UTHM
Universiti Tun Hussein Onn Malaysia

UNIVERSITI TUN HUSSEIN ONN MALAYSIA

FINAL EXAMINATION
(OTHER SUMMATIVE ASSESSMENT)
SEMESTER II
SESSION 2019/2020

COURSE NAME : REAL TIME EMBEDDED SYSTEM

COURSE CODE : BEH 42003

PROGRAMME CODE : BEJ

EXAMINATION DATE : JULY 2020

DURATION : 4 HOURS

INSTRUCTIONS : ANSWER **ALL** QUESTIONS.
      OPEN BOOK EXAMINATION

THIS QUESTION PAPER CONSISTS OF **THREE (3)** PAGES

Q1   (a)   Assume a system has three independent tasks A, B, and C, as given in **Table Q2**.

Table Q1: Task Specification

Task	Name of Task (Maximum 10 characters)	CPU resources (ms)	Period (ms)	Deadline (ms)
A	Your name (e.g. KSCHIA)	4	10	6
B	Your Matrix number (e.g. AE101010)	2	30	15
C	Your Pet's name (e.g. FISH)	6	20	20

   (i)   Sketch the task activition diagram of system operation for the priority level of Task A > Task B > Task C,

(4 marks)

   (ii)   Analyze the task activation diagram using that simulated using Microsoft Visual Studio and SimSo Simulation. State all the steps with a concise explanation for each step. Attach a 1-3 minutes video for the simulation analysis.

(15 marks)

   (iii)   Construct a table to state the start delay, elapse time, and completion time for each task.

(6 marks)

(b)   Analyze the schedulability of the tasks in the **Table Q1** by using:

   (i)   A full test of rate monotonic schedulability (RMS).

(10 marks)

   (ii)   A full test of deadline monotonic schedulability (DMS).

(10 marks)

   (iii)   Compare the analysis **Q1(b)(i)** and **Q1(b)(ii)** with that simulated using Microsoft Visual Studio and SimSo Simulation. State all the steps with a concise explanation for each step, including complete C-code programming. Attach a 1-3 minutes video for the simulation analysis.

(15 marks)

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Q2 An Arduino-based microcontroller system consists of a variable resistor, a LED indicator, and a UART interface. The time specification and the task operation of this system are given in **Table Q2**. In order to design a real-time embedded system, FreeRTOS functions of analogRead(), xTaskCreate(), vTaskDelay(), etc may be used.

Table Q2: The time specification and task operation

Task	Name of Task (Maximum 10 characters)	Arduino Pin	Working Area Size	CPU time (ms)	Period (ms)	Deadline (ms)
A	Your name (e.g. KSCHIA)	A2	128 bytes	5	60	30
B	Your Matrix number (e.g. AE101010)	D1 (Tx)	64 bytes	10	60	20
C	Your Pet's name (e.g. FISH)	D2	64 bytes	10	60	60

(a)   Analyze the system performance based on its total CPU utilization.

(5 marks)

(b)   Analyze the system performance by using full schedulability test when the tasks are scheduled using Rate Monotonic scheduling and Deadline Monotonic scheduling.

(10 marks)

(c)   Compare the analysis **Q2(b)** with that simulated using Microsoft Visual Studio and SimSo Simulation. State all the steps with a concise explanation for each step, including complete C-code programming. Attach a 1-3 minutes video for the simulation analysis.

(15 marks)

(d)   Identify the precedence constraints, assumptions, and limitations of this real-time system.

(10 marks)

- END OF QUESTIONS -