Name : .....

Roll No. : .....

Invigilator's Signature : .....

CS/M.TECH/CSE(O)/SE(O)/IT(O)/SEM-1/PGCSE-102/PGSE-102/PGIT-105/2012-13

2012

DISTRIBUTED REAL TIME OPERATING SYSTEMS.
ADVANCED OPERATING SYSTEMS.
REAL TIME OPERATING SYSTEMS.

Time Allotted : 3 Hours *Full Marks* : 70

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Answer *all* questions from Section-A and any *three* from Section-B.

SECTION – A

[Marks : 25]

1. a) How does Real Time operating systems differ from general purpose operating systems ?

   b) A library function f ( ) is being shared by two processes in a system. It is desirable for the function to be stateful or stateless ? State your answer with proper reasoning.

   c) Define the following terms :

      i) Static system

      ii) Static scheduler

      iii) Static Priority-driven scheduler.

   d) What do you mean by 'Temporal Parameters' of jobs in a real-time system ? 6 + 6 + (3 × 3) + 4

SECTION – B

Answer any *three* of the following. $3 \times 15 = 45$

2. a) What is the usefulness of hyperperiod in the Periodic Task Model of a Real Time (RT) system ?

   b) What is a feasible schedule ? What is an optimal scheduler ?

   c) Using an example of your own choice, demonstrate that Basic Priority Inheritance Protocol does not prevent deadlocks ?

   d) Define 'competitive factor' of an online scheduling algorithm. Demonstrate using an example of your choice that competitive factor of EDF algorithm is 0.

   2 + (1 + 1) + 5 + (3 + 3)

3. a) How would you implement the NPCS protocol in an RTOS which does not support it ?

   b) State the rules of the Basic Priority Ceiling Protocol.

   c) With reference to the rules stated in your answer to question 3.(b) above, describe using a suitable example how the Basic Priority Ceiling Protocol succeeds in preventing deadlocks. 5 + 5 + 5

4. a) Prove that on single processor based systems with independent preemptable tasks, fixed priority scheduling algorithms can never be optimal.

   b) Name and describe any three performance metrices used to measure the performance of schedulers used for scheduling jobs in a Real Time System. 6 + 9

5. a) Consider three preemptive periodic tasks (to be scheduled on a single processor based system) : T1 (4, 1), T2 : (5, 2) and T3 : (9, 4) that have no feasible schedule. By how much must the execution time of T1 be reduced, in order for the tasks to be schedulable using the LST algorithm ?

b) Consider the following five fixed-priority tasks (lower the task index, higher the task priority) :

T1 = (10, 2), T2 = (14, 2,), T3 = (15, 3), T4 = (50, 1) and T5 = (24, 3).

Suppose that the scheduler makes a scheduling decision every 1 unit of time, that is, the tick size is 1·0. Each time, it takes 0·1 unit of time regardless of whether there are jobs waiting to be scheduled and 0·2 additional unit of time to schedule each waiting job. Write the time-demand function w3(t) of T3. Is T3 schedulable ? 7 + 8

6. a) Suppose we have a stream of sporadic jobs whose interrelease times are uniformly distributed from 9 to 11. Their execution times are uniformly distributed from 1 to 3.

i) What are the parameters of the periodic task if we were to use such a task to model the stream ?

ii) Compare the utilization of the periodic task in (i) with the average utilization of the sporadic job stream.

b) A system contains the following 4 periodic tasks (Rx and Ry are resources used) :

T1 (0, 5, 1, [Rx ; 0·5]) (requests Rx after running for 0·2 time units)

T2 (0, 6, 3, [Rx; 1]) (requests Rx after running for 1 time units)

T3 (2, 3, 1, [Ry; 0·5]) (requests Ry after running 0·1 time units)

T4 (1, 5, 0·5)

The tasks are scheduled by the LST algorithm and the priority inheritance protocol. Show the schedule produced during the first 15 time units. (3 + 4) + 8

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