Question Paper

Exam Date & Time: 28-Jun-2024 (02:30 PM - 05:30 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

Department of Information and Communication Technology
IV Semester B.Tech(CCE) Degree Make-up Examinations June 2024

OPERATING SYSTEMS [ICT 2227]

Marks: 50 **Duration: 180 mins.**

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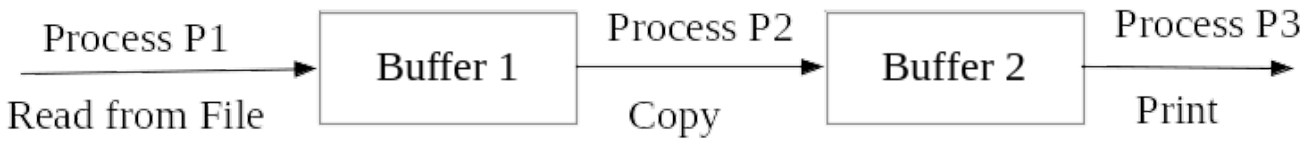
Answer all the questions. Section Duration: 180 mins

Missing Data suitably be assumed

1) Consider three processes (P1, P2, and P3) that are involved in printing a file (as shown below). Process P1 reads the data from the disc into Buffer 1, then Process P2 copies the data from Buffer 1 to Buffer 2, and finally Process P3 prints the data from Buffer 2. Assume all three processes operate on one file at a time, and buffers 1 and 2 have a capacity of 1 file/record. Write pseudo code as a solution that uses semaphores to coordinate the three processes. Represent the operations executed in the critical section, using proper comment lines. (5)



2) Write pseudo code to demonstrate how Dekker's algorithm can be used as a solution to the critical section problem for two processes P0 and P1. (3)

3) With a neat diagram, illustrate and explain how operating system manages the ready queue while serving system services like handling I/O requests and interrupts. (2)

4) The memory access time is 1 nanosecond for a read operation with a hit in TLB, 5 nanoseconds for a read operation with a miss in TLB, 2 nanoseconds for a write operation with a hit in TLB and 10 nanoseconds for a write operation with a miss in TLB. Execution of a sequence of instructions involves 100 instruction fetch operations, 60 memory read operations and 40 memory write operations. The TLB hit ratio is 90%. Determine the average memory access time (in nanoseconds) in executing the sequence of all instructions by providing detailed steps. (5)

5) Consider processes P={S1, S2, S3} and resources R={R1, R2, R3} with one instance of resource type R1, two instances of resource type R2 and one instance of resource type R3. Currently S1 is holding an instance of R2 and waiting for instance of R1. S2 is holding an instance of resource type R1, one instance of resource type R2 and waiting for an instance of resource type of R3. S3 is holding an instance of resource type R3. (3)

(a) Draw Resource Allocation Graph

(b) Check is there any deadlock. Justify your answer.

(c) If there is a deadlock, write how to make it deadlock free. If not, write all possible safe sequences.

6) Consider the set of processes burst time in milliseconds as given below. Find the waiting time, response time and turnaround time of each process using round robin scheduling with time quantum 3ms. (2)

Process	Arrival Time	Burst Time
P1	3	3
P2	2	5

P3	1	8
P4	0	10

7) Consider a swapping system in which memory consists of the following fragment sizes in order: 10K, 4K, 20K, 18K, 7K, 9K, 12K, and 15K. Which fragment is taken for successive segment requests of: a) 12K b) 10K c) 9K for first fit, best fit, worst fit memory allocation algorithms? Which memory allocation algorithm is a better solution for applications that need very large process sizes? Justify your answer. (5)

8) Consider the following snapshot of a system: (3)

	Allocation				**Max**				**Available**			
	A	**B**	**C**	**D**	**A**	**B**	**C**	**D**	**A**	**B**	**C**	**D**
P0	0	0	1	2	0	0	1	2	1	5	2	0
P1	1	0	0	0	1	7	5	0				
P2	1	3	5	4	2	3	5	6				
P3	0	6	3	2	0	6	5	2				
P4	0	0	1	4	0	6	5	6				

Use Banker's algorithm and answer the following:

a. Find need matrix.

b. Is the system in a safe state? If yes, write the safe sequence, show steps.

c. If a request from process *P*1 arrives for (0,4,2,0), can the request be granted immediately? If yes, show the steps.

9) With a neat diagram explain the working of medium-term scheduler. (2)

10) Compare and contrast three methods of managing free disk space: Linked List (Free List), Grouping, and Counting. Discuss their advantages and disadvantages in managing free disk space with an example for each. (5)

11) With the help of neat diagram show the stack implementation of LRU page replacement algorithm for the memory references:0300, 0632, 0101, 0812, 0302, 0303, 0304, 0301, 0811, 0302, 0303,0304,0301,0810,0302,0303,0304,0301,0809,0302,0305. Find the reference string if there exist100 bytes per page, calculate the number of page faults and page hits, show frame allocation. (3)

12) Differentiate between the following frame allocation strategies of virtual memory. (2)

(a)Equal allocation and Proportional allocation

(b)Global allocation and Local Allocation

13) Suppose a disk drive has 5000 cylinders, numbered 0 to 4999. Consider a disk queue with requests for i/o to blocks on cylinder: 106, 1370, 814, 1671, 863, 1416, 1149, 1620, 140. Assume that disk head is currently at cylinder 122. With neat diagram show the trace of SSTF, SCAN, and C-SCAN, disk scheduling algorithm. Assume the direction of movement is towards the higher cylinders in case of SCAN and C-SCAN. Calculate the head movement and the average seek time for each of these disk scheduling algorithms (5)

14) (3)

Given a computer system with a memory access time of 150 ns and a page fault rate of 0.08 (or 8%), calculate the effective memory access time if the page fault service time is 25 ms. Explain the significance of this effective memory access time value in terms of system performance. How would you optimize the system to reduce the effective memory access time and improve overall performance?

15) Consider a real time system having three periodic tasks with their periods and execution times as $T_i(p_i, e_i)$: T1(20,3) T2(5,2), T3(10,2). Check is it RMA schedulable? Draw the pre-emptive RMA (Rate Monotonic Analysis) schedule of jobs on single processor for timeline from 0-20units. (2)

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