

Monsoon 2020

Course: Real-Time Systems

Quiz 1

Instructions:

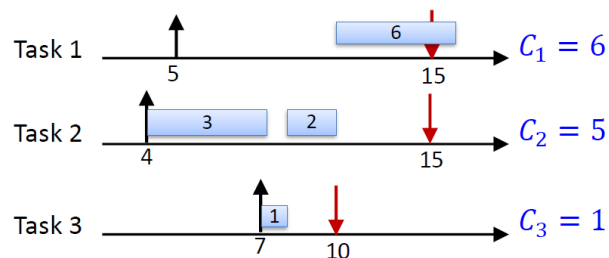
Relative Deadline for the test = 30 mins.

All questions carry 2 marks.

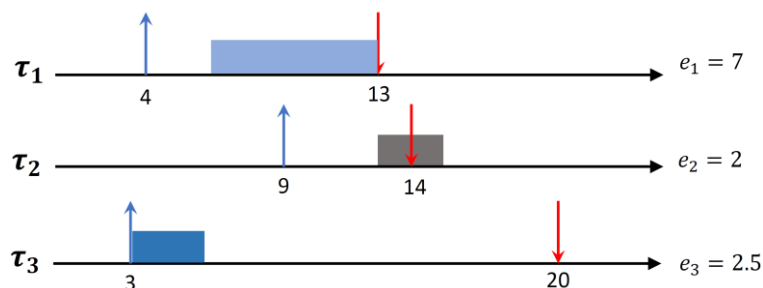
For questions with multiple correct choices, 2 marks will be given only if all the correct choices are selected. If a wrong choice is selected, you will be given 0 marks. If you select only some correct choices with no wrong choices, then you will get 1 mark.

- 1) A control software for safety critical system is analysed using two mathematical techniques - V_1 and V_2 . V_1 is a technique designed to analyse safety critical systems, while V_2 is used to analyse soft real time systems. Let us assume that the execution time of the software obtained using V_1 and V_2 are e_1 and e_2 respectively. What would be the relation between e_1 and e_2 ?
 - a) $e_1 > e_2$
 - b) $e_1 < e_2$
 - c) $e_1 = e_2$
 - d) $e_1 \geq e_2$
- 2) For a digital controller, what parameter(s) is(are) critical to keep the system stable?
 - a) End-to-End Deadline
 - b) Release time of Reference Input
 - c) Sampling Period
 - d) Processor time
- 3) If a timing analysis good at average case analysis is suitable for a task system to find whether the tasks adhere to deadlines, then which of the following is true about the task system?
 - a) The tasks have hard deadlines
 - b) The tasks are periodic
 - c) The task system is a soft real-time system
 - d) Some of the tasks may have non-zero tardiness values
- 4) The minimum inter arrival time for a sporadic task is given as 10 msec. If the first job of the task released at $t = 100$ msec, which among the following times are possible for the release of 3rd job of the task?
 - a) $t = 180$ msec
 - b) $t = 122$ msec
 - c) $t = 115$ msec
 - d) $t = 125$ msec

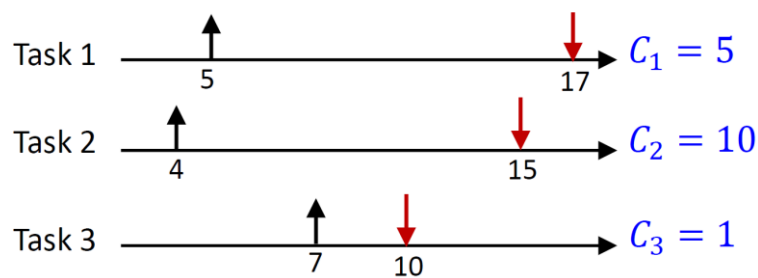
- 5) Given C_1 , C_2 and C_3 are the worst-case execution times of tasks T_1 , T_2 and T_3 respectively and the black arrows are release times and red arrows are deadlines, what is the absolute deadline of task T_1 , relative deadline of task T_2 and slack of task T_3 from the figure below? Please write down only the answer in the answer sheet.



- 6) Given 4 periodic tasks with periods 10, 5, 25 and 15, and assuming that release of first job of all tasks is at $t = 0$, what is the next time instant when the release times of jobs of all the tasks coincide?
- 50
 - 100
 - 150
 - 200
- 7) Three tasks $\{T_1, T_2, T_3\}$ execute according to a precedence relation $T_1 < T_2 < T_3$. If all the tasks have period 20 and execution times 3, 5 and 4 respectively, what are the earliest completion times of first jobs of T_1, T_2, T_3 , if tasks T_1 and T_2 have a temporal dependency of 7? Please write down only the answer (i.e. earliest completion times of tasks) in the sheet.
- 8) A scheduling algorithm S always finds a feasible schedule for a set of hard real-time tasks if such a feasible schedule exists. What main property of the scheduler is exhibited here? Please write the one word answer in the sheet.
- 9) What are the response times of tasks τ_1, τ_2, τ_3 in the below figure with execution times e_1, e_2, e_3 respectively? Please write your answer in the sheet.



- 10) Given the set of tasks $\{T_1, T_2, T_3\}$ in the figure below (C_1, C_2 and C_3 are the worst-case execution times of tasks T_1, T_2 and T_3 respectively), how many deadline violations will occur under FIFO scheduling?
- 0
 - 1
 - 2
 - 3



- 11) In the above question, if the priorities of tasks T_1, T_2 and T_3 are p_1, p_2 and p_3 respectively, then what is the relation that the priorities must have to follow a FIFO schedule?
(Note: $p_i < p_j$ means task T_i has higher priority than task T_j)
- $p_1 < p_2 < p_3$
 - $p_2 < p_3 < p_1$
 - $p_1 < p_3 < p_2$
 - $p_2 < p_1 < p_3$
- 12) For a task system $\{T_1, T_2, T_3\}$, if the context switch overheads of tasks T_1, T_2 and T_3 are 0.1, 0.05 and 0.15 respectively, what should be the minimum value of Q required for round robin scheduling in order to keep the overhead less than 1% of the scheduling duration in rounds with all the tasks present? Please write only the answer (i.e., value of Q).
- 13) For a task system $\{T_1, T_2, T_3, T_4\}$, with parameters $(8,3), (15,8), (20,4)$ and $(22,10)$, find the minimum average response time possible with release times $r_1 = 2, r_2 = 2, r_3 = 0$ and $r_4 = 0$. Please write only the answer (i.e., the minimum average response time).
- 14) If a set of tasks $\{T_1, T_2, T_3, T_4\}$ with parameters $(4,1), (5,1.8), (20,1)$ and $(20,2)$ is scheduled using cyclic scheduling with frame size = 2, then how many frames exist in the major cycle of the schedule?
- 8
 - 9
 - 10
 - 11