



42081 - SISTEMAS OPERATIVOS E DE TEMPO-REAL

2022-2023

Exam, Normal Period, January 12th, 2023

Duration: 1h30m

#MEC: _____ Name: _____

Note 1: all answers should be properly justified. Just answering Yes/No or writing numerical results without indicating the equations and values used, implies that the corresponding answer will not be considered.

Note 2: the weight of each question is stated at the beginning, between square brackets.

Note 3: several answers have a limited size. In such cases the maximum number of lines that can be used is indicated at the end of the question. E.g. “[5 lines]” means that up to 5 lines of text can be used for the answer. Diagrams/figures are not size-limited.

Part I – Short Questions (6/20 points)

1. [1.5] In C language the use of “if” statements impacts negatively on the real-time characteristics of tasks? If so identify which task characteristics(s) is(are) affected, illustrating why it happens with a simple example (“C” or pseudo-code). [6 lines + example]

2. [1.5] Consider that you have an application composed of several tasks with distinct periods. A subset of these tasks are high-frequency tasks and require short response times and low jitter. Should this system be scheduled with RM or EDF? [6 lines]

3. [1.5] The **task state model studied in the theoretical classes** comprises, among others, the following states: Idle, Suspended and Blocked. [8 lines]
 - a) Do these states have any common characteristic? If so, identify it.
 - b) Indicate the type of events that move a task to which one of these states.

4. [1.5] Indicate one advantage of “Deferrable Servers” with respect to “Poling Servers”, and indicate one advantage of “Poling Servers” with respect to “Deferrable Servers”. Provide a short justification for each case, based on the working principles of the servers. [12 lines]



Part II – Development Questions (14/20 points)

II.1 - Consider the following set of periodic tasks, scheduled with RM and preemption.

	C_i	$T_i=D_i$
τ_1	1	3
τ_2	3	10
τ_3	7	30

- a) [1.0] Can the schedulability of the task set be determined via an utilization-based criteria?
- b) [1.5] Compute the worst-case response time of task τ_3 .
- c) [2.0] Consider now that the system is scheduled not-preemptively. Is task τ_3 schedulable in such circumstances?

II.2 - Consider the following task set, scheduled with preemptive EDF and implicit deadlines. The system tick is 1 t.u.:

	C_i	T_i
τ_1	2	10
τ_2	4	12
τ_3	20	60

In a) to c) it is intended to verify the system schedulability using the CPU Load Analysis technique.

- a) [1.0] Compute the Synchronous Busy Period
- b) [2.0] Compute the Load function
- c) [1.0] Is the system schedulable?
- d) [1.5] Consider that it is pretended to add to the system a Constant Bandwidth Server (CBS), which handles an aperiodic task that has an WCET of 2 t.u. per activation. Compute the CBS parameters in order to minimize preemptions and the response time to the aperiodic requests.



II.3 - Consider the following set of periodic tasks.

	C_i	$T_i=D_i$
τ_1	1	2
τ_2	2	3
τ_3	2	3

- a) [1.0] Is there any scheduling algorithm that allows the task set to be schedulable using just one core?
- b) [1.5] Assume that are used two cores, **global** scheduling and EDF. Is the task set schedulable? If it is schedulable, draw one such feasible schedulable (Gantt, 6 time units). If it is not schedulable, justify.
- c) [1.5] Assume that are used two cores, **partitioned** scheduling and EDF. Is the task set schedulable? If it is schedulable, draw one such feasible schedulable (Gantt, 6 time units). If it is not schedulable, justify.