Registration No. : | | | | | | | | | | |

Total number of printed pages – 4

B. Tech

PECS 5403

Seventh Semester Examination – 2013

REAL TIME SYSTEMS

BRANCH : CSE, IT

QUESTION CODE : C-264

Full Marks – 70

Time : 3 Hours

*Answer Question No. **1** which is compulsory and any **five** from the rest.*
The figures in the right-hand margin indicate marks.

1. Answer the following questions : 2×10

(a) It is difficult to achieve software fault tolerance as compared to hardware fault tolerance. Why ?

(b) Can we consider EDF as a dynamic priority scheduling algorithm for real-time tasks ?

(c) Explain scheduling point of a task scheduling algorithm. How the scheduling points are determined in (i) clock-driven, (ii) event-driven, (iii) hybrid schedulers ?

(d) What is a "fail-safe" state ? Since safety-critical systems do not have a fail-safe state, how is safety guaranteed ?

(e) Briefly mention the advantages of RMA over EDF.

(f) Differentiate between valid and feasible schedules.

(g) Contrast between pessimistic and optimistic concurrency control protocols.

P.T.O.

(h) Explain why algorithms that can be satisfactorily used to schedule real-time tasks in multiprocessors often are not satisfactory to schedule the real-time tasks on distributed systems, and vice versa.

(i) What do you mean by transient overloading in EDF ?

(j) What do you mean by temporal data ? Explain briefly.

2. (a) Explain the important differences between hard, firm and soft real-time systems. 5

(b) In a distributed system, six clocks need to be synchronized to a maximum difference of 10 mSec between any two clocks. Assume that the individual clocks have a maximum rate of drift of 2×10^{-6}. Ignore clock set-up times and communication latencies.

(i) What is the rate at which the clocks need to be synchronized using a simple server time method and simple internal synchronization method ?

(ii) What is the communication overhead in each of the two schemes ?

(iii) Assuming the communication latency to be 0.1 mSec, what would be the drift of synchronized time with respect to the UTC for each of the two synchronization schemes ? 5

3. (a) List the different types of timing constraints that can occur in a real-time system. 5

(b) In the following, the partial behavior of a telephone system is given.

(i) If you press the button of the handset for less than 15 s it connects to the local operator. If you press the button for any duration lasting between 15 to 30 s, it connects to the international operator. If you keep the button pressed or more than 30 s, then on releasing it would produce the dial tone.

(ii) Once the receiver of the handset is lifted, the dial tone must be produced by the system within 20 s, otherwise a beeping sound is produced until the handset is replaced.

Draw the EFSM model for telephone system. 5

4. What do you mean by priority inversion ? Distinguish bounded from unbounded priority inversion. Demonstrate with a neat diagram. Briefly explain the Priority Inheritance Protocol (PIP) scheme for avoiding priority inversion problem. 10

5. (a) What are the distinguishing characteristics of periodic, aperiodic, and sporadic real time tasks ? 5

(b) Assume that the drift rate between any two clocks is restricted to $\rho = 5 \times 10^{-6}$. Suppose we want to implement a synchronized set of six distributed clocks using the central synchronization scheme so that the maximum drift between any two clocks is restricted to $\Delta = 1$ mSec at any time, determine the period with which the clocks need to be synchronized. 5

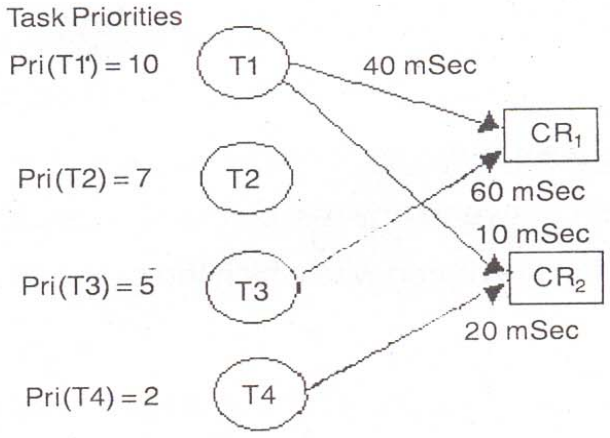
6. (a) What do you mean by a Real Time system ? Mention salient features and applications of such system. 5

(b) Determine whether the following set of periodic real-time tasks is schedulable on a uniprocessor using RMA. 5

Tasks	Start-Time (ms)	Processing-Time (ms)	Period (ms)	Deadline (ms)
T1	20	25	150	100
T2	40	7	40	40
T3	60	10	60	50
T4	25	10	30	20

7. (a) Briefly explain the Priority Ceiling Protocol (PCP). Mention some important features of PCP. 5

(b) A system has four tasks: T1, T2, T3, T4. These tasks need two critical resources CR1 and CR2. Assume that the priorities of the four tasks are as follows: pri(T1) = 10, pri(T2) = 7, pri(T3) = 5, pri(T4) = 2. These four tasks have been arranged in decreasing order of their priorities. The exact resource requirements of these tasks and the duration for which the tasks need the two resources have been shown in figure. Compute the different types of inversions that each task might have to undergo in the worst case. 5



8. Write short notes on any **two** of the following : 5×2

(a) Highest Locker Protocol

(b) Chain blocking

(c) Recovery block for software fault tolerance

(d) MLF (Minimum Laxity First)