

**TERBUKA**



**UNIVERSITI TUN HUSSEIN ONN MALAYSIA**

**FINAL EXAMINATION  
(ONLINE)  
SEMESTER I  
SESSION 2020/2021**

COURSE NAME : ADVANCED FORMAL METHOD  
COURSE CODE : CIE 10803  
PROGRAMME : CIE  
EXAMINATION DATE : JANUARY / FEBRUARY 2021  
DURATION : 3 HOURS  
INSTRUCTION : ANSWER ALL QUESTIONS  
OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF FIVE (5) PAGES

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- Q1** (a) Identify and explain **THREE (3)** differences between formal methods and informal methods. (5 marks)
- (b) Discuss **THREE (3)** examples of formal specification used for formal methods. (5 marks)
- (c) Based on **ONE (1)** formal specification chosen in **Q1(b)**, define the following using a formal specification:
- (i) A passenger has been given a ticket. (2 marks)
- (ii) A passenger can choose to sit near the aisle or next to the window. (2 marks)
- (iii) Proof that a passenger can choose to sit next to the window based from **Q1c(i)** and **Q1c(ii)**. (3 marks)
- (iv) Proof that a passenger does not have a sit if he/she does not have a ticket. (3marks)
- Q2** Which of the following are propositions? What are the truth values of those that are propositions?
- (a) Do not pass go. (2 marks)
- (b) What time is it? (2 marks)
- (c)  $4 + x = 5$ . (2 marks)
- (d)  $x + 1 = 5$  if  $x = 1$  (2 marks)
- (e)  $x + y = y + z$  if  $x = z$ . (2 marks)

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**Q3** Construct *Definition 1* using algebraic specification.

*Definition 1:* A Component Based System (CBS) consists of:

- Generators
- Nodes
- Edges
- Threads

where

- A generator is a function that has the class identifier with its environment;
- A node is a state that maps the fields of generator class identifier to class values;
- An edge is a state that maps the outgoing interface to incoming interface of a node;
- A thread records the traversal of nodes caused by a sequence of function calls.

(10 marks)

**Q4** (a) Give the definition of Z specification.

(2 marks)

(b) Write the Z specification to compute the sum of the first 10 odd integers.  
(8 marks)

(c) Write the Z specification to display the first 100 prime numbers. (Note that, a prime number is a number that is divisible only by 1 and itself. For example, 2, 3, 5, and 7 are prime numbers but 4, 6, and 8 are not prime numbers.)

(10 marks)

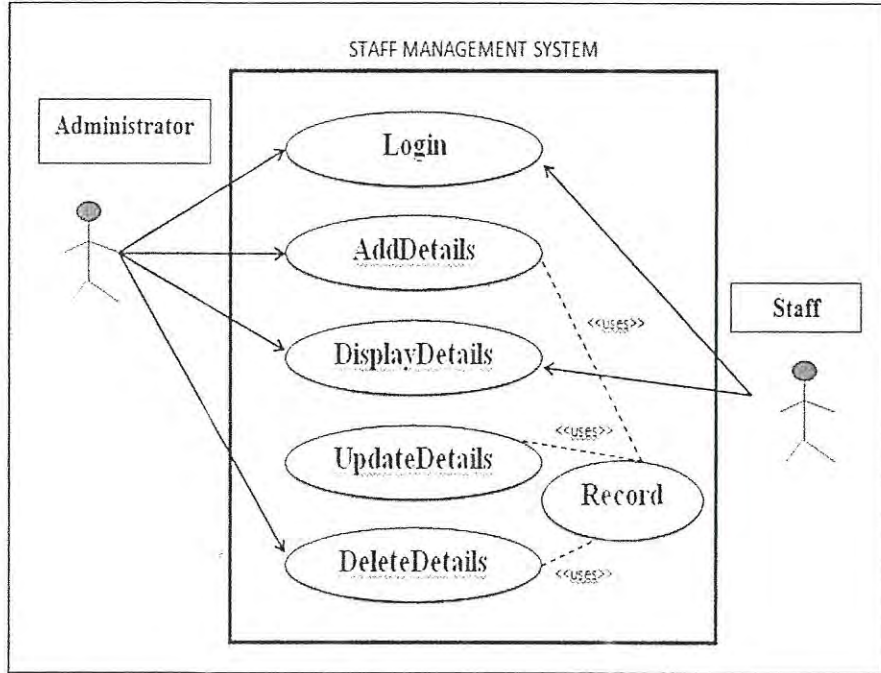
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- Q5** Answer **Q5(a)**-**Q5(d)** based on **Figure Q5**. **Figure Q5** shows the use case diagram for Staff Management System. There are two actors involved in this system. They are *Administrator* and *Staff*.
- (a) Develop **TWO (2)** activity diagrams based on the two actors from the use case diagram.  
(10 marks)
- (b) Develop **TWO (2)** sequence diagrams based on the two actors from the use case diagram.  
(10 marks)
- (c) Based on activity diagrams in **Q5(a)**, formalize the general activity diagram using formal specification. (List all the notations used for the activity diagram).  
(10 marks)
- (d) Based on sequence diagrams in **Q5(b)**, formalize the general sequence diagram using formal specification. (List all the notations used for the sequence diagram).  
(10 marks)

- END OF QUESTIONS -

**FINAL EXAMINATION**

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FORMAL METHOD



**Figure Q5:** Use case diagram for Staff Management System