfer / sync
- ... could cause lag / slow performance within the application

Reliability of third party

- The cloud service provider could experience server downtime / go out of business
- ... resulting in temporary inability to use the application
- ... resulting in permanent loss of the application's data

(d)

- Physical servers
- Storage devices / HDDs / SSDs