OCR
Oxford Cambridge and RSA

Wednesday 15 May 2024 – Afternoon

GCSE (9–1) Computer Science

J277/01 Computer Systems

Time allowed: 1 hour 30 minutes

Do not use:
- a calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) MyCSTutor.co.uk

Last name Computer Science Worked Solutions

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.

INFORMATION
- The total mark for this paper is **80**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended response will be assessed in questions marked with an asterisk (*).
- This document has **16** pages.

ADVICE
- Read each question carefully before you start your answer.

1

(a) The following table has either the binary or denary value of 3 numbers.

Complete the table by converting the 8-bit binary number into denary and the denary number into 8-bit binary.

8-bit Binary	Denary
128 64 32 16 8 4 2 1 11110000	128 + 64 + 32 + 16 = 240
128 64 32 16 8 4 2 1 0 1 1 0 1 0 0 1	105
00011110	16 + 8 + 4 + 2= 30

[3]

(b) Complete the table by writing the answer to each statement.

Statement	Answer
The smallest denary number that can be represented by a 4-bit binary number	0
The largest denary number that can be represented by a 6-bit binary number	$2^6 - 1 = 63$
The maximum number of different colours that can be represented with a colour depth of 7-bits	$2^7 = 128$
The minimum number of bits needed to represent 150 different characters in a character set	8

[4]

(c) Show the result of a left binary shift of 4 places on the binary number 00001111.

11110000 ..... **[1]**

shift left = add 0's to right

(d) Describe how to convert a 2-digit hexadecimal number into denary.

Use an example in your answer.

First digit's value is multiplied by 16

Second digit's value is added

[3]

(e) Add these two 8-bit binary numbers using binary addition.

Show your working out.

```
  0 1 1 0 1 0 1 1
+ 0 0 0 0 1 1 1 1
-----------------
```

[2]

2 An airport has computers that are connected together on a Local Area Network (LAN).

(a) Each computer has an IP address and a MAC address.

(i) Give **one valid** example of an IPv4 address and **one valid** example of an IPv6 address.

IPv4 123.45.67.89

IPv6 2001:0db8:85a3:0000:0000:8a2e:0370:7334

[2]

(ii) Describe the format of a MAC address.

6 groups of hexadecimal numbers, separated by colons

first part contains manufactuer ID, second part contains serial number

[2]

(b) The airport currently has wired connections in their Local Area Network.

(i) Describe **two** benefits to the airport of using wired connections in their network.

1 Very fast speed - reduces delays at airport

Low interference - reliable connection

2

[4]

(ii) Explain the reasons why the airport should also allow the network to be accessed using a wireless connection.

So that to use the network , we don't have to be in fixed positions with a wire, can be accessed in ar

Easier to add more devices

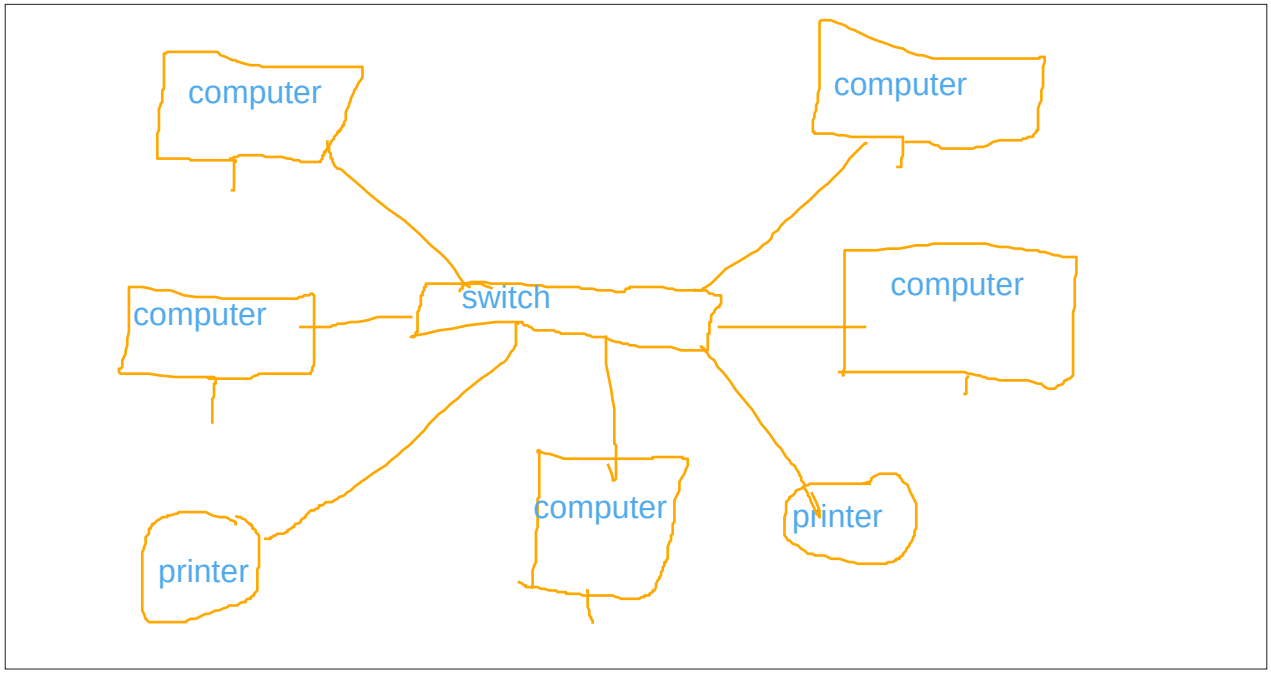
Backup, if wired connection fails

[3]

(c) One office in the airport has five computers connected to one switch. There are two printers in the office that can be accessed by all computers.

The computers are connected using a star topology.

(i) Draw a diagram to show how the five computers, switch and two printers are connected in a star topology.



[3]

(ii) Give **one** benefit and **one** drawback of the office using a star topology instead of a mesh topology.

Benefit .....
Fewer node collisions
.....

Drawback ..... If switch fails, the whole network fails
.....

[2]

(iii) Describe the role of the switch in the star topology.

.....
Connects all devices in the network together
.....
Directs data to destination
.....
Recieves data from all devices
.....
.....
..... **[3]**

3 A computer has an operating system and utility software.

(a) The table contains operating system functions and a task that each function performs.

Complete the table by writing the two missing function names and a task performed by the two given functions.

Function	Task
Memory Management	Moves data from secondary storage to RAM
Peripheral management	Transmits data to peripheral devices
File Management	Allows the user to create, name and delete folders
User interface	Allows the user to interact with the computer+ GUI

[4]

(b) Complete the description of utility system software using the words provided in the box. Not all words are used.

access	amount	apart	compression	consecutive
defragmentation	deleted	encryption	key	lock
quantity	separate	speed	understood	

Encryption ..... software changes data using a ..... key ..... . If the changed data is intercepted, it cannot be ..... understood ..... . This software does not stop the data from being intercepted.

Defragmentation ..... software analyses the data on a disk to find files that have been split and stored in separate locations. The split files are moved to be ..... consecutive ..... in storage and the free space is moved together. This does not provide more storage space on the disk, instead it makes the ..... access ..... of the data faster because the read head does not have to move as far to access the next part of the file.

[6]

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4* A computer programmer has developed a computer game that they want to release for users to download over the internet. The programmer needs to decide whether to release the game as open source or proprietary software.

Discuss the features, benefits and drawbacks of each type of licence for this program and make a recommendation to the programmer.

You should include the following in your answer:
- features of each licence
- legal and ethical issues of each licence
- benefits and drawbacks of each licence. **[8]**

KEY POINTS:

Open source is usually free, and the user can view and change the source code

Proprietary -> costs money and we can't view the source code.

LEGAL+ETHICAL:

Both provide copyright

Open source allows for code to be changed and resold by others, or to claim it as their own,whe proprietary forbids this

Proprietary allows less people to access the game, as there is a cost, whereas more people can access an open-source game as it is free

Open Source is open source - wider userbase which means more people are exposed -> usually will be easier to improve; change; fix bugs ETC

Propreitary allows creater / programmer to make money -> software is usually tested better with higher quality.There are usually more strict copyright rules

(You can argue for either licence, but as long as you argue for it with the key points)

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5 A musician uses a computer to make and record music.

(a)

(i) Tick (✓) **one** box to identify the correct description of sound sampling.

- ☐ The frequency of the wave is measured a set number of times each second.
- ☑ The amplitude of the wave is measured at set intervals.
- ☐ The digital sound wave is measured a set number of times each second.
- ☐ The analogue sound wave's resolution is measured at set intervals.

[1]

(ii) Explain how changing the bit depth will affect the sound file.

If increased, file size will change as there will be more bits per sample, and sound quality would also increase

[2]

(b) The musician has run out of storage space on their secondary storage device and needs to buy a replacement.

(i) Identify whether the musician should buy a magnetic secondary storage device or a solid state secondary storage device for their computer.

Justify your choice.

Type Solid State Drive

Justification

Durable as there are no moving parts, so lower risk of losing data

Fast data access speeds

Small size, so portable

Quieter as less moving parts

[4]

(ii) Identify **one other** type of secondary storage.

Optical

[1]

(iii) Tick (✓) **one** box to identify the smallest secondary storage capacity.

- ☐ 2.1 GB = 2100 MB
- ☐ 300 MB = 300 MB
- ☑ 200 000 KB = 200 MB
- ☐ 0.0021 TB = 2100 MB

[1]

(iv) The musician's recordings have an average (mean) file size of 3 MB. The musician has 1000 recordings.

Calculate an estimate of the storage space in GB that the 1000 files will require, assuming they are each 3 MB in size. Show your working out.

Working space:

3x 1000 = 3000MB 3000 / 3 = 3GB

Answer: 3 GB **[2]**

6 A computer has a Central Processing Unit (CPU).

(a) Describe what happens during the fetch-execute cycle.

.....

Instructions are fetched from memory

.....

Instructions are stored by registers

.....

Data/instructions are decoded, split into opcode and operand

..... **[2]**

(b) Complete the table by writing the name of **two** registers used in the fetch-execute cycle **and** the purpose of each register.

Register	Purpose
Accumulator (ACC)	Stores result of ALU
Program Counter (PC)	Stored address of next instruction to be fetched

[4]

(c) Give **three** characteristics of a CPU that can affect its performance.

1 Number of cores .....

2 Clock speed .....

3 Cache memory size .....

[3]

7 A car has a 'Follow Me' system that uses a cruise control feature to allow the car to follow the car in front of it. It will keep the same speed and distance without the driver's intervention. The cruise control system is an example of an embedded system.

(a) Explain the reasons why the 'Follow Me' system is an example of an embedded system.

Built within the car, for a specific urpose - only performs one task

Has dedicated hardware (sensors) + microprocessor

it is a CONTROL SYSTEM

[3]

(b) The car's system has Read Only Memory (ROM) and Random Access Memory (RAM).

(i) State **two** items that will be stored in the ROM for the 'Follow Me' system.

1 BIOS / bootstrap

2 Operating System

[2]

(ii) The RAM will store currently running data and instructions.

State **three** items of data that will be stored in the RAM for the 'Follow Me' system.

1 Distance to car in front

2 Current speed of vehicle in front

3 Current speed of our vehicle

[3]

(iii) Explain why the 'Follow Me' system does not need virtual memory.

No secondary storage to use virtual memoru

Only stores a small amount of data in RAM

[2]

END OF QUESTION PAPER

EXTRA ANSWER SPACE

If you need extra space use these lined pages. You must write the question numbers clearly in the margin.