



UNIVERSITI  
TEKNOLOGI  
PETRONAS

## FINAL EXAMINATION MAY 2024 SEMESTER

**COURSE : TEB1024 - COMPUTER SYSTEMS**  
**DATE : 1 AUGUST 2024 (THURSDAY)**  
**TIME : 9:00 AM - 12:00 NOON (3 HOURS)**

### INSTRUCTIONS TO CANDIDATES

1. Answer **ALL** questions in the Answer Booklet.
2. Begin **EACH** answer on a new page in the Answer Booklet.
3. Indicate clearly answers that are cancelled, if any.
4. Where applicable, show clearly steps taken in arriving at the solutions and indicate **ALL** assumptions, if any.
5. **DO NOT** open this Question Booklet until instructed.

**Note :**

- i. There are **SIX (6)** pages in this Question Booklet including the cover page
- ii. **DOUBLE-SIDED** Question Booklet.

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1. a. Illustrate the elements involved in an Input-Process-Output (IPO) model. [2 marks]
- b. Describe the role of Storage component in an IPO model of a computer system. [4 marks]
- c. Consider the digital circuit diagram shown in **FIGURE Q1** where A, B, C are the inputs and Q is the output.

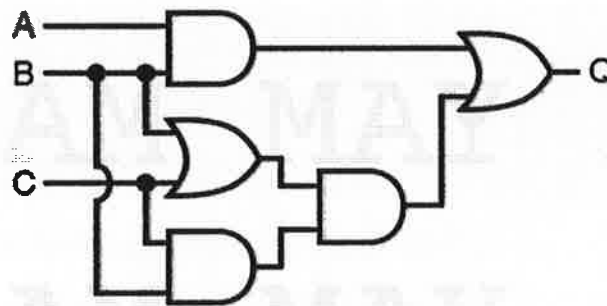


FIGURE Q1

- i. Write the Boolean expression of Q. [3 marks]
  - ii. Construct a complete Truth Table for the output, Q. [7 marks]
- d. State and verify the **TWO (2)** DeMorgan's theorems by means of Truth Tables. [4 marks]

2. a. i. Explain **ONE (1)** benefit of 1's complement number compared with sign-and-magnitude representation. [2 marks]
- ii. Explain **ONE (1)** benefit of 2's complement number compared with 1's complement number representation. [2 marks]
- b. Complete the addition of the two-signed decimal numbers,  $-23$  and  $-104$  by using a 10-bit 1's complement representation. [8 marks]
- c. A computer system operated using decimal digits. The system stored a floating-point number in a format of SEEMMMMM in excess-60. The sign is 1 for a positive number and 2 for a negative number. Based on the system specifications:
- i. Compute the floating-point representation for the decimal number,  $-0.00002234657$ . [2 marks]
- ii. Complete the addition of the two floating-point numbers 26054321 and 25811223. Check your answer using the decimal number representation. [6 marks]

3. a. Discuss the concept of CPU registers in a modern computer with regards to the relevant components of Little Man Computer (LMC) model. [6 marks]
- b. Draw a flowchart that describes the steps in which LMC follows to fetch and execute a branch instruction. [4 marks]
- c. i. Describe the memory characteristics of the Von Neumann architecture. [4 marks]
- ii. Write an LMC program that finds a positive difference of two numbers. [6 marks]

4. a. Differentiate between batch and interactive systems in terms of response time and how data enters the system. [4 marks]
- b. Explain **TWO (2)** issues in a relocatable dynamic partition system. [4 marks]
- c. Discuss **ONE (1)** issue in memory sharing within a computer system. [4 marks]
- d. A job with four pages, namely *A*, *B*, *C*, and *D* is to be processed by a system that has only three available page frames. The job pages would be swapped into the page frames in the order: *A*, *B*, *A*, *C*, *D*, *A*, *B*, *A*, *C*, *D*, *C*. Using appropriate diagrams, determine how many page faults will occur if the following policies are used:

i. First In First Out (FIFO).

[4 marks]

ii. Least Recently Used (LRU).

[4 marks]

5. a. Explain the key responsibilities of Job and Process Schedulers by using a sketch of a state transition diagram. [4 marks]
- b. Differentiate between preemptive and non-preemptive scheduling policies. [4 marks]
- c. **TABLE Q5** presents a list of jobs in a queue.

TABLE Q5

Arrival Time	0	1	2	3
Job	A	B	C	D
CPU Cycle (ms)	7	4	2	5

Compute the average turnaround time of the jobs in **TABLE Q5** using the following algorithms.

- i. Shortest Remaining Time (SRT). [4 marks]
- ii. Shortest Job Next (SJN). [4 marks]
- d. Conclude your answers from **part (c)(i)** and **part (c)(ii)** in terms of the average turnaround time. [4 marks]

- END OF PAPER -