EE5903 REAL-TIME SYSTEMS – SAMPLE SECTION A PRACTICE PROBLEMS

Question paper format:

Section A – 10 Questions (10 x 2 = 20 Marks)

Section B – 3 Questions (3 x 10 = 30 Marks) [3 out of 4]

Guide sheet: One A4 size guide sheet allowed (Both sides can be used - **HANDWRITTEN**) If it is printed, it will **NOT** be allowed. *No extra "stickers" on the guide sheet allowed*!

Writing your answers – Following MUST be strictly followed:

(a) **VERY CLEAR, READABLE HANDWRITING (bigger letters) with adequate spaces** is expected. You MAY loose securing full marks even if your answers are correct and if your presentation of answers is NOT LEGIBLE. Even if you are appealing after exams, NO CONSIDERATION will be GIVEN for this case!!

(b) No interleaving of your answers anywhere! Your answers may not get noticed if your paper is messy!

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SECTION A: The question in this section is compulsory.

Q.1 Answer all questions. Each question carries 2 marks. Give **one or two line answers** for questions that require comments.

(i) For a set of 2 periodic tasks schedulable under RMA on a uniprocessor system, compute the **upper bound** on the utilization.

(ii) Consider 4 tasks T_1=(0,8), T_2=(1,4), T_3=(2,9), and T_4=(3,5), scheduled under *Shortest Remaining Job First* (**SRJF)** algorithm. In the above representation of a task, the first component denotes the arrival time and the second component denotes the execution time of the task. Compute the ***average waiting time*** of the tasks.

(iii) In a Cyclic scheduler, the minimum separation of the task arrival instant from the corresponding frame start time considering all instances of a task T_i is equal to _____.

(iv) Using a Constant Failure Rate (CFR) model, for a 2-core CPU system, determine the failure rate function. Assume that the cores have identical failure rates and fail independently and that the system failure will occur only when both cores have failed.

(v) For **n** independent CPU cores running in parallel, each having an availability factor $A_i(t)$, the overall system availability is given by _____.

(vi) Consider a priority-driven pre-emptive scheduler handling two periodic tasks T_1=(e_1=10 ms, p_1=20 ms) and T_2=(e_2=20 ms, p_2=50 ms) as foreground tasks and one background task T_3 requires 100 ms to complete. Assuming all tasks start at t=0, determine the time at which T_3 will complete.

(vii) Why implementing synchronization primitives by disabling interrupts in user-level programs is not appropriate in a single processor, single core system?

(viii) How (a) FCFS and (b) Round Robin (RR) scheduling algorithms discriminate in favour of short processes?

(ix) Draw clearly a task state transition diagram that captures all events from a task activation stage to its termination stage.

(x) State three primary advantages of using a non-preemptive scheduling algorithm for real-time tasks.

(2 x 10 = 20 Marks)