Reg. No.										

MANIPAL INSTITUTE OF TECHNOLOGY
Manipal University

SIXTH SEMESTER B.TECH (E & C) DEGREE END SEMESTER EXAMINATION
APRIL/MAY 2017
SUBJECT: REAL TIME SYSTEMS (ECE - 4004)

TIME: 3 HOURS **MAX. MARKS: 50**

Instructions to candidates
- Answer **ALL** questions.
- Missing data may be suitably assumed.

1A. Differentiate the following by giving relevant example for each.
   i) Deterministic constraint and probabilistic constraint.
   ii) Absolute deadline and relative deadline
   iii) Event-triggered and time-triggered real-time systems
   iv) AND/OR precedence constraints
   v) Hard and soft real time systems.

1B. What are the distinguishing characteristics of periodic, aperiodic and sporadic tasks? Explain using suitable example for each.

1C. Discuss briefly the traditional performance measures in real time systems.

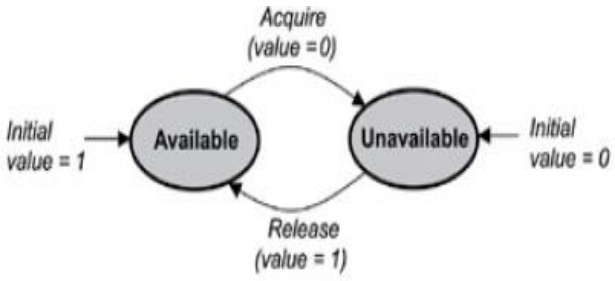
(5+3+2)

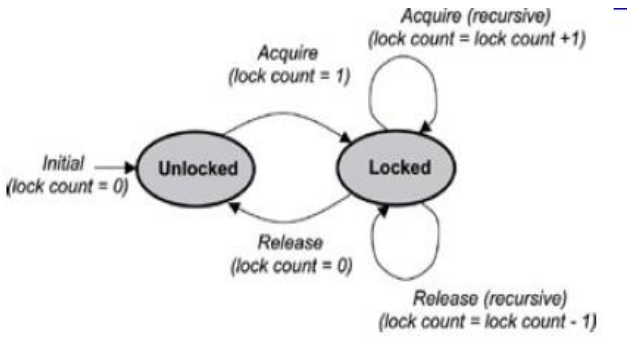
2A. Explain the key characteristics of an RTOS in detail.

2B. Elaborate on typical ways to use message queue within the application.

2C. Identify the state diagrams of the following kernel objects and define them.

i) ii)





(5+3+2)

3A. Draw the process state diagram. Three processes with process IDs P1, P2 and P3 with estimated completion time 8, 4, 7 milliseconds respectively enter the ready queue together in the order P3, P2 and P1. Process P4 with estimated execution completion time 4ms enters the ready queue after 2ms. Process P2 enters the Blocked state after 2ms of starting of its execution and has an IO waiting time of 3ms. Calculate the waiting time, TAT, average waiting time and average TAT if preemptive FIFO scheduling is applied. All the estimated execution completion time is excluding I/O waiting time

3B. A system contains nine non preemptable jobs named J_i, for $i = 1, 2, \ldots, 9$. Their execution times are 3, 2, 2, 2, 4, 4, 4, 4, and 6, respectively, their release times are equal to 0, and their deadlines are 12. $J1$ is the immediate predecessor of $J9$, and $J4$ is the immediate predecessor of $J5$, $J6$, $J7$, and $J8$. There is no other precedence constraints. For all the jobs, J_i has a higher priority than J_k if $i < k$.

(a) Draw the precedence graph of the jobs.

(b) Can the jobs meet their deadlines if they are scheduled on three processors?
(c) Can the jobs meet their deadlines if they are scheduled non pre-emptively on four processors? Justify the answer.

3C. What is the scheduling point of a task in scheduling algorithm? How the scheduling points are determined in i) clock driven ii) event driven schedulers.

(5+3+2)

4A. For the table given below, with different release times (all the tasks are not ready at time t=0). The next burst of each tasks is to be calculated with respect to its first release time. Try scheduling this by checking the necessary and sufficient conditions with i) RM algorithm ii) EDF algorithm
Draw the Gantt graph and also show the schedule in single time axis.

Tasks	Period	CPU Burst	Release time
T1	5	1	0
T2	8	3	1
T3	10	2	3
T4	15	2	0

4B. Write the differences between ESR and ISR.

4C. Write the bounded and unbounded priority inversion with example diagrams

(5+3+2)

5A. The feasible interval of each job in the precedence graph in figure Q 5A is given next to its name. The execution time of all jobs are equal to 1.

a) Find the effective release time and effective deadlines of all jobs
b) A job is said to be at level *i* if the length of the longest path from the job to jobs that have no successors is *i* . So, jobs *J*3, *J*6, and *J*9 are at level 0, jobs *J*2, *J*5, and *J*8 are at level 1, and so on. Suppose that the priorities of the jobs are assigned based on their levels: the higher the level, the higher the priority. Find a priority-driven schedule of the jobs according to this priority assignment.
c) Write the EDF schedule on 2 processor system.

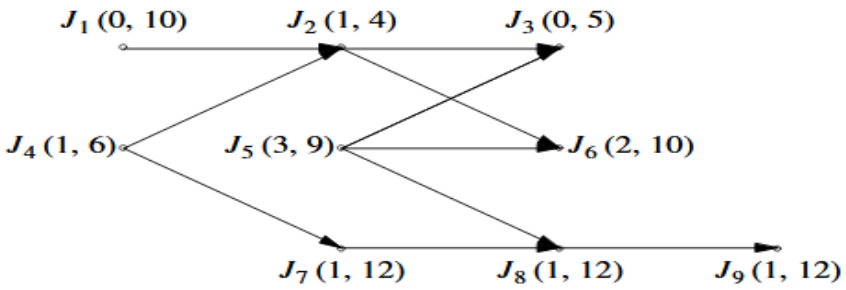


Fig 5.A

5B. For the following task set:,i) perform table driven scheduling ii) determine the frame size for cyclic scheduling

Tasks	Execution .Time	Period
T1	1	5
T2	2	10
T3	4	15
T4	3	15

5C. Define valid schedule and feasible schedule?

(5+3+2)