25MCPC503

MANGALORE INSTITUTE OF TECHNOLOGY & ENGINEERING

(A Unit of Rajalaxmi Education Trust®, Mangalore)
Autonomous Institute affiliated to VTU, Belagavi, Approved by AICTE, New Delhi
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Model Question Paper

First Semester MCA Degree Examination

Operating System

Time: 3 Hours **Max. Marks: 100**

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M: Marks, L: RBT (Revised Bloom's Taxonomy) level, C: Course outcomes.

<table>
<tr><th colspan="3">Module -1</th><th>M</th><th>L</th><th>C</th></tr>
<tr><td rowspan="2">Q1</td><td>a.</td><td>Discuss the different types of system calls commonly found in operating systems. Describe suitable examples of system calls for each category.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td>b.</td><td>Describe the relationship between the kernel, system calls, and application programs in an operating system. Illustrate this relationship with a neat diagram.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td rowspan="2">Q2</td><td>a.</td><td>Describe the booting process of an operating system by outlining the major steps. Discuss what happens when an operating system fails to boot properly.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><td>b.</td><td>Discuss the importance of storage structure in an operating system. Outline the hierarchy of storage devices with appropriate details.</td><td>10</td><td>L2</td><td>CO1</td></tr>
<tr><th colspan="6">Module- 2</th></tr>
<tr><td rowspan="2">Q3</td><td>a.</td><td>Apply the concept of a process to a real-time or multitasking operating system scenario. Illustrate how a process moves through different states during its lifecycle with the state transitions using a suitable diagram.</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td>b.</td><td>Utilize different CPU scheduling algorithms—First-Come-First-Served (FCFS), Shortest Job First (SJF), Priority Scheduling (with priorities of 3, 1, 4, and 3 for processes P1, P2, P3, and P4, respectively), and Round Robin (with a time quantum of 3)—to a system with four processes: P1, P2, P3, and P4. Given the arrival and burst times of P1 (0, 5), P2 (1, 7), P3 (3, 3), and P4 (5, 6), calculate and compare the average waiting time and turnaround time for each algorithm.</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="6">OR</th></tr>
<tr><td rowspan="2">Q4</td><td>a.</td><td>Apply the concept of a Process Control Block (PCB) to demonstrate how an operating system manages processes. Show how the PCB is used during process creation, execution, and termination, and illustrate the significance of each component stored in the PCB with appropriate examples.</td><td>10</td><td>L3</td><td>CO3</td></tr>
<tr><td>b.</td><td>Given four processes - P1, P2, P3, and P4 - arriving at times 0, 1, 2, and 3 respectively and requiring 5, 7, 6, and 4 time units, apply the Round Robin scheduling algorithm with a CPU quantum of 2 time units, First-Come-First-Serve (FCFS), and Shortest Job First (SJF) to draw Gantt charts. Determine the process completion sequence and calculate the average waiting time for each scheduling method.</td><td>10</td><td>L3</td><td>CO2</td></tr>
<tr><th colspan="6">Module - 3</th></tr>
<tr><td>Q5</td><td>a.</td><td>Using Banker's algorithm, answer the following questions:
<table>
<tr><th>Processes</th><th>Allocation</th><th>Max</th><th>Available</th></tr>
<tr><td></td><td>A B C D</td><td>A B C D</td><td>A B C D</td></tr>
</table>
</td><td>10</td><td>L3</td><td>CO2</td></tr>
</table>

P0	6 0 1 2	4 0 0 1	3 2 1 1
P1	2 7 5 0	1 1 0 0	
P2	2 3 5 6	1 2 5 4	
P3	1 6 5 3	0 6 3 3	
P4	1 6 5 6	0 2 1 2	

How many resources of type A, B, C, D are there?
Calculate the need matrix? Is the system in a safe state? If it is, find the safe sequence.

b. Implement a semaphore-based solution for the Dining Philosophers Problem. Show how each semaphore regulates the actions of philosophers during thinking and eating. Illustrate potential issues such as deadlock or starvation that may arise in the design, and use appropriate strategies to mitigate these problems.
10 L3 CO3

OR

Q6

a. Implement Peterson's solution to achieve mutual exclusion for two processes, P1 and P2, that share a common variable and require access to a critical section. Write the pseudocode or program (in a language of your choice) to realize Peterson's algorithm. Show how the implementation enforces mutual exclusion and prevents race conditions during concurrent execution.
10 L3 CO3

b. Consider the following snapshot of a system:
10 L3 CO2

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

Using the banker's algorithm, determine whether or not each of the following states is unsafe. If the state is safe, illustrate the order in which the processes may complete. Otherwise, illustrate why the state is unsafe.
i. Available = (0,3,0,1) ii. Available = (1,0,0,2)

Module - 4

Q7

a. Write a shell script that performs the following actions: Change the ownership of the file report.txt, located in /home/user/documents, from the current user to user3. Use the appropriate command to verify the ownership change by displaying the file's long listing information. In the script, include comments to explain how changing file ownership affects access and permissions. Add a section in the script to discuss potential security implications of incorrect file ownership settings and the significance of maintaining the correct ownership.
10 L3 CO4

b. Write a shell script that performs the following actions: Set the umask value to ensure that new files are created with permissions of 644 and new directories with permissions of 755. Create a new file and a new directory to verify that the default permissions are correct. Include comments in the script to explain how the umask value affects default permissions for files and directories. Discuss the potential issues related to setting an incorrect umask value, particularly regarding system security and access control.
10 L3 CO5

OR

Q8

a. The task is to locate all files with the .log extension that were modified in the last 7 days within the /var/log directory. Make use of the find command to search for these files and list them. Discuss how the find command helps in managing files based on their attributes and modification times. Explain how this capability
10 L3 CO4

		supports system administration tasks.			
	b.	You are responsible for organizing a directory structure where multiple links are used to provide flexible access to important configuration files. Specifically, you need to manage access to a central configuration file named settings.conf by creating both hard and symbolic links to it. Write a shell script to: Create a hard link and a symbolic link to settings.conf, Display the inode numbers of the original file, the hard link, and the symbolic link to verify their relationships. The script should include comments that explain what happens to the file system when the hard link is deleted and when the symbolic link is deleted.	10	L3	CO5
Module - 5					
Q9	a.	You are logging output from a script and want to discard any error messages generated during the execution, while still saving standard output to a file. Build the script with the appropriate redirection. Explain how redirection works in this scenario, the purpose of /dev/null, and why you would use this approach for logging.	10	L3	CO4
	b.	Construct a script that accepts two command line arguments: a filename and a word to search for within that file. The script should output the number of occurrences of the word in the file. Use command line arguments to perform the search operation. Discuss how to handle and validate command line arguments in a script. Explain the use of positional parameters and its advantages.	10	L3	CO5
OR					
Q10	a.	Build a script that iterates over a list of directories and prints the number of files in each directory. Explain how for loops work in shell scripting and how to handle list iteration and file counting.	10	L3	CO4
	b.	Write a shell script that lists all files in a specified directory that meet the following criteria: Files must start with the letter "d" and end with ".txt". Files starting with "debug_" should be excluded from the list. Build the command or series of commands to achieve the desired file listing. Explain how you used wildcards (e.g., *, ?) in the script to filter the files based on these patterns. Discuss how different wildcards (like * or []) can affect the search results. Specifically describe how you managed the exclusion of files that start with "debug_" while including the rest that match the criteria.	10	L3	CO5

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