



Summer 2019 - Semester

Exam Date: 3.8.2019

Exam Time 01:30 H.

**Embedded Systems Design - CSE 347**

The Exam Consists of Five Questions in One Page

**Total Marks: 25 Marks**

**Question No. 1**

[5 Points]

Discuss whether the following are hard, firm, or soft real - time systems:

- The Library of Congress print - manuscript database system.
- A police database that provides information on stolen automobiles.
- An automatic teller machine in a shopping mall.
- A coin - operated video game in some amusement park.
- A university grade - processing system.

**Question No. 2**

[5 Points]

- A control system is measuring its feedback quantity at the rate of  $100 \mu s$ . Based on the measurement, a control command is computed by a heuristic algorithm that uses complex decision making. The new command becomes available  $27 - 54 \mu s$  (rather evenly distributed) after each sampling moment. This considerable jitter introduces harmful distortion to the controller output. How could you avoid (reduce) such a jitter? What (if any) are the drawbacks of your solution?
- Should an interrupt service routine be allowed to be interruptible? If it is, what are the consequences?

**Question: 3**

[5 Points]

- Consider priority preemptive system with 3 tasks –  $t_1$ ,  $t_2$ ,  $t_3$ , having execution times 40, 20, 30 and priorities 3,1,2 respectively (priority of level 1 is highest). They arrive at time instances 1,2,3 respectively. What is the time to complete task 1,2, 3?
- Calculate processor utilization and hyper-period for the following task set:

Task#	Exec. Time	Period
1	3	7
2	5	16
3	3	15

**Question No. 4**

[5 Points]

Consider a system of 4 tasks with the following table

Task #	Arrival time	Exec. Time
T1	5	7
T2	4	4
T3	2	1
T4	0	4

Using the shortest remaining time pre-emptive scheduling (where the schedule will always put the task with the shortest remaining execution time first to the CPU) The scheduler will run up on a process arrives or finishes. Calculate the average turnaround time of the processes. Turnaround time is defined as the total time of a process from its arrival until it finishes.

**Question No. 5**

[5 Points]

Assume the following values for the ADC, the clock frequency = 1 MHz; The reference voltage is 10.23 V and a 10-bits output. Determine the following values.

- The digital equivalent obtained for an input  $V = 3.728 V$ .
- The resolution of this converter
- determine the approximate range of analog input voltages that will produce the same digital result obtained in (a)

مع أطيب أمنياتنا بالتوفيق والنجاح

**Examination Committee:**

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