AQ–2701

Faculty of Engineering & Technology

M.E. (Computer Sci. & Engg.) (F.T.) Second Semester (CGS) Examination

REAL TIME SYSTEM

Paper—2RMEF3/4RME1

Time—Three Hours] [Maximum Marks—80

INSTRUCTIONS TO CANDIDATES

(1) All questions carry marks as indicated.

(2) Due credit will be given to neatness and adequate dimensions.

(3) Assume suitable data wherever necessary.

(4) Diagrams and Chemical equations should be given wherever necessary.

(5) Illustrate your answers wherever necessary with the help of neat sketches.

(6) Use pen of Blue/Black ink/refill only for writing the answer book.

1. (a) Define Real-time system. List and explain the different types of timing constraints that occur in a Real-time system. 8

(b) Explain periodic task model with examples. 6

OR

2. (a) How does the timing attribute divide the Real-time process in various categories ? Explain each in detail. 8

(b) Job-1 | Job-2 denotes a pipe : The result produced by Job-1 is incrementally consumed by Job-2. (As an example, suppose that Job-2 reads and displays one character at a time as each hand written character is recognized and placed in a buffer by Job-1). Draw a precedence constraint graph to represent this producer—consumer relation between the jobs. 6

3. A system contains nine nonpreemptable jobs named J_i, for i = 1, 2, ... 9. Their execution times are 3, 2, 2, 2, 4, 4, 4, 4 and 9 respectively, their release times are equal to 0, and their deadlines are 12. J_1 is the immediate predecessor of J_9 and J_4 is the immediate predecessor of J_5, J_6, J_7 and J_8. There are no other precedence constraints. For all the jobs, J_i has a higher priority than J_k if i < k.

   (i) Draw the precedence graph of the jobs.

   (ii) Can the jobs meet their deadlines if they are scheduled on three processors ? Explain your answer.

   (iii) Can the jobs meet their deadlines if we make them preemptable and schedule them preemptively ? Explain your answer.

   (iv) Can the jobs meet their deadlines if they are scheduled non-preemptively on four processors ? Explain your answer. 13

OR

4. (a) Explain Optimality and Non-optimality of EDF Algorithms. 7

   (b) Explain weighted round-robin approach for Real-time scheduling. Give example. 6

5. (a) Each of the following systems of periodic tasks is scheduled and executed according to a cyclic schedule. For each system, choose an appropriate frame size. Preemption are allowed, but the number of preemption should be kept small :

   (i) (8, 1), (15, 3), (20, 4) and (22, 6).

   (ii) (5, 0.1), (7, 1.0), (12, 6) and (45, 9).

   (iii) (9, 5.1, 1, 5.1), (8, 1), (13, 3) and (0.5, 22, 7, 22). 8

   (b) Describe the advantages and disadvantages of Clock-driven scheduling. 5

OR

6 (a) Discuss various algorithms for constructing static schedules. 7

(b) Give the meaning of each of the following practical situations and explain the method for handling each situation :

(i) Frame Overruns.

(ii) Mode Changes. 6

7. (a) Explain Rate-Monotonic and Deadline Monotonic fixed priority algorithm. 8

(b) Find the length of an in-phase level-3 busy interval of the following fixed-priority tasks :

$T_1 = (5, 1)$, $T_2 = (3, 1)$, $T_3 = (8, 1.6)$ and $T_4 = (18, 3.5)$. 6

OR

8. (a) The periodic tasks (3, 1), (4, 2) and (6, 1) are scheduled according to the rate-monotic algorithm :

(i) Draw the time-demand function of the tasks.

(ii) Are the tasks schedulable ? Why or Why not ? 7

(b) A system T contains four periodic tasks, (8, 1), (15, 3), (20, 4) and (22, 6). Its total utilization is 0.87. Construct the initial segment in the time interval (0, 50) of a rate-monotonic schedule of the system. 7

9. Explain in detail the concept of Weighted Fair-Queuing Algorithm. 13

OR

10. (a) Explain the following approaches with reference to improve performance of a scheduling algorithm with suitable example :

(i) Background.

(ii) Polled Execution.

(iii) Interrupt-Driven Execution. 7

(b) In a fixed priority system of two periodic tasks $T_1 = (3, 1)$ and $T_3 = (9, 3)$, there is a sporadic server $(p_s, e_s) = (8, 2)$. Suppose that two aperiodic jobs A_1 and A_2 arrive at time 0.5 and 5, respectively, their execution times are both equal to 1. What is the response time of A_2 if the server is a simple sporadic server ? 6

11. (a) Consider a fixed-priority system in which there are five tasks T_i, for i = 1, 2, 3, 4 and 5, with decreasing priorities. There are two resources x and y. The critical section of T_1, T_2, T_4 and T_5 are [y ; 3], [x ; 4], [y ; 5 [x ; 2]] and [x ; 10], respectively. (Note that T_3 does not require any resource). Find the blocking times b_i(rc) of the tasks. 7

(b) Differentiate between priority inheritance and priority ceiling protocols. 6

OR

12. (a) Explain the basic priority inheritance protocol in brief. 6

(b) A system contains the following five periodic tasks. The tasks are scheduled rate-monotonically. Compare the schedulability of the system when the priority ceiling protocol is used verses the NPCS protocol :

T_1 = (6, 3, [X ; 2])

T_2 = (20, 5, [Y ; 1])

T_3 = (200, 5, [X ; 3[Z ; 1]])

T_4 = (210, 6, [Z ; 5[Y ; 4]]). 7