Monsoon 2020

Course: Real-Time Systems

Quiz 3

Instructions:
Relative Deadline for the test = 1 hour.
For questions with multiple correct choices, 2 marks will be given only if all the correct choices are selected. If you select a correct choice or choices with a wrong choice, then you will get 1 mark.

1) What is always true about a polling server given by (10,3)? (**2 marks**)
   a) It executes for 3 time units every 10 time units
   b) In the worst-case, an aperiodic job waits for 10 time units before being serviced by the above polling server
   c) For an aperiodic job with execution time = 4 time units, the best case response time is 13 time units when serviced by the above polling server
   d) None of the above

2) Suppose there are 2 periodic tasks $T_1(3,1)$ and $T_2(10,4)$ executed along with the poller (2.5,0.5). The server is scheduled with periodic tasks rate-monotonically. If there is an aperiodic job that arrives at 0.5 time units with execution time of 1.5 time units, what is the worst-case response time of the aperiodic job? (**2 marks**)

3) A system contains 3 periodic tasks (0,2.5,1), (0,4,0.5), (0,5,0.75) with total utilization = 0.475. If it has a deferrable server given by (2,0.5), what is the response time of the following two aperiodic jobs? (The server is scheduled with periodic tasks using EDF) (**4 marks**)

   i) Arrives at 3 and has execution time 0.75
   ii) Arrives at 6 and has execution time 0.6

4) With the same task set as in Question 3 and a basic sporadic server (2,0.5), find the response time of the two aperiodic jobs given in Question 3, if the server is scheduled with periodic tasks rate-monotonically. (**4 marks**)

5) Let a system contain two periodic tasks $T_1(7,2)$ and $T_2(10,3)$. If the server is a deferrable server and supposing that the periodic tasks and the server are scheduled using EDF, what is the maximum server size that will allow task T_1 and T_2 to be schedulable if the period of the server is 6? (**4 marks**)

6) What is/are true about Constant Utilization Server? (**2 marks**)
   a) Each time the budget is replenished with same amount equal to the size of the server
   b) One of the main functionalities of the replenishment rule is to set the deadline of the server
   c) The budget required is high when the aperiodic job is pre-empted
   d) When the server is pre-empted, the budget is retained

7) A system contains 5 jobs. There are 3 resources X, Y and Z. The resource requirements of the jobs are given below:

J1: [X; 3],
J2: [Y; 1],
J3: none,
J4: [X; 4 [Z; 1]]
J5: [X; 3 [Y; 3 [Z; 2]]]
The lower the job index, higher is the priority, i.e., J1 has higher priority than all other jobs, J2 has higher priority than J3, J4 and J5 and so on. What is the maximum blocking times of the jobs under nonpreemptive critical section protocol? (**4 marks**)

8) Under priority inheritance protocol, what is the worst-case blocking time of a job that requires 10 resources if there are 20 lower priority jobs and the execution time of critical section of all resources is 1 time unit? (**2 marks**)

9) What is/are true about Global Scheduling? (**2 marks**)
   a) Global EDF is an optimal algorithm on m identical cores
   b) If the total utilization of the task set is less than 1, then global scheduling finds a feasible schedule on m identical cores
   c) The critical instant for schedulability in global scheduling is observed when all the highest m priority tasks are simultaneously executed on the m cores
   d) The overheads in global scheduling are due to shared caches and global ready queue

10) Given below are the parameters of 10 tasks for the partitioned EDF algorithm on multicores

p_i	2.5	3	4.5	5	8	8	10	15	20	30
e_i	1	0.6	1	1	1	0.5	1	3	4	3

Use the best fit bin packing algorithm to find a feasible assignment of tasks to minimum number of cores with EDF scheduling. (**4 marks**)