

SECTION A SHORT QUESTIONS

QUESTION 1 DEFINITIONS

Supply a concise definition for each of the following computing terms.

1.1 Multiprocessing

(2)

1.2 Encapsulation

(2)

1.3 E-book

(2)

1.4 Helper method

(2)

1.5 Defragmentation

(2)
[10]

QUESTION 2 MATCHING COLUMNS

For each of the items shown in column A below, select the most correct definition in column C. You should write your answer in the appropriate space in column B, matching your answer to the question number. There is an example for you, shown as Question 2.0 using V as the answer.

Column A		Column B	Column C
2.0	Computer term	V	A. A technique for identification/authorisation that uses characteristics of a person for identity verification.
2.1	Hotspot		
2.2	RFID		
2.3	Interpreter		B. Software used to capture keystrokes to be used in an attack on a PC.
2.4	Device Driver		
2.5	Bridge		C. Device that links two networks segments and can reduce network traffic.
2.6	Router		
2.7	SMTP		
2.8	Plug-in		D. Protocol for sending email.
2.9	Biometric input		E. Zone for accessing Wi-Fi.
2.10	Virus		F. Converts and executes high-level language code one line at a time.
			G. A method of ensuring devices have equal status on a network.
			H. A piece of software that controls a peripheral on a computer.
			I. A web-based protocol for receiving e-mails.
			J. Device used only with ADSL connections.
			K. A value that represents the sum of a series of values used to check for errors.
			L. Software that adds functionality to a browser.
			M. Malicious code.
			N. Device used to boost network signals.
			O. Product tag with a low-power radio transmitter.
			P. Device that determines the best path for data packet transmission.
			Q. Software that converts source code into object code.

[10]

20 marks

SECTION B SYSTEM TECHNOLOGIES

Consider the scenario given below when answering the rest of this examination paper, unless the questions are of a general nature or otherwise stated.

Peter and Sam own and manage a bed and breakfast venue called "**The B&B**". **The B&B** is located in a rural area. There is currently one building that has three bedrooms which are let out to guests. Peter and Sam also live in the building.

QUESTION 3

Peter and Sam are not tech-savvy so they rely on advice for most things tech-related. They have purchased a server for the technological needs of the business. They have bought this in anticipation of future expansion. Currently the server is being used for day-to-day computer needs, such as generating invoices, making payments online, emailing, and updating their Facebook page. The server is connected to the Internet and has a local USB printer. The specification of the computer is shown below:

- Intel® Xeon® Quad-core processor – 8 MB cache, 3.60 GHz
- 16 GB DDR4 RAM installed (Maximum RAM 64 GB)
- Onboard Intel® HD Graphics
- Linux® (64 bit)
- Storage: 2 × 4 TB SATA 7 200 rpm HDD
- Onboard network card – Dual media 10/100/1000
- Onboard RAID controller
- USB: Rear 2 × USB 3.0 and 4 × USB 2.0; Front 1 × USB 2.0 and 1 × USB 3.0
- Single 290 W power supply.

3.1 Give an example of any device that would be connected to a USB port.
 _____ (1)

3.2 USB 3.0 is the current standard for this interface.
 3.2.1 Explain why motherboard manufacturers still include USB 2.0 ports on their motherboards.

 _____ (1)

3.2.2 Explain why most mice do not need to be USB 3.0 devices.

 _____ (1)

3.3 The server has been supplied with Linux[®] as its operating system.

3.3.1 Give ONE reason why this was a suitable choice of operating system for this machine in the given scenario.

(1)

3.3.2 A friend of Peter and Sam has suggested that they should rather use Microsoft[®] Windows[®] 10 as the operating system. Compare the two operating systems in terms of licencing and user support. Answer this question by completing the table below.

	Linux	Windows
Licencing	<hr/> <hr/> <hr/>	<hr/> <hr/> <hr/>
User support	<hr/> <hr/> <hr/>	<hr/> <hr/> <hr/>

(4)

3.4 The maximum amount of RAM that can be installed in this computer is specified as being 64 GB.

3.4.1 What factor is most likely to limit the amount of RAM to 64 GB on this server?

(1)

3.4.2 What is the theoretical maximum amount of RAM that a 64-bit system can address? Express your answer as a formula in **bytes**.

(2)

3.4.3 How would you convert your answer from Question 3.4.2 to **bits**?

(1)

3.5 The specification of the network card on this is listed as:

"Dual media 10/100/1000"

3.5.1 What is meant by "10/100/1000"?

(1)

3.5.2 "Dual media" means that the network card can have two types of cabled media connected to it. Name two types of media that could connect to this card.

(2)

3.6 The processor has an 8 MB cache.

3.6.1 What type of RAM is usually used in processor caches?

(1)

3.6.2 What is processor cache memory?

(2)

3.7 The computer has an onboard graphics card.

Give ONE advantage and ONE disadvantage of an onboard graphics card.

Do not merely write statements that are the opposite of each other.

(2)

3.8 Modern processors make use of a number of techniques to ensure that they operate as efficiently as possible.

3.8.1 Define multithreading and hyper-threading.

(2)

3.8.2 Provide an example of the performance enhancements that multithreading and hyper-threading could offer the server in this scenario.

(2)

3.9 **The B&B** needs a desktop computer for their guests to use. The guests want to use this computer to check their other reservations, confirm flights, surf the Internet and send emails. You are required to suggest a specification for such a computer.

3.9.1 The table shown below has four specification factors for a desktop computer. Each factor has been given three options. Bearing in mind the purpose for which this computer will be used, you are required to choose one of each to form the basis of the specification for the guest desktop computer.

CPU	Amount of RAM	HDD capacity and type	Operating System
(a) Intel i3	(a) 12 GB	(a) 256 GB SSD	(a) Windows [®] 10 home
(b) Intel i7	(b) 4 GB	(b) 1 TB HDD	(b) Linux [®]
(c) Intel i5	(c) 8 GB	(c) 128 GB SSD	(c) Mac [®] OS X

Write your answers in the grid below, writing down the letter a, b or c for each item.

CPU	Amount of RAM	HDD capacity and type	Operating System

(4)

3.9.2 Justify your answer for each of your choices by referring to the scenario.

CPU

Amount of RAM

HDD capacity and type

Operating System

(4)

3.10 In addition to the existing printer connected to the server, suggest a suitable type of printer to be attached to the desktop computer, which guests will occasionally use, for printing holiday photos, emails and boarding passes for their flights. You should support your choice with TWO reasons.

(3)

3.11 **The B&B** needs to ensure that the server's data is secure against loss. You need to detail a backup policy for the owners. You should include the following TWO factors as well as ONE other factor of your choice in your answer:

- Medium for backups
- Location of backups

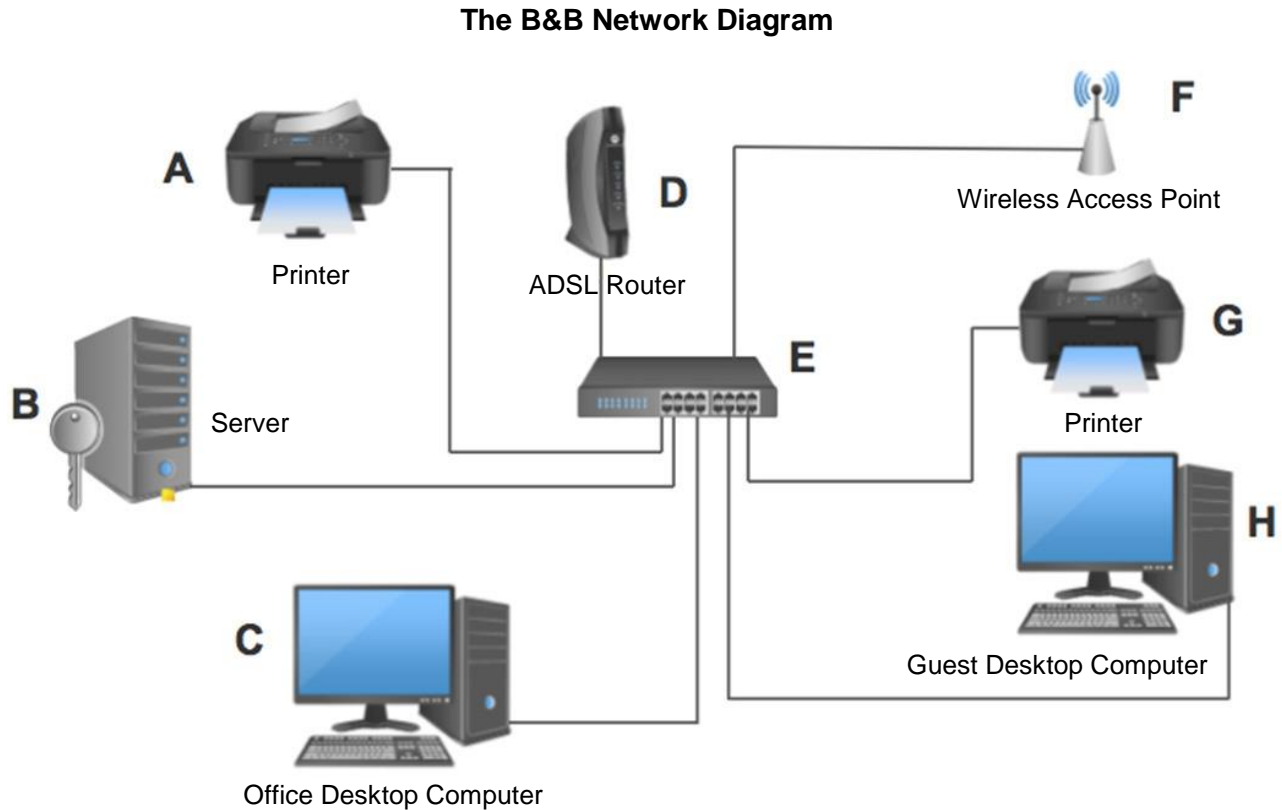
(3)

38 marks

SECTION C INTERNET AND COMMUNICATION TECHNOLOGIES

QUESTION 4

The **B&B** have installed a network in the building, connecting the original server, the guest desktop computer as well as a new office desktop computer which has been purchased to be used by the owners for the day-to-day running of the business. They have also networked the printers so they can be used from any of the computers connected to the network. A basic network diagram showing the layout of the network is shown below.



[Source: <<https://images.google.com>>]

Guests who stay at **The B&B** would like to be able to use their own devices by connecting to a Wi-Fi network provided by **The B&B**.

4.1 Define each of the following:

4.1.1 Wireless Access Point

(2)

4.1.2 Network Topology

(2)

4.2 There is a need to ensure that data transferred over the wireless network is secure. The owners are unsure whether they should use Wired Equivalent Privacy (WEP) or Wi-Fi Protected Access (WPA) encryption.

4.2.1 What is meant by the term "encryption"?

(2)

4.2.2 List TWO shortcomings of WEP as a wireless encryption protocol.

(2)

4.2.3 WPA has a number of improvements over WEP making it a preferred encryption protocol.

(a) How many bits does WPA use?

(1)

(b) Give TWO reasons why WPA2 is an improvement on WPA.

(2)

4.3 When a network card connects to a network there are two unique identifiers that aid in the routing of traffic to and from the network card.

4.3.1 What is a Media Access Control (MAC) address?

(1)

4.3.2 What is an Internet Protocol (IP) address?

(1)

4.3.3 IPv6 is a newer version of the original IP addressing system, IPv4.

(a) Why did IPv6 need to be introduced?

(1)

(b) How many bits are used for each of IPv4 and IPv6 addresses?

(2)

Peter and Sam have plans to build three new standalone buildings on the property to be able to increase the number of guests staying at any one time. These buildings will be spaced far apart from one another as well as from the main building. Each building will have a lounge, kitchen, two bedrooms and a bathroom.

4.4 Peter and Sam want some advice on how to connect the new buildings to the existing network.

4.4.1 Give TWO possible media to connect each of these new buildings to the main building.

(2)

4.4.2 Give ONE advantage and ONE disadvantage of each medium you chose in Question 4.4.1 above considering the scenario.

(4)

4.5 **The B&B** wish to make Video on Demand (VoD) facilities available to all guests. The equipment to run the system will be housed in the main building.

4.5.1 Define VoD.

(2)

4.5.2 Would you choose Transmission Control Protocol (TCP) or User Datagram Protocol (UDP) for video transmission?

(1)

4.5.3 What TWO characteristics of the protocol you chose in Question 4.5.2 above make it suitable for this task?

(2)

Peter and Sam would like to further expand their technology offering by allowing future guests to make online reservations to **The B&B** via a website. They are unsure whether they should host this website on their server or have it hosted remotely using a hosting service.

4.6 Answer the following questions regarding the hosting options.

4.6.1 List TWO advantages and TWO disadvantages of hosting the website themselves on their current server.

(4)

4.6.2 If they choose to host the website on their local server, it has been suggested that they install a firewall.

(a) What is a firewall?

(1)

(b) Do you believe it is necessary for a firewall to be installed just because they are going to host a website locally with reference to the scenario? Substantiate your answer with TWO facts.

(3)

4.7 When guests are submitting their data during the online booking process on the website, the owners need to ensure that the transmitted data is kept secure.

4.7.1 What web protocol will be used to ensure safety while users are using the website?

_____ (1)

4.7.2 Guests need to know that the website they are visiting to make the payments is an authentic website when submitting payment details. What needs to be added to authenticate a website to ensure security for the guests?

_____ (1)

4.7.3 Websites often use scripting to add features to the site.

(a) Distinguish between server-side and client-side scripting.

_____ (2)

(b) If a calculator was added to the website to assist guests making bookings to work out what their total bill for their stay would be, would this be an example of client-side or server-side scripting?

_____ (1)

4.8 As a result of the increased use of the server, there is now considerably more data being stored on the server. Despite the backup procedure that they have put in place, the owners are still concerned about preventing data loss. They now wish to enable the Redundant Array of Independent Disks (RAID) controller on the server and make use of its functionality.

For reference, here are the specifications of the server you were shown at the start of Question 3:

- Intel® Xeon® Quad-core processor – 8 MB cache, 3.60 GHz
- 16 GB DDR4 RAM installed (Maximum RAM 64 GB)
- Onboard Intel® HD Graphics
- Linux® (64 bit)
- Storage: 2 × 4 TB SATA 7 200 rpm HDD
- Onboard network card – Dual media 10/100/1000
- Onboard RAID controller
- USB: Rear 2 × USB 3.0 and 4 × USB 2.0; Front 1 × USB 2.0 and 1 × USB 3.0
- Single 290 W power supply.

4.8.1 What is RAID? (Do not merely expand the acronym.)

(2)

4.8.2 The owners are unsure whether they should use RAID 1 or RAID 5.

(a) Which of RAID 1 or RAID 5 would require the least amount of hardware upgrades? Provide TWO reasons for your answer.

(3)

(b) Given the scenario details, which RAID level would you recommend and why?

(2)

4.9 After running their website and booking service for a number of months, the owners have decided to migrate their data and email services to the cloud.

Recommend to the owners a single cloud-based service that will satisfy their needs. Include in your answer THREE factors that will justify your recommendation.

(4)

51 marks

SECTION D SOCIAL IMPLICATIONS

QUESTION 5

5.1 The owners wish to advertise **The B&B** online in order to attract more guests. Suggest THREE different online services or technologies in addition to their website that **The B&B** could make use of to reach a greater client base.

(3)

5.2 Despite having installed a firewall on the network, the owners are still concerned about the need to safeguard their network given the large number of guest devices that are constantly connecting to the network. They are looking at installing an anti-virus solution.

5.2.1 Why is it insufficient to install an anti-virus solution only on the firewall?

(2)

5.2.2 Would an anti-virus program prevent a phishing attack? Justify your answer.

(3)

5.2.3 How frequently would you suggest that the anti-virus solution is updated? Justify your answer.

(2)

5.2.4 Explain to the owners why they need to regularly update the operating systems on the server and desktop machines on the network. Provide TWO different reasons.

(2)

5.3 A regular guest has complained about receiving a large amount of email supposedly from **The B&B**.

5.3.1 What do we call this type of mail?

_____ (1)

5.3.2 Suggest ONE technique which the email recipients can use to check to see if these emails are legitimately from **The B&B**.

_____ (1)

5.4 A promotions company has contacted the owners asking them to supply the company with the names and contact details of their regular guests so that they can enter the guests into a competition.

5.4.1 Explain why the owners are not permitted to hand over such information without the permission of the guests.

_____ (2)

5.4.2 State one set of circumstances when the owners can give out such information without the permission of the guests.

_____ (1)

17 marks

SECTION E DATA AND INFORMATION MANAGEMENT AND SOLUTION DEVELOPMENT

QUESTION 6

6.1 List and explain any TWO characteristics of quality data.

(2)

6.2 A certain bank's database has an input field on a web page that asks for the user to enter a userID. Each userID is used to link to the account data, including each account number and the account balance. Assume that the data is stored in a table called "**accounts**".

A user enters the following when prompted to enter a userID:

0 or 1=1

The resulting SQL query looks like this:

```
SELECT accountNumber, balance FROM accounts WHERE user_ID = 0 OR 1=1
```

6.2.1 This is a common example of a particular malicious SQL technique. What do we call this technique?

(1)

6.2.2 What will this piece of SQL code achieve?

(2)

6.3 "Big data" refers to the large-scale collection of data, typically via the Internet, which can be analysed in order to reveal patterns or trends.

6.3.1 List THREE sources of big data common to everyday life.

(3)

6.3.2 Name and explain TWO different ways in which an e-commerce site such as takealot.com might use big data for future planning.

(4)

The B&B needs a database to store details of their bookings, rooms and guests. It has been decided that the database should contain the following fields:

- Guest name
- GuestID (*A unique identifier for each guest*)
- Reservation start date
- Reservation end date
- Room number (*Room numbers are all unique*)
- Room capacity (*The number of people who can sleep in each room*)
- Room rate
- Booking reference (*A unique reference number for each booking for each guest*)

6.4 Study the table below. Some of the fields have been given a data type for you, as examples. You need to complete the table for the remaining fields.

Field Name	Data Type
Guest Name	
GuestID	
Reservation Start date	
Reservation End date	
Room Number	Number (Integer)
Room Capacity	
Room Rate	Currency
Booking Reference	String

(4)

QUESTION 7

7.1 Study the following two algorithms carefully:

Bubble sort algorithm

```

for i ← size –1 downto 0
begin
  for j ← 0 to i
  begin
    if (arr[j] < arr[j+1])
    begin
      temp ← arr[j]
      arr[j] ← arr[j+1]
      arr[j+1] ← temp
    end if
  end loop
end loop

```

Bubble sort with flag algorithm

```

i ← size –1
do
  sorted ← true
  for j ← 0 to i
  begin
    if (arr[j] < arr[j+1])
    begin
      temp ← arr[j]
      arr[j] ← arr[j+1]
      arr[j+1] ← temp
    end if
  end loop
  sorted ← false
end loop
i ← i –1
while sorted = false

```

7.1.1 The second algorithm offers some improvement over the simple bubble sort algorithm. How does making the outer loop a while loop improve the sort?

(2)

7.1.2 TRUE or FALSE: The outer loop will be executed at least once to check if the array is sorted.

(1)

