



UNIVERSITI
TEKNOLOGI
PETRONAS

FINAL EXAMINATION MAY 2024 SEMESTER

COURSE : TEB2103 - MODELLING AND SIMULATION
DATE : 2 AUGUST 2024 (FRIDAY)
TIME : 3:00 PM - 6:00 PM (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 **SEVEN (7)** pages in this Question Booklet including the cover page
- ii. **DOUBLE-SIDED** Question Booklet.

1. a. Define a Model mentioning any **TWO (2)** suitable examples.

[4 marks]

- b. Define Simulation giving any **THREE (3)** objectives of it.

[8 marks]

- c. List any **EIGHT (8)** steps of Simulation and Model Building.

[8 marks]

2. a. Discuss when to use Simulation using any scenario.

[8 marks]

- b. Explain the purpose of Mathematical models in representing real-world objects or systems.

[8 marks]

- c. Discuss any **FOUR (4)** types of Simulation Models.

[4 marks]

3. A large airport is facing issues with long security check lines and extended passenger waiting times. The airport management has requested a simulation study to address these issues. The initial description provided by the management on its security check process is as follows:

Each passenger, upon arrival at the security check area, is first screened by a security officer. The security officer assigns a risk level to the passenger, which ranges from one (low risk) to three (high risk). Some passengers, such as those with VIP status, are directed to a fast-track lane without the initial screening. Passengers are then prioritized based on their risk level and are assigned to an available security lane for further screening. If no security lanes are available, the passenger waits in a general waiting area, where they are prioritized based on their risk level. A limited number of security officers and security lanes are always available to screen the passengers.

- a. Write the required steps to implement the study.

[6 marks]

- b. Draw a UML class diagram that demonstrates the simulation model.
[**NOTE:** Indicate in the diagram the queues and servers identified]

[8 marks]

- c. Develop the simulation pseudocode for the given scenario.

[6 marks]

4. Consider designing a hospital-based appointment scheduling system. The system should efficiently handle incoming appointment requests, prioritize them based on urgency, and ensure a fair distribution of appointments among available doctors. Patients should be able to wait in a queue until an appointment slot is available.

a. Draw a UML class diagram for this queuing system, considering the various components, interactions, and functionalities involved in the process.

[8 marks]

b. Develop the simulation pseudocode for **part(a)**.

[8 marks]

c. Explain the verification and validation process for this scenario.

[4 marks]

5. Consider a Scenario of Inventory Management System: An organization that specializes in selling electronic gadgets. The organization has a central warehouse where all the inventory is stored. The inventory includes various electronic devices such as smartphones, laptops, tablets, and accessories. The organization wants to develop an efficient inventory management system to keep track of stock levels, manage restocking, and optimize the overall inventory control process.
- The inventory management system will consist of three main agents: Warehouse Agent, Supplier Agent, and Customer Agent as mentioned below in **TABLE Q5**.

<p>Warehouse Agent Responsibilities:</p> <p>Track current stock levels of each product.</p> <p>Manage restocking requests.</p> <p>Generate reports on inventory status.</p> <p>Warehouse Agent Attributes:</p> <p>ProductID</p> <p>StockLevel</p> <p>RestockThreshold</p> <p>RestockQuantity</p> <p>Warehouse Agent Behaviors:</p> <p>CheckStockLevel()</p> <p>RequestRestock()</p>	<p>Supplier Agent Responsibilities:</p> <p>Receive restock requests from Warehouse Agents.</p> <p>Fulfill restock requests by supplying the required quantity of products.</p> <p>Supplier Agent Attributes:</p> <p>SupplierID</p> <p>ProductID</p> <p>AvailableStock</p> <p>Supplier Agent Behaviors:</p> <p>ReceiveRestockRequest()</p> <p>FulfillRestockRequest()</p>	<p>Customer Agent Responsibilities:</p> <p>Place orders for electronic devices.</p> <p>Receive order confirmation and delivery updates.</p> <p>Customer Agent Attributes:</p> <p>CustomerID</p> <p>OrderID</p> <p>ProductID</p> <p>OrderQuantity</p> <p>Customer Agent Behaviors:</p> <p>PlaceOrder()</p> <p>ReceiveOrderConfirmation()</p>
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TABLE Q5 (Agent Based Simulation)

- a. Draw a UML class diagram representing the three agents (Warehouse, Supplier, and Customer) with their attributes and relationships. [8 marks]
- b. Develop the simulation pseudocode by defining the classes for Warehouse, Supplier, and Customer, along with methods and functions to check stock levels, request restocks, receive restock requests, fulfill restock requests, place orders, and receive order confirmation to perform the specified behaviors. [8 marks]
- c. Write the steps for simulation. [4 marks]

- END OF PAPER -

