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KUMARAGURU
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MCA DEGREE EXAMINATIONS: NOV / DEC 2024

(Regulation 2024)

First Semester

MASTER OF COMPUTER APPLICATIONS

24CAT504: Operating Systems

COURSE OUTCOMES

CO1: Understand the core components and functions of operating systems.

CO2: Apply process management techniques to manage and schedule processes effectively.

CO3: Analyze different mechanisms for process synchronization and deadlock management in solving synchronization problems.

CO4: Implementation of appropriate memory management techniques in operating systems.

CO5: Analyze and apply core operating system concepts and techniques through case studies, focusing on process management, synchronization, and memory management.

Time: Three Hours **Maximum Marks: 100**

PART A (4*20 = 80 Marks)

1.	a)	Explain the critical section problem with an example.	5	CO3	[K_2]
	b)	How can the Dining Philosophers problem be solved to ensure that no deadlock occurs, and all philosophers get a chance to eat?	5	CO3	[K_3]

Scenario: A company's server system runs four critical processes P_0, P_1, P_2 and P_3, which use three types of resources: A (10 instances), B (7 instances), and C (7 instances). The system administrator needs to ensure that resource allocation is safe, and no deadlock occurs during peak operations.

The current state of allocation, maximum resource demand, and available resources is shown below:

	Allocation	*Max*	*Available*
	A B C	***A B C***	***A B C***
P_0	1 0 1	7 5 3	3 2 2
P_1	2 1 1	3 2 2	
P_2	3 1 0	9 0 2	
P_3	2 2 1	4 3 3	

Answer the following questions using Banker's algorithm:

	c)	Calculate the need matrix.	2	CO3	[K_3]
	d)	Is the system in a safe state? If yes, write the safe sequence.	8	CO3	[K_4]
2.	a)	Explain the core components of an operating system and its key functions.	5	CO1	[K_2]
	b)	Differentiate between multiprogramming and multitasking with examples.	5	CO1	[K_3]
	c)	What are the key components of a Linux system?	5	CO1	[K_2]
	d)	Write short notes on multiprocessing architecture.	5	CO1	[K_2]
3.	a)	Illustrate the process life cycle with a diagram.	5	CO2	[K_2]
	b)	Describe the differences between the many-to-one and one-to-one multithreading models.	5	CO2	[K_3]

Scenario: A computer system is managing a set of processes that need to be scheduled for execution on a single CPU core. The processes are listed below, along with their arrival times and burst times (the time they need to complete their execution):

Process	Arrival Time	Burst time
P1	0	5
P2	1	3
P3	2	8
P4	3	6
P5	4	2

You are the system scheduler, and your task is to schedule these processes using two different CPU scheduling algorithms given below and evaluate their performance:

	c)	Calculate the average waiting time and average turnaround time for the processes using First-Come-First-Served (FCFS) and Shortest Job First (SF) algorithms.	6	CO2	[K_3]

	d)	Compare the performance of the FCFS and SJF algorithms in terms of average waiting time and average turnaround time. Which algorithm performs better, and why?	4	CO2	[K_4]
4.	a)	Differentiate between internal and external fragmentation with examples.	5	CO4	[K_3]
	b)	What is demand paging and how does it help in virtual memory management?	5	CO4	[K_2]
	c)	How does memory management work in Linux?	5	CO4	[K_3]
	d)	Discuss the concept of a working set in memory management.	5	CO4	[K_2]

Answer any ONE Question

PART B (1*20 = 20 Marks)

5.	a)	A mobile app development team is deciding between Android and iOS for their flagship application. Analyze the memory management and synchronization capabilities of both platforms to recommend the better option.	10	CO5	[K_4]
	b)	Consider the following page reference string: 3,2,1,3,4,1,6,2,4,3,4,2,1,4,5,2,1,3,4 Assuming demand paging with three frames, analyze how many page faults would occur using the following page replacement algorithms and compare the efficiency of the two algorithms based on the results: • First-In-First-Out (FIFO) replacement • Least Recently Used (LRU) replacement	10	CO5	[K_4]

OR

6.	a)	Analyze the key features of the Android OS. How has it evolved to become the dominant mobile operating system?	10	CO5	[K_4]
	b)	Suppose that a disk drive has 200 cylinders numbered 0 to 199. The read-write head is currently serving a request at cylinder 55. The queue of pending requests is as follows: 93, 176, 42, 148, 27, 14, 180	10	CO5	[K_4]

Starting from the current head position, analyze the total distance that the disk arm moves to satisfy all the pending requests using SCAN and C-SCAN algorithms and compare their performance.

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