

**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. 4th Sem

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

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

**Time:30 Minutes (7×2=14 Marks)**

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| **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?  (a) stack  (b) address space  (c) file descriptor table  (d) message queue | CO3 | (a) |
|  |  | Which of the following may block running process?  (a) fork  (b) read  (c) down  (d) both fork and down  (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.  (a) 2.5 sec  (b) 2.15 sec  (c) 2.9 sec  (d) 3 sec | CO4 | c |
|  |  | If fixed priority scheduling is used in different queues in multilevel queue scheduling then  (a) Starvation can occur  (b) Starvation cannot occur  (c) All the queues will get almost fair chance  (d) none of these | CO4 | a |
| **Q.No:2** |  | Which of the following disk scheduling strategies is likely to give the best throughput?  (a) Farthest cylinder next  (b) Nearest cylinder next  (c) First come first served  (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,  (a) i+j\*k  (b) (i+j)/k  (c) i+j/k  (d) i+2\*j/k | CO3 | c |
|  |  | What will be the minimum RAM size so that the following program can run?  **Untitled.jpg**  (a) 16 kb  (b) 15 kb  (c) 14 kb  (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.  (a) 0  (b) 1  (c) 2  (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?  (a) 10014  (b) 10024  (c) fc224  (d) ff243 | CO5 | a |
|  |  | Which of the following is false in context of inter process communication?  (a) communicate with each other  (b) share same address space  (c) synchronize their actions  (d) passing message with each other | CO3 | b |
|  |  | **Untitled.jpg**  (a) 8  (b) 7  (c) 10  (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  (a) 3008 micro sec.  (b) 5004 micro sec.  (c) 4008 micro sec.  (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?  (a) 5  (b) 6  (c) 4  (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:  (a) n(n+1)/2  (b) n  (c) 3^n-1  (d) 2^n-1 | CO1 | d |
|  |  | Consider the following statements:  S1: CPU is a non preemptive resource  S2: I/O device is preemptible  Which of the above statements is/are true?  (a) S1  (b) S2  (c) both are true  (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?  (a) 2MB  (b) 4MB  (c) 6 MB  (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, 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?  (a) 3  (b) 2  (c) 1  (d) 4 | CO3 | b |
|  |  | Consider the following cooperating processes p1 and p2 using shared variable i = 11  **Method Used by P1**  begin  **A**  i++;  printf(“%d”,i);  end  **Method Used by P2**  begin  printf(“%d”,i);  **B**  end  Write the code for **A** and **B** so that output will be 9 10.  (a) S = 0, A: Signal(S), B: Wait(S)  (b) S= 1, A: Signal(S), B: Wait(S)  (c) S = 0/1, A: Signal(S), B: Wait(S)  (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)?  (a) 8  (b) 7  (c) 9  (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?  (a) 1  (b) 3  (c) 2  (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?  (a) 180  (b) 190  (c) 200  (d) none | CO6 | d |
|  |  | 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?  (a) yes  (b) no  (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?  (a) 0  (b) 2  (c) 1  (d) none | CO3 | c |
|  |  | medium term scheduler taken place  (a) between ready state and execution state  (b) between start state and ready state  (c) between execution state and termination state  (d) between execution state and waiting state  (e) none of these | CO1 | e |
| **Q.No:7** |  |  | 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.  a) memory  b) mapping  c) page  d) frame | CO6 | d |
|  |  | In real time operating system \_\_\_\_\_\_\_\_\_\_\_\_  a) process scheduling can be done only once  b) all processes have the same priority  c) kernel is not required  d) a task must be serviced by its deadline period | CO3 | d |
|  |  | Program always deals with:  A. logical address  B. absolute address  C. physical address  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)**

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| **Question No** | **Question** | **CO Mapping**  **(Each question should be from the same CO(s))** |
| **Q.No:8** | Consider the following snapshot of a system with 5 processes (P1 … P5) and 4 resources (R1 … R4). Available resources R1: 2, R2: 1, R3: 1 and R4: 0  11.jpg  Where, X = Roll no % 6  (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?  (b) If P4 requests (0 1 0 1) resources, then it can be granted or not? | CO4, CO5, CO6, |
| Consider the following snapshot of a system with 5 processes (P1 … P5) and 4 resources (R1 … R4). Available resources R1: 2, R2: 1, R3: Y and R4: 0  11.jpg  Where, X = Roll no % 6  (a) For which value of Y, the aforementioned system can reach in safe state? What is the safe sequence?  (b) If P4 requests (0 1 0 1) resources, then it can be granted or not? |
| (a) A system is having ‘N’ user processes. Each requires 4 unit of resource ‘R’. What is the minimum number of units of ‘R’ such that no deadlock occurs? N = right most significant digit of your Roll No.( ex:- for Roll No. 180854, N=4) (5 marks)  (b) Consider the following program segments for two different processes executing concurrently:    Variable X starts at zero and is a shared variable. Variables A and B are not shared variables. If Processes Pl and P2 execute only once at any speed, what is the largest possible value of X? Justify. (marks 4)  (c) Suppose, in a distributed environment, where multiple computers or systems provide various services to the end users. Therefore, tasks or jobs need to be distributed among the systems such a way that the vast number of users gets efficient services. In such scenario, the users may demand various metrics like, low computation cost, less waiting time and so on. Here, we are planning to use such existing CPU scheduling algorithm which can provide high throughput where, others metrics are less bother to us.  1st Explain why the selected existing CPU scheduling algorithm is suitable for the aforementioned environment? (marks 3) |
| **Q.No:9** | Consider process arrival as given below where N = right most significant digit of your Roll No.( ex:- for Roll No. 180854, N=4):   |  |  |  |  | | --- | --- | --- | --- | | Process | CPU Burst Time | Arrival Time | Priority | | A | 10 | 0 | 3 | | B | 17 | 5 | 2 | | C | 5 | 9 | N | | D | 2 | N | 1 | | E | 9 | 7 | 6 |   Calculate the following for *priority (preemptive)* and *round robin* (time quantum = 3 ms) CPU scheduling algorithm:   1. Average waiting time 2. Turnaround time for each process 3. Order of completion   (*Note:-lower digits indicate higher priority*)  *(12 marks)* | 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.   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Process | Arrival time | CPU burst | I/O burst | CPU burst | | P1 | 0 | 1 | 4 | Roll no % 5 | | P2 | 2 | 3 | 3 | 1 | | P3 | 3 | 1 | 3 | 1 |     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? |
| Consider process arrival as given below where N = right most significant digit of your Roll No.( ex:- for Roll No. 180854, N=4):   |  |  |  |  | | --- | --- | --- | --- | | Process | CPU Burst Time | Arrival Time | Priority | | A | 10 | 0 | 4 | | B | 15 | 5 | 7 | | C | 2 | 9 | N | | D | 8 | N | 1 | | E | 6 | 7 | 6 |   Calculate the following for *priority (preemptive)* and *round robin* (time quantum = 3 ms) CPU scheduling algorithm:  i. Average waiting time  ii. Turnaround time for each process  iii. Order of completion  (*Note:-higher digits indicate higher priority*) *(12 marks)* |
| **Q.No:10** | 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.  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 what synchronization and/or what critical section 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. (10 marks) | CO4, CO2, CO5 |
| Assume a set *X of n* processes, where *n* < 20 with process IDs [0, *n*-1]. A function *void Barrier(int pid)* is defined over the set *X* such that if any one process *P0* in *X* with a process ID *pid0* calls *Barrier(int pid0)*, it is blocked until all processes in *X* have called *Barrier( )* with their process IDs. Write the pseudo code for the *Barrier( )* function using only semaphores, you cannot use any shared variables; however, you can use any number of semaphores.  First list the semaphores that you will use and their initial values (don’t worry about who creates and initializes them). Then show the code for *Barrier( )* that uses the semaphores declared by making P/Wait and V/Signal calls on them. (10 marks) |
| In a civilized society, a gentle man lives with his spouse and his elderly parents. Due to old age, his parents cannot be left alone in the house. So, at least any one of the spouse must be available in the house. Write a synchronize solution using semaphore for this problem. (10 marks) |
| **Q.No:11** | (a) Why SJF and SRTF cannot be applied in real world solution? What is the solution for that? – discuss briefly (marks 3)    (b) Consider the following page reference strings: 7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, X, 0, 1. What will be the difference in page faults between optimal page replacement and LRU with three empty frames? Note: X = roll no % 7 (marks 5)  (c) A machine has 56-bit virtual addresses and 32-bit physical addresses. The size of a page is 4K. Find the number of entries needed for a conventional page table. (marks 4) | CO3, CO4,CO5, CO6 |
| (a)  **11.jpg**  (6 marks)  (b)  (i) A machine has 64-bit virtual addresses and 32-bit physical addresses. The size of a page is 8K. Find the number of entries needed for a conventional page table. (3 marks)  (ii)A machine has 72-bit virtual addresses. Page size of 1GB, and page table entry is 8B. Show the virtual address split w.r.t page number and page offset. (3 marks) |
| (a) A machine has 64-bit virtual addresses. Page size of 16KB, and page table entry is 4B. Show the virtual address split w.r.t page number and page offset. (3 marks)  (b) Explain static and dynamic linking with proper example. (3 marks)  (c)11.jpg  Where x = roll no % 9 (marks 6) |