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Complete, fold and seal
(see note 2 below)

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Examination Answer Books

12 Pages

Instructions to Candidates

1. Please give the information requested in the boxes below.
2. Enter your name in the space provided to the right, fold over and seal down (using the label provided) to hide your name.
3. The answers must be legibly written. The Examiners can either read your legible script or have it typed and the expense of typing charged to the candidate.
4. Write your answers in ink.
5. Begin each answer on a fresh page. Do all rough work in the answer book and cross it through.
6. No part of this book is to be torn out; it must be handed in complete.
7. If more books than one are used, fasten them together using the tags available from the invigilator(s).
8. Every book must be handed in. In no circumstances may answer books, used or unused, be taken out of the examination venue.

1	Student Number	2404449
2	Title of Examination Paper	Computer Architecture and Operating Systems
3	Module Code	ACCA4022
4	Date and Time of Examination	12/5/25 9:00 AM
5	Examination Venue	
6	Seat Number	50
7	Number of Answer Books handed in	1

List the numbers of the questions you have attempted	Office Use
1	34
2	19
3	12
4	22
Total	87

87

D	H	B	
0	0	0000	$2^0 = 1$
1	1	0001	$2^1 = 2$
2	2	0010	$2^2 = 4$
3	3	0011	$2^3 = 8$
4	4	0100	$2^4 = 16$
5	5	0101	$2^5 = 32$
6	6	0110	$2^6 = 64$
7	7	0111	$2^7 = 128$
8	8	1000	$2^8 = 256$
9	9	1001	$2^9 = 512$
10	A	1010	$2^{10} = 1024$
11	B	1011	
12	C	1100	
13	D	1101	
14	E	1110	
15	F	1111	

1) a)
i)

$$\begin{array}{l}
 62/2 = 31 \text{ r } 0 \\
 31/2 = 15 \text{ r } 1 \\
 15/2 = 7 \text{ r } 1 \\
 7/2 = 3 \text{ r } 1 \\
 3/2 = 1 \text{ r } 1 \\
 1/2 = 0 \text{ r } 1
 \end{array}
 \begin{array}{c}
 \uparrow \\
 | \\
 | \\
 | \\
 | \\
 |
 \end{array}$$

111110

3 3

ii) B2

$$\begin{array}{l}
 125/2 = 62 \text{ r } 1 \\
 62/2 = 31 \text{ r } 0 \\
 31/2 = 15 \text{ r } 1 \\
 15/2 = 7 \text{ r } 1 \\
 7/2 = 3 \text{ r } 1 \\
 3/2 = 1 \text{ r } 1 \\
 1/2 = 0 \text{ r } 1
 \end{array}
 \begin{array}{c}
 \uparrow \\
 | \\
 | \\
 | \\
 | \\
 | \\
 |
 \end{array}$$

1111101

3 3

b) ~~31~~ ~~16~~ ~~8~~ ~~4~~ ~~2~~ ~~1~~
 10011001
 $128+16+8+1=153$ ✓

256	128	64	32	16	8	4	2	1
	1	0	0	1	1	0	0	1

3 3

ii) $11110 = 30$ ✓

16	8	4	2	1
1	1	1	1	0

 $16+8+4+2=30$

3 3

c) i) 2 & F use table from start

$2 = 0010 \quad F = 1111$

$2F = 00101111$ ✓

2 2

ii) 36 use table

$3 = 0011 \quad 6 = 0110$

$36 = 00110110$ ✓

2 2

d) C3 Hex → Binary → Decimal
use table

$C = 1100 \quad 3 = 0011$

$C3 = 11000011$

128	64	32	16	8	4	2	1
1	1	0	0	0	0	1	1

$128+64+2+1 = 197$ ✓

2 2

ii) 66

128	64	32	16	8	4	2	1
0	1	1	0	0	1	1	0

$6 = 0110 \quad 6 = 0110$

$66 = 01100110 \quad 64+32+4+2=102$ ✓

3 3

e) Use from start

$$2^5 = 32$$

f)

i) $4000 \times 3000 = 12\,000\,000$ total pixels
 $12\,000\,000 / 1\,000\,000 = 12$ mega pixels

ii) ~~16 million colours = 24 bit depth~~
~~= 8 bit per channel~~
~~= 1 byte per channel~~
~~= 3 bytes per pixel~~

$$\frac{\text{pixels}}{\text{bytes/pixel}} \quad 12\,000\,000 \times 3 = 36\,000\,000 \text{ bytes}$$

ii) 36 MB BMP

$$36 \rightarrow 3.6$$

10:1

3.6 MB .JPG

g) 36 MB 80 Mb/s
 $80 \div 8 = 10 \text{ MB/s}$
 bit to byte

file size

$$36 \div 10 = 3.6 \text{ seconds}$$

transfer speed

3)

a)

i) ~~8.7 GB~~ 8.5 GB

ii) 4 TB

iii) 2 TB

b) 2000 - 7000 MB/s

ii) ~~150 MB/s~~ 100 - 200 MB/s

iii) 1 Gb/s - 2.5 Gb/s

- c) Raid 0, or Striping, allows 2+ drives to act as one single drive. The benefit is that they are used in parallel, increasing the speed. The downside is that if a single drive fails, all data is lost. The total storage would be 6TB as both are used.

Raid 1 is ~~cloning~~ mirroring, where the data is copied to the other drive. The ~~downside~~ ^{upside} of this is that if one drive fails, the data is ~~safe~~ secure. The downsides though are that write speed is typically slower as a result, and that there would only be 3TB total space, as the data is duplicated.

- 4)
a) ~~A~~ For this workstation, a mid-high end CPU would be optimal, as ~~as~~ the software would usually be somewhat CPU intensive, particularly due to the high resolution of the footage. A good option would include 12th/13th generation ~~i7/i9~~ CPUs from Intel, or a 7000 series Ryzen 7/9 from AMD. These CPUs average around £200-300 and can provide enough performance and more. These would be better than the i3/i5 or Ryzen 3/5 CPUs which are targetted more for lower end systems.

- b) A sensible amount of RAM would range from 48-64GB of ~~SR~~ RAM, as 4K editing has high RAM consumption. ~~is using DDR5~~ DDR5 6000MHz RAM is considered the most common, and would cost approximately £250-300 for 64GB.

- c) 4K video footage has large file sizes, and as such large storage should be utilised. However, when ~~editing~~ editing, the files need quick access. For this reason, M.2 storage should be utilised.

The average M.2 SSD costs approximately £100, and should be used for software and other things requiring fast speeds. For bulk but slower storage HDDs can be utilised so that more files can be stored. The average 4TB HDD cost approximately £80. This would total 6TB Storage for £180, which can always be expanded.

d) The I/O necessary would likely consist of a USB-C port along with USB 3 ports, as these are used to ensure fast communication/transfer with connected devices. A gigabit/2.5 gigabit ethernet port may also be optimal for any cloud storage /NAS access if required. Typical HDMI / DisplayPort ports would be used for high resolution displays. These are all common features on modern motherboards with prices ranging approximately £200-300.

e) A graphics card would not be in much if any need of specialised features (e.g. ~~Invalid~~ RTX Cards / DLSS) ~~and was~~ as no editing workflows make use of these technologies. However, the GPU could use approximately 8GB of VRAM to ensure that if the software uses the GPU that there is enough VRAM for ~~sim~~ the software. Most modern cards have 8-16 GB ~~so this~~ ranging from £300 - 1000. A ~~use~~ A GPU such as a RTX 40/50 60 should handle most needs without issue at around £400, or ~~also 70~~ a card 40/50 70 card could be used which would handle 4K ~~with~~ even better, at around £700.

f) Typical video editing software would include the premium softwares, such as Adobe Premiere Pro and After Effects, both use ~~seoul~~ on their own for editing but stronger combined

Both share features, but Premiere Pro is most aimed at editing footage, with ~~After Effects~~ ^{After} being used for VFX and more. There are free alternatives such as VSDC video editor, which is similar to Premiere Pro providing similar features. ~~Alt~~ Premiere Pro is the go-to choice, having a lot of support and being an industry standard, as opposed to free alternatives.

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2)

a)

1) The CPU is the Central Processing Unit, and it is used for the interpretation of instructions to perform actions in a system and run processes. ✓

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The memory is used to store and access both data and the instructions for the system. ✓

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The input and output refers to any peripherals/devices that send or receive data/instructions within the system, including a keyboard or a display. ✓

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The control bus is used for the control of instructions for the system. It is bidirectional with all three components. # ?

The address bus is used for memory, with the CPU writing to it, and it writing to the memory. ?

The data bus is used for the traversal of data through the system, and is bidirectional with all components. ✓

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- ii) This architecture as a principle, allows for data and instructions to be sent between the memory, CPU and I/O, along with memory addressing and the control bus for the CPU.

If a program were to read text from a keyboard, the ~~data CPU would read the data from~~ I/O would send the data through the data bus to the CPU, where the program of the CPU would then send the data to the volatile memory (RAM/cache). Using the ~~data~~ address bus ~~it would~~ then use the data ~~bus~~ / address buses, it would send the data to non-volatile storage, where it is saved.

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