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Indian Institute of Information Technology Ranchi

Department of CSE

B. Tech End Semester Examination – Autumn Semester 2022-23

Semester: 5	**Branch: CSE**
Course Code: CS3003	**Course Name: Operating System**

QUESTION PAPER

Duration: 3 hrs.	**Max Marks: 100**

Instructions:
(1) Answer all the questions. Number in [ ] indicates marks.
(2) Scientific calculator is allowed in the examination.
(3) Any missing data can be assumed suitably.

1	(a)	What is Kernel in Operating System (O.S.)? Briefly describe the types of Kernel.	[4]
1	(b)	There are some data given as: logical address is L bits, 2^M pages, and 512 frames. Now find out the offset bit, physical address bit, physical address space in terms of L and M?	[5]
1	(c)	The aging algorithm with Smoothing factor (α) = 0.6 is being used to predict run times. The previous four runs from oldest to most recent are 50, 20, 40, and 15 ms. The initial estimate is 20 ms. What is the prediction of the next time?	[3]
2	(a)	What are the various 6 types of disk scheduling algorithms? Explain with examples.	[6]
	(b)	We wish to schedule three processes P1, P2 and P3 on a single processor system. The priorities, CPU time requirements and arrival times of the processes are as shown below. Process | Priority | CPU time required | Arrival time P1 | 9(Highest) | 20 | 5 P2 | 8 | 10 | 3 P3 | 6(Lowest) | 15 | 0 We have a choice of preemptive or non-preemptive scheduling. What are the waiting times of P2 using preemptive and non-preemptive scheduling algorithm, respectively?	[4]
2	(c)	Each process P_i, i= 1,2,3,….9 is coded as follows: Repeat {critical section} V (Mtext) Forever The code for P_{10} is identical except that it uses V (Mutex) in place of P (Mutex). What is the largest number of process that can be inside the critical section at any moment?	[3]
3	(a)	How Memory Management is done in Operating System and what are the different memory partitioning techniques? Explain with diagrams.	[6]
	(b)	What are the two types of Synchronization problem? What are the classical problems of Synchronization and also describe the any of them with their solution.	[6]
4	(a)	Consider three processes (Process id 0, 1, 2, respectively) with compute time burst 8, 6 and 3 times units. All processes arrive at time zero. Consider the Shortest Remaining Time First (SRTF) scheduling algorithm. In SRTF ties are broken by giving priority to the process with the lowest process id. Draw the Gantt chart and also calculate the average turn-around time and average waiting time.	[6]
	(b)	The address sequence generated by tracing a particular program execution in a pure demand paging system with 100 records per page with 1 free main memory frame is	[5]

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		recorded as follows: 0100, 0200, 0430, 0499, 0510, 0530, 0560, 0120, 0220, 0240, 0260, 0320 and 0370. What is the number of page faults?	
	(c)	Assume that there are 3 page frames which are initially empty. If the page reference string is 1, 2, 3, 4, 2, 1,5,3,2 4, 6. Calculate the number of page faults using the Optimal page replacement policy.	[4]
	(a)	If an instruction takes I micro-sec, and with page fault, it takes an additional J micro-sec. What is the effective memory access time, if a page fault occurs on an average every K instruction?	[5]
	(b)	What is Belady's Anomaly in O.S? Which algorithms are suffered from it?	[3]
	(c)	What are the necessary conditions for Deadlock? Explain with example and diagram.	[4]
6	(a)	What is the Long-term, Short-term and Medium-term scheduler? Explain with diagram.	[5]
	(b)	Consider six memory partitions of size 200KB, 400KB, 600KB, 500KB, 300KB and 250KB. These partitions need to be allocated to four processes of sizes 357KB, 210KB, 468KB and 491KB in that order. If the best fit algorithm is used, which partitions are not allotted to any process?	[5]
	(c)	What are the differences between Paging and Segmentation?	[4]
7	(a)	Consider a System with a total of 150 units of memory, allocated to three processes as shown in the table: Process | Max need | Hold P1 | 70 | 45 P2 | 60 | 40 P3 | 60 | 15 Apply the Banker's algorithm to determine whether it would be safe to grant each of the following requests. If yes, indicate a Sequence of terminations that could be guaranteed possible. If no, show the reduction of the Resulting allocation table. (i) A fourth process arrives, with a maximum memory need of 60 and an initial need of 25units. (ii) A fourth process arrives, with a maximum memory need of 60 and an initial need of 35units.	[6]
	(b)	Consider a system having m resources of same type. These resources are shared by 3 processes P1, P2 and P3, which have peak demands of 3, 4 and 6 respectively. For what value of m deadlock will not occur?	[3]
	(c)	Derive the formula for effective memory access time for Translation Look Aside Buffer and N levels of paging in terms of m (main memory access time), c (TLB access time) and x (page fault rate).	[4]
8	(a)	Write short notes on Thrashing and Virtual Memory.	[4]
	(b)	A disc has 200 tracks (numbered 0 through 199) and initially head starts at track number 53. Calculate total seek time if we are using Shortest seek time first and C-LOOK disk scheduling algorithms. 98, 183, 37, 122, 14, 124, 65, 67	[5]

***All the best! ***