



PRIFYSGOL CYMRU  
**Y Drindod Dewi Sant**  
UNIVERSITY OF WALES  
**Trinity Saint David**

**LOCATION BIRMINGHAM**

**LLEOLIAD BIRMINGHAM**

**LEVEL 4**

**LEFEL 4**

**EXAMINATION PERIOD  
MAY 2023**

**CYFNOD ARHOLIADAU  
MAI 2023**

**MODULE CODE: ACCA4022  
COMPUTER ARCHITECTURE**

**TIME: 2 HOURS**

**TOTAL: 100 MARKS**

**ANSWER ALL QUESTIONS**

*Equipment or materials required – None*

*The Candidates are not permitted to bring dictionaries; text books/case studies or any other reference materials into the exam room.*

*The Candidates are only permitted to use calculators.*

*Show all your calculations in your exam book*

## ANSWER ALL FOUR QUESTIONS

### QUESTION ONE

(Total: 25 marks)

Attempt all of the following. Electronic Calculators are not permitted. *Write down and show all your manual calculations in your exam book.*

- i. Convert the following base 10 numbers to binary  
a.  $(263)_{10}$  (4 marks)
- ii. Convert the following  
a.  $(011101001011110)_2$  into Octal number (3 marks)  
b.  $(290)_{10}$  into Octal (3 marks)  
c.  $(A5E)_{16}$  into Octal (3 marks)
- iii. Convert the following binary numbers to hexadecimal  
a.  $(1110101000100101)_2$  (3 marks)
- iv. Convert the following hexadecimal numbers into base 10 numbers.  
a.  $(A6D9)_{16}$  (4 marks)
- v. If you have 4 bits to store numbers, how many different/ unique values can be represented? Please explain with at least one example. (5 marks, at least 50 words)

### QUESTION TWO

(Total: 8 marks)

Categorise the following hardware based on its usages into the following categories:

- (a) CPU (b) Memory & Integrated device (c) Input device (d) Output device (e) Storage Device (f) Communication device

1. Mouse
2. Monitor
3. RAM
4. Ethernet Port
5. Microphone
6. Flash Drive
7. MODEM
8. Gamepad

### QUESTION THREE

(Total: 7 marks)

Determine the time required to complete 10000 instructions by a single core CPU (Perform one instruction per clock cycle) with a clock frequency of 3.8 GHz. ( $1\text{GHz} = 1 \times 10^9 \text{ Hz}$ )

### QUESTION FOUR

(Total: 10 marks)

Construct a logical circuit from the given logical expression and construct a truth table.

$$Q = \overline{(A + B)}C\overline{D}$$

**QUESTION FIVE****(Total: 25 marks)**

- a. Define RAID and its levels in detail with a suitable diagram (max. 150 words required).  
(15 marks)
- b. State at least five characteristics and five benefits of RAID.  
(10 marks)

**QUESTION SIX****(Total: 15 marks)**

Define Bus and its types in detail with a suitable diagram (max. 150 words required).

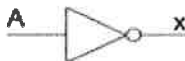
**QUESTION SEVEN****(Total: 10 marks)**

State at least five differences between Harvard and von Neumann architecture.



## Support Sheet

### Logic Gates

| NOT                                                                                                    | AND                                                                               | NAND                                                                              | OR                                                                                 | NOR                                                                                 |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|--------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| $\overline{A}$                                                                                         | $AB$                                                                              | $\overline{AB}$                                                                   | $A + B$                                                                            | $\overline{A + B}$                                                                  |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
|                       |  |  |  |  |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| <table><tr><th>A</th><th>X</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table> | A                                                                                 | X                                                                                 | 0                                                                                  | 1                                                                                   | 1 | 0 | <table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | B | A | X | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | <table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | B | A | X | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 0 | <table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table> | B | A | X | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 1 | <table><tr><th>B</th><th>A</th><th>X</th></tr><tr><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td></tr></table> | B | A | X | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 0 |
| A                                                                                                      | X                                                                                 |                                                                                   |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 1                                                                                 |                                                                                   |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 0                                                                                 |                                                                                   |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B                                                                                                      | A                                                                                 | X                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 1                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 1                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B                                                                                                      | A                                                                                 | X                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 0                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 1                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 0                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 1                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B                                                                                                      | A                                                                                 | X                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 1                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 0                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 1                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| B                                                                                                      | A                                                                                 | X                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 0                                                                                 | 1                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 0                                                                                                      | 1                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |
| 1                                                                                                      | 1                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |                                                                                                                                                                                                                    |   |   |   |   |   |   |   |   |   |   |   |   |   |   |   |

### Tables

| Binary | Octal |
|--------|-------|
| 000    | 0     |
| 001    | 1     |
| 010    | 2     |
| 011    | 3     |
| 100    | 4     |
| 101    | 5     |
| 110    | 6     |
| 111    | 7     |

| Binary | Hex | Binary | Hex |
|--------|-----|--------|-----|
| 0000   | 0   | 1000   | 8   |
| 0001   | 1   | 1001   | 9   |
| 0010   | 2   | 1010   | A   |
| 0011   | 3   | 1011   | B   |
| 0100   | 4   | 1100   | C   |
| 0101   | 5   | 1101   | D   |
| 0110   | 6   | 1110   | E   |
| 0111   | 7   | 1111   | F   |

**Truth table**

| Inputs |   |   |   | Outputs |  |  |  |
|--------|---|---|---|---------|--|--|--|
| A      | B | C | D |         |  |  |  |
| 0      | 0 | 0 | 0 |         |  |  |  |
| 0      | 0 | 0 | 1 |         |  |  |  |
| 0      | 0 | 1 | 0 |         |  |  |  |
| 0      | 0 | 1 | 1 |         |  |  |  |
| 0      | 1 | 0 | 0 |         |  |  |  |
| 0      | 1 | 0 | 1 |         |  |  |  |
| 0      | 1 | 1 | 0 |         |  |  |  |
| 0      | 1 | 1 | 1 |         |  |  |  |
| 1      | 0 | 0 | 0 |         |  |  |  |
| 1      | 0 | 0 | 1 |         |  |  |  |
| 1      | 0 | 1 | 0 |         |  |  |  |
| 1      | 0 | 1 | 1 |         |  |  |  |
| 1      | 1 | 0 | 0 |         |  |  |  |
| 1      | 1 | 0 | 1 |         |  |  |  |
| 1      | 1 | 1 | 0 |         |  |  |  |
| 1      | 1 | 1 | 1 |         |  |  |  |

**The End**