| Name:<br><br>Enrolment No: | UPES<br>UNIVERSITY WITH A PURPOSE |
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**UNIVERSITY OF PETROLEUM AND ENERGY STUDIES**
**End Semester Examination, May2020**

**Course: Real Time Operating System Internals** **Semester: VIII**
**Program: B.Tech CSE (Telecom Informatics)** **Time : 03 hrs.**
**Course Code: CSIB475** **Max. Marks: 100**

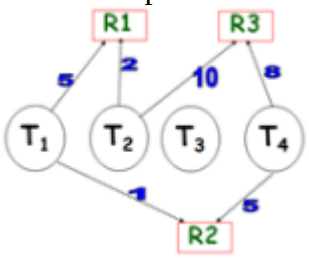
**Instructions: 1.** All Questions from **SECTION A** and **SECTION C** are **Compulsory.**
**2.** In **SECTION B**, for Q31 and Q32 internal choice is given.

**SECTION A**

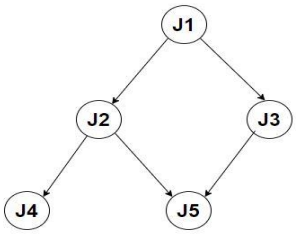
| S. No. | | Marks | CO |
|---|---|---|---|
| Q 1 | Components of a model are<br>A. workload model<br>B. Resources Model<br>C. Scheduling model<br>D. All of Above | **2** | **CO2** |
| Q 2 | Typical Real time applications are<br>A. Digital Control System<br>B. High level control system<br>C. Signal Processing<br>D. All of above | **2** | **CO1** |
| Q 3 | In a real time system the computer results<br>A. must be produced within a specific deadline period<br>B. may be produced at any time<br>C. Time independent<br>D. All of above | **2** | **CO1** |
| Q 4 | "In a safety critical system, incorrect operation"<br>A. does not affect much<br>B. causes minor problems<br>C. causes major and serious problems<br>D. none of the mentioned | **2** | **CO1** |
| Q 5 | "Antilock brake systems, flight management systems, pacemakers are examples of"<br>A. safety critical system<br>B. hard real time system<br>C. soft real time system<br>D. safety critical system and hard real time system | **2** | **CO1** |
| Q 6 | The priority of a real time task<br>A. must degrade over time<br>B. must not degrade over time<br>C. may degrade over time | **2** | **CO1** |

| | | | |
|---|---|---|---|
| | D. none of the above | | |
| Q 7 | Memory management units<br>A. increase the cost of the system<br>B. increase the power consumption of the system<br>C. increase the time required to complete an operation<br>D. all of the these | **2** | **CO2** |
| Q 8 | Real time systems are embedded in sensors and<br>A. actuators<br>B. frames<br>C. major cycles<br>D. none of these | **2** | **CO2** |
| Q 9 | The _____ scheduling algorithm schedules periodic tasks using a static priority policy with preemption.<br>A. earliest deadline first<br>B. rate monotonic<br>C. first cum first served<br>D. priority | **2** | **CO3** |
| Q 10 | If a set of processes cannot be scheduled by rate monotonic scheduling algorithm, then :<br>A. they can be scheduled by EDF algorithm<br>B. they cannot be scheduled by EDF algorithm<br>C. they cannot be scheduled by any other algorithm<br>D. none of the these | **2** | **CO3** |
| Q 11 | Using EDF algorithm practically, it is impossible to achieve 100 percent utilization due to :<br>A. the cost of context switching<br>B. interrupt handling<br>C. power consumption<br>D. all of the mentioned | **2** | **CO3** |
| Q 12 | Priority inversion is solved by use of _____<br>A. priority inheritance protocol<br>B. two phase lock protocol<br>C. time protocol<br>D. all of the mentioned | **2** | **CO4** |
| Q 13 | If jobs have unpredictable release times, a task is termed as:<br>A. aperiodic<br>B. sporadic<br>C. periodic.<br>D. None of these | **2** | **CO6** |
| Q 14 | For a periodic real-time task, which one of the following is true?<br>A. The absolute deadline changes for different task instances, but the relative deadline is fixed.<br>B. The relative deadline changes for different task instances, but the absolute deadline is fixed.<br>C. Both the relative deadline for different task instances, as well as the absolute deadline are fixed. | **2** | **CO6** |

| | | | |
|---|---|---|---|
| | D. Both the relative deadline as well as the absolute deadline change for different task instances. | | |
| Q 15 | Rate monotonic scheduling assumes that the :<br>A. processing time of a periodic process is same for each CPU burst<br>B. processing time of a periodic process is different for each CPU burst<br>C. periods of all processes is the same<br>D. none of the these | **2** | **CO3** |
| Q 16 | A process P1 has a period of 50 and a CPU burst of t1 = 25, P2 has a period of 80 and a CPU burst of 35. The total CPU utilization is :<br>A. 0.90<br>B. 0.74<br>C. 0.94<br>D. 0.80 | **2** | **CO3** |
| Q 17 | Suppose a cyclic scheduler is used to schedule a set of periodic real-time tasks Ti. The execution time, period, and deadline of a task Ti is given by <ei, Pi, di>. If the frame size chosen is F, then which one of the following must be false?<br>A. $F > \max\{ei\}$<br>B. F divides the major cycle<br>C. $F - (\gcd(F,Pi)/2) < di/2$ for every task Ti<br>D. $2 \times F - \gcd(F,Pi) > di$ for every task Ti | **2** | **CO6** |
| Q 18 | There are two processes P1 and P2, whose periods are 50 and 100 respectively. P1 is assigned higher priority than P2. The processing times are t1 = 20 for P1 and t2 = 35 for P2. Is it possible to schedule these tasks so that each meets its deadline using Rate monotonic scheduling?<br>A. yes<br>B. no<br>C. maybe<br>D. none of the these | **2** | **CO3** |
| Q 19 | Which one the following is considered as a dynamic priority real-time task scheduler?<br>A. Rate monotonic scheduler<br>B. Cyclic scheduler<br>C. Deadline monotonic scheduler<br>D. Earliest deadline first scheduler | **2** | **CO2** |
| Q 20 | Suppose three periodic tasks with execution times of 20 millisecond, 30 millisecond, and 40 millisecond, and periods of 150 millisecond, 250 millisecond, and 350 millisecond are to be run using a basic table-driven scheduler. What is the minimum time period for which the task schedule should be stored in a schedule table?<br>A. 750 milliseconds<br>B. 120 milliseconds<br>C. 80 milliseconds<br>D. 5250 milliseconds | **2** | **CO6** |
| Q 21 | What would be the processor utilization due to the following three tasks when run on a uni-processor? | **2** | **CO6** |

| | | | |
|---|---|---|---|
| | <table><tr><th>Task</th><th>Execution Time (in millisec)</th><th>Period (in millisec)</th><th>Deadline (in millisec)</th></tr><tr><td>T1</td><td>10</td><td>100</td><td>100</td></tr><tr><td>T2</td><td>20</td><td>150</td><td>150</td></tr><tr><td>T3</td><td>5</td><td>50</td><td>50</td></tr></table><br>A. 0.68<br>B. 0.44<br>C. 0.34<br>D. 0.24 | | |
| Q 22 | What is the time complexity of an EDF scheduler in terms of the number of tasks (n) to be scheduled, when tasks are maintained by the scheduler using a priority queue?<br>A. O(n)<br>B. $O(n^2)$<br>C. O(log n)<br>D. O(nlog n) | **2** | **CO3** |
| Q 23 | Assume that four periodic real-time tasks T1, T2, T3, and T4 share three non-preemptable resources R1, R2, and R3 as shown in the following diagram. The time for which each task needs a resource is annotated on the arrow connecting the task to the corresponding resource. The tasks are arranged in decreasing order of their priorities, with T1 being the highest priority task and T4 the lowest priority task. The tasks are scheduled using a rate monotonic scheduler incorporating the basic priority inheritance protocol. Which tasks would undergo direct blocking?<br>  <br>A. T1, T2, and T4<br>B. T1 and T2<br>C. T2 and T4<br>D. T2 only | **2** | **CO5** |
| Q 24 | Which one of the following statements is true?<br>A. The priority ceiling protocol (PCP) can be considered to be a satisfactory protocol to be deployed when a number of serially reusable pre-emptable resources are to be shared among a set of real-time tasks.<br>B. When priority ceiling protocol (PCP) is used in a Unix-based real-time operating system, the ceiling priority value of a critical resource would be the maximum of the priority values of all the tasks using that resource.<br>C. Under PCP the duration for which a lower priority task can inheritance block a higher priority task is also identical to the duration for which it can avoidance block the higher priority task. | **2** | **CO5** |

<table>
<tr><td></td><td>D. Under PCP even a task which does not require any resource may undergo priority inversion for some duration on account of resource usage by other tasks.</td><td></td><td></td></tr>
<tr><td>Q 25</td><td>Which one of the following is false regarding the utilization-balancing algorithm for task allocation in multiprocessors?<br>A. In the resultant allocation, the typical utilization of each processor is different from the average utilization of the processors<br>B. It is a greedy algorithm<br>C. It is a non-optimal algorithm<br>D. It is typically used when the tasks assigned to the individual processors are to be scheduled using rate monotonic schedulers</td><td>2</td><td>CO5</td></tr>
<tr><td>Q 26</td><td>Describe which of these scheduling policies is most suited for controlling a set of periodic tasks.<br>A. FCFS<br>B. Least laxity first<br>C. Earliest dead line first<br>D. Rate monotonic policy schedule</td><td>2</td><td>CO3</td></tr>
<tr><td>Q 27</td><td>Which of the following strategy is employed for overcoming the priority inversion problem?<br>A. Abandon the notion of priorities altogether<br>B. Have only two priority levels<br>C. Allow for temporarily raising the priority of lower level priority process<br>D. Use pre-emptive policies strictly based on priorities</td><td>2</td><td>CO5</td></tr>
<tr><td>Q 28</td><td>soft real time operating system has ___ jitter than a Hard real time operating system<br>A. less<br>B. more<br>C. equal<br>D. none of these</td><td>2</td><td>CO2</td></tr>
<tr><td>Q 29</td><td>Delay and Jitter :<br>A. mean the same thing<br>B. are two completely different things<br>C. all of the mentioned<br>D. none of these</td><td>2</td><td>CO2</td></tr>
<tr><td>Q 30</td><td>If the tasks shown in the following table are to be run on a uniprocessor by a rate monotonic scheduler, which one of the following is a correct priority assignment to the tasks? Assume that the higher is the priority value assigned to a task, the lower is its priority.
<table>
<tr><th>Task</th><th>Execution Time (in millisec)</th><th>Period (in millisec)</th><th>Deadline (in millisec)</th></tr>
<tr><td>T1</td><td>10</td><td>100</td><td>100</td></tr>
<tr><td>T2</td><td>20</td><td>150</td><td>150</td></tr>
<tr><td>T3</td><td>5</td><td>50</td><td>50</td></tr>
</table>
A. Priority(T1)=1, Priority(T2)=2, Priority(T3)=3<br>B. Priority(T1)=3, Priority(T2)=2, Priority(T3)=1<br>C. Priority(T1)=2, Priority(T2)=3, Priority(T3)=1<br>D. Priority(T1)=2, Priority(T2)=1, Priority(T3)=3</td><td>2</td><td>CO5</td></tr>
</table>

<table>
<tr><td colspan="4">SECTION B</td></tr>
<tr><td>Q 31</td><td>a) Explain priority ceiling protocol. What is priority inversion?<br><br>OR<br><br>b) Define the term Task. What is the precedence constraint among tasks? Follow the precedence graph below and find the priority of tasks.<br><br> 
</td><td>10</td><td>CO4, CO6</td></tr>
<tr><td>Q 32</td><td>a) What is CPU utilization factor? How to find schedulablity on the basis of Utilization factor? Schedule the following task using EDF and find the CPU Utilization Factor.<br><br>
<table>
<tr><th>Process</th><th>Computation time C</th><th>Period T</th></tr>
<tr><td>T1</td><td>2</td><td>5</td></tr>
<tr><td>T2</td><td>4</td><td>7</td></tr>
</table>
<br>OR<br>b) Discuss the Rate Monotonic Scheduling algorithm. Schedule the following tasks using the RM scheduling<br><br>
<table>
<tr><th>Process</th><th>Computation time C</th><th>Period T</th></tr>
<tr><td>T1</td><td>1</td><td>4</td></tr>
<tr><td>T2</td><td>2</td><td>5</td></tr>
<tr><td>T3</td><td>5</td><td>20</td></tr>
</table></td><td>10</td><td>CO3</td></tr>
<tr><td colspan="4">SECTION-C</td></tr>
<tr><td>Q 33</td><td>Define TCB? Explain all the fields of the TCB. Differentiate between task object and Task control block.</td><td>10</td><td>CO4</td></tr>
<tr><td>Q 34</td><td>Describe all the real time requirements of an Embedded Systems. What are the all design metrics of E.S. design?<br>List all the requirements of fully automatic Washing Machine design. What are the control requirements of this design?</td><td>10</td><td>CO2, CO5</td></tr>
</table>