**Sample Question Format**
**(For all courses having end semester Full Mark=50)**

**KIIT Deemed to be University**
**Online End Semester Examination(Autumn Semester-2021)**

**Subject Name & Code:** Operating Systems and CS-2002
**Applicable to Courses:** B.tech. 5th Sem

**Full Marks=50**
**Time:2 Hours**

**SECTION-A(Answer All Questions. Each question carries 2 Marks)**

**Time:30 Minutes**
**(7×2=14 Marks)**

| Question No | Question Type (MCQ/SAT) | Question | CO Mapping | Answer Key (For MCQ Questions only) |
|---|---|---|---|---|
| **Q.No:1** | | Which one of the following is not shared by the threads of the same process?<br>(a) stack<br>(b) address space<br>(c) file descriptor table<br>(d) message queue | CO3 | (a) |
| | | Which of the following may block running process?<br>(a) fork<br>(b) read<br>(c) down<br>(d) both fork and down<br>(e) all | CO2 | e |
| | | Assume that 3 processes all with requirements of 1 second of CPU time each and no I/O arrives at the same time. What will be the Avg. time to completion for the processes if R-R CPU scheduling is used with 0.1 sec time span and assume no overhead for context switch.<br>(a) 2.5 sec<br>(b) 2.15 sec<br>(c) 2.9 sec<br>(d) 3 sec | CO4 | c |
| | | If fixed priority scheduling is used in different queues in multilevel queue scheduling then<br>(a) Starvation can occur<br>(b) Starvation cannot occur | CO4 | a |

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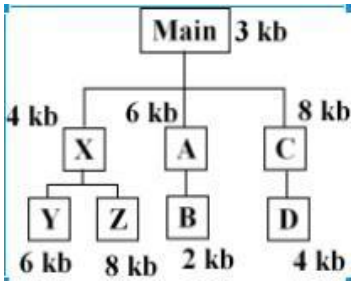
| | | (c) All the queues will get almost fair chance<br>(d) none of these | | |
| **Q.No:2** | | Which of the following disk scheduling strategies is likely to give the best throughput?<br>(a) Farthest cylinder next<br>(b) Nearest cylinder next<br>(c) First come first served<br>(d) Elevator algorithm | CO6 | b |
| | | Let an instruction takes i ms and page fault takes an additional j ms. If the avg. page fault occurs after k instructions, the effective instruction time will be,<br>(a) i+j*k<br>(b) (i+j)/k<br>(c) i+j/k<br>(d) i+2*j/k | CO3 | c |
| | | What will be the minimum RAM size so that the following program can run?<br>  <br><br>(a) 16 kb<br>(b) 15 kb<br>(c) 14 kb<br>(d) 17 kb | CO5 | b |
| | | Consider the following page reference string: 7, 6, 5, 4. 7, 6, 8, 7, 6, 5, 4, 8. If MRU (most recently used) page replacement technique is used, then what will be the difference of page faults in case of memory with 4 and 3 frames are used respectively. Assume initially, frames are empty.<br>(a) 0<br>(b) 1<br>(c) 2<br>(d) 3 | CO5 | a |
| **Q.No:3** | | If a CPU generates address 00f2 and re-locatable register contains ff22 then what will be the physical address?<br>(a) 10014<br>(b) 10024<br>(c) fc224<br>(d) ff243 | CO5 | a |
| | | Which of the following is false in context of inter process communication?<br>(a) communicate with each other<br>(b) share same address space<br>(c) synchronize their actions<br>(d) passing message with each other | CO3 | b |

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| | | The address sequence generated by tracing a particular program executing in a pure demand paging system with 100 records per page with 1 free main memory frame is recorded as follows: What is the number of page faults?<br><br>100, 200, 430, 499, 510, 530, 560, 120, 220, 240, 260, 320, 370<br><br>(a) 8<br>(b) 7<br>(c) 10<br>(d) 13 | CO5 | b |
| | | Suppose the to service a page fault is on average 20 ms, while a memory access takes 10 micro seconds. Then 80% hit ratio results in avg. memory access time of<br>(a) 3008 micro sec.<br>(b) 5004 micro sec.<br>(c) 4008 micro sec.<br>(d) 2008 micro sec. | CO5 | c |
| **Q.No:4** | | If time span size is 3 unit of time and only one process with 16 burst time is there in ready queue, then we apply R-R CPU scheduling algorithm. What will be the number of context switch?<br>(a) 5<br>(b) 6<br>(c) 4<br>(d) 7 | CO3 | a |
| | | A process executes the following segment of code: for(i=1; i<=n; i++) fork(); The number of new processes created is:<br>(a) n(n+1)/2<br>(b) n<br>(c) 3^n-1<br>(d) 2^n-1 | CO1 | d |
| | | Consider the following statements:<br>S1: CPU is a non preemptive resource<br>S2: I/O device is preemptible<br>Which of the above statements is/are true?<br>(a) S1<br>(b) S2<br>(c) both are true<br>(d) none of these | CO2 | d |
| | | A company has hired you to design the virtual memory system for their new line of desktop computers. Each computer will have 32 bits virtual and physical addresses, and memory will be allocated in pages of size 2KB. How much physical memory is required to store the page table?<br>(a) 2MB<br>(b) 4MB<br>(c) 6 MB<br>(d) 3 MB | CO5 | a |
| **Q.No:5** | | Consider 4 processes sharing the CPU in a round-robin fashion. Assuming that each process switch takes 1 second, | CO3 | b |

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| | | what must be the quantum size q such that the overhead resulting from process switching is minimized but at the same time each process is guaranteed to get its turn at the CPU at least every 10 seconds?<br>(a) 3<br>(b) 2<br>(c) 1<br>(d) 4 | | |
| | | Consider the following cooperating processes p1 and p2 using shared variable i = 11<br>**Method Used by P1**<br>begin<br>A<br>i++;<br>printf("%d",i);<br>end<br>**Method Used by P2**<br>begin<br>printf("%d",i);<br>B<br>end<br>Write the code for **A** and **B** so that output will be 9 10.<br>(a) S = 0, A: Signal(S), B: Wait(S)<br>(b) S= 1, A: Signal(S), B: Wait(S)<br>(c) S = 0/1, A: Signal(S), B: Wait(S)<br>(d) none of these | CO4 | d |
| | | A counting semaphore has a value of (-8) in a certain period. So, what is the number of waiting process (es)?<br>(a) 8<br>(b) 7<br>(c) 9<br>(d) none | CO4 | a |
| | | At a particular time of computation the value of a counting semaphore is 7.Then 20 P operations and 14 V operations were completed on this semaphore. The resulting value of the semaphore is?<br>(a) 1<br>(b) 3<br>(c) 2<br>(d) None | CO4 | a |
| **Q.No:6** | | A system uses FIFO policy for page replacement. It has 5 page frames with no pages loaded to begin with. The system first accesses 100 distinct pages in some order and then access the same 100 pages but now in the reverse order. How many page faults will occur?<br>(a) 180<br>(b) 190<br>(c) 200 | CO6 | d |

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| | | (d) none | | |
| | | A system has 3 co-operating processes sharing a resource with 4 instances. If each process needs maximum 2 instances, then deadlock will occur or not?<br>(a) yes<br>(b) no<br>(c) can't say | CO4 | b |
| | | Suppose, s is a Semaphore with the initial value of 2. There are four active processes A, B, C and D are executing in the following order: A: P(s), B: P(s), C: V(s), D: P(s), C: P(s). At the end how many processes will be blocked?<br>(a) 0<br>(b) 2<br>(c) 1<br>(d) none | CO3 | c |
| | | medium term scheduler taken place<br>(a) between ready state and execution state<br>(b) between start state and ready state<br>(c) between execution state and termination state<br>(d) between execution state and waiting state<br>(e) none of these | CO1 | e |
| **Q.No:7** | | Which of the following does not interrupt a running process?<br>(A) A Device (B) Timer<br>(C) Scheduler process (D) Power failure | CO1 | c and d |
| | | The operating system maintains a _____ table that keeps track of how many frames have been allocated, how many are there, and how many are available.<br>a) memory<br>b) mapping<br>c) page<br>d) frame | CO6 | d |
| | | In real time operating system _____<br>a) process scheduling can be done only once<br>b) all processes have the same priority<br>c) kernel is not required<br>d) a task must be serviced by its deadline period | CO3 | d |
| | | Program always deals with:<br>A. logical address<br>B. absolute address<br>C. physical address<br>D. relative address | CO6 | a |

**SECTION-B(Answer Any Three Questions. Each Question carries 12 Marks)**

**Time: 1 Hour and 30 Minutes**
**(3×12=36 Marks)**

<table>
<tr><th>Question No</th><th>Question</th><th>CO Mapping (Each question should be from the same CO(s))</th></tr>
<tr><td>Q.No:8</td><td>Consider the following snapshot of a system with 5 processes (P1 … P5) and 4 resources (R1 … R4). Total instance R1: 6, R2: 7, R3: 12 and R4: 12
<table>
<tr><th></th><th colspan="4">Current allocation</th><th colspan="4">Maximum need</th></tr>
<tr><th>Process</th><th>R1</th><th>R2</th><th>R3</th><th>R4</th><th>R1</th><th>R2</th><th>R3</th><th>R4</th></tr>
<tr><td>P1</td><td>0</td><td>0</td><td>1</td><td>2</td><td>0</td><td>0</td><td>1</td><td>2</td></tr>
<tr><td>P2</td><td>2</td><td>0</td><td>0</td><td>0</td><td>2</td><td>7</td><td>5</td><td>0</td></tr>
<tr><td>P3</td><td>0</td><td>0</td><td>3</td><td>4</td><td>6</td><td>6</td><td>5</td><td>6</td></tr>
<tr><td>P4</td><td>2</td><td>3</td><td>5</td><td>4</td><td>4</td><td>3</td><td>5</td><td>6</td></tr>
<tr><td>P5</td><td>0</td><td>3</td><td>3</td><td>2</td><td>0</td><td>6</td><td>5</td><td>2</td></tr>
</table>
(a) Check that the aforementioned system can reach in safe state or not? If it is in safe state, then what is the safe sequence?<br>(b) If P4 requests (0 1 0 1) resources, then it can be granted or not?</td><td>CO4, CO5, CO6,</td></tr>
<tr><td></td><td>Consider a disk system with 3000 cylinders, numbered 0 to 2999. The drive is currently serving a request at cylinder 143, and the previous request was at cylinder 125. The requests to access the cylinders occur in the following sequence:<br><br>86, 1470, 913, 1774, 948, 1509, 1022, 1750, 130.<br><br>Starting from the current head position, evaluate the time taken to satisfy all the requests using shortest seek time first policy if it takes 1ms to move from one cylinder to adjacent one? Also show the total head movement (in cylinders) for servicing the request for C-SCAN and C-LOOK policy?</td><td></td></tr>
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| | In the memory four partitions are there of size 4KB, 8KB, 20KB and 2KB (in order) respectively. Total 8 processes arrive at time 0 with memory request size( in Bytes) and usage time (in ms) as given in the following table: Calculate the time at which process P7 will be completed if the Best fit method is used for fixed sized partitioned memory.<br><br>Illustrate the concept of segmentation memory management scheme in detail with diagram. | |

| Req. No | P1 | P2 | P3 | P4 | P5 | P6 | P7 |
|---|---|---|---|---|---|---|---|
| Req. Size | 2K | 14K | 3K | 6K | 6K | 10K | 7K |
| Usage time | 4 | 10 | 2 | 8 | 4 | 1 | 8 |

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| **Q.No:9** | Why SJF and SRTF cannot be applied in real world solution? What is the solution for that? – discuss briefly | CO3, CO4 |
| | The arrival time and duration of the CPU and I/O bursts for each of the three processes A, B, and C are given in the table below. Each process has a CPU burst followed by an I/O burst followed by another CPU burst. Assume that each process has its own I/O resource.<br><br>The multi programmed operating system uses the shortest remaining time first (SRTF) scheduling. What are the completion times of the processes A, B and C and find individual waiting times of processes? | |
| | During this lockdown period, you are playing Ludo with your n number of family members where, n < 5. Assume that all the tokens are in the starting square and consider following scenarios: If the outcome of the dice is 6 (six), then you can move your one token and get the chance to play dice again; otherwise, you can move your one token and give the dice to the next player.<br>Think of the players as processes which should be synchronized. You are required to write a code for it using semaphore. Your answer should first (i) list (in English sentences) what synchronization and/or what critical section | |

| Process | Arrival time | CPU burst | I/O burst | CPU burst |
|---|---|---|---|---|
| A | 0 | 1 | 4 | 4 |
| B | 2 | 3 | 3 | 1 |
| C | 3 | 1 | 3 | 1 |

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| | problems you have to solve, (ii) define what semaphore(s) you have to use (including their initial value(s)), and (iii) then write the pseudo code for it. You can assume that wait and signal are variables as primitive calls on a semaphore with their usual meanings. | |
| **Q.No:10** | An operating system uses the Banker's algorithm for deadlock avoidance when managing the allocation of three resource types X, Y, and Z to three processes A,B, and C. The allocation of the resources and Maximum requirements.<br><br>The contents of Available vector is 3,2,2 for X, Y and Z respectively.<br><br>(a) Whether the current state is safe? If so find a Safe Sequence.<br><br>(b) A request 2,0,0 by Process B is generated. Whether the request will be granted? | CO4, CO2, CO5 |
| | Consider following three processes arrived in a system.<br><br>What will be the order of execution, response time and waiting time for the processes, if the scheduling algorithm is<br><br>(i) Round Robin with time slice as 4 time units<br>(ii) SJF | |

| Process | Allocation | | | Max | | |
|---|---|---|---|---|---|---|
| | X | Y | Z | X | Y | Z |
| A | 0 | 0 | 1 | 8 | 4 | 3 |
| B | 3 | 2 | 0 | 6 | 2 | 0 |
| C | 2 | 1 | 1 | 3 | 3 | 3 |

| Process | Execution Time | Arrival time |
|---|---|---|
| A | 12 | 1 |
| B | 3 | 2 |
| C | 4 | 3 |

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| | (a) Discuss various memory allocation techniques in a real memory system and make an analysis of memory wastage.<br>(b) Consider a logical address space of 32 pages of 1024 words mapped into memory of 32 frames.<br>(i) How many bits are there in the logical address?<br>(ii) How many bits are there in physical address? | |
| **Q.No:11** | Consider the set of 5 processes whose arrival time and burst time are given below.<br>Process id / Arrival time / Burst time<br>P1 / 0 / 3<br>P2 / 1 / 5<br>P3 / 2 / 1<br>P4 / 2 / 4<br>P5 / 4 / 5<br>If the CPU scheduling policy is FCFS and context switching time is 1 time unit, then,<br>i. Find the CPU utilization.<br>ii. What will be the CPU Utilization in case the context switching time is 2 time units?<br>(Hint: CPU Utilization is the percentage of time the CPU is busy in execution) | CO3, CO4,CO5, CO6 |
| | (a) What is meant by domain of protection? How is it implemented by the operating system?<br>(b) Consider the following page reference string: 7 0 1 2 0 3 0 4 2 3 0 3 2 1 2 0 1 7 0 1. How many page faults would occur for the Optimal replacement algorithm and LRU with three frames assuming that all frames are initially empty? | |

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| | (a) Explain 1st readers-writers problem and write its solution using semaphore.<br><br>(b) If the virtual address space is represented by 32 bits, the page size is 4Kbyte, the size of the physical memory is 64Mbyte and only 2 bits are used as control bits, calculate the size of the page table. | |