BH/K/TX

Reg. No: 22BCI0189

Final Assessment Test – November 2024

VIT® Vellore Institute of Technology

Course: **BCSE303L - Operating Systems**

Class NBR(s): **1552/1564/1568/1576/1580/1585/1590/ 1596/1604/1608/1613/1618/1621/1625/1630/1634/ 1637/1642/1647/1654/1658/1663**

Slot: **B2+TB2**

Time: **Three Hours**

Max. Marks: **100**

- **KEEPING MOBILE PHONE/ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE**
- **DON'T WRITE ANYTHING ON THE QUESTION PAPER**

Answer ALL Questions

(10 X 10 = 100 Marks)

1. Considering the diverse architectures of operating systems, analyze the common structural elements they share. How do these commonalities impact the efficiency and functionality of various operating systems, and what might this suggest about the future development of OS design?

2. Evaluate the use of monolithic kernels in real-time scenarios compared to microkernels. In your analysis, discuss specific situations where a monolithic kernel may be preferred and critically assess its advantages over microkernels. Additionally, explore the mechanisms of interaction between user programs and system services in a monolithic architecture, while also considering the potential disadvantages of this approach. How might these factors influence the choice of kernel design in modern operating systems?

3. Consider the processes with their arrival time, burst time, priority and time quantum. Apply SJF, Priority (consider greatest number as highest priority) and round robin CPU scheduling algorithms for the below processes. Assume that the time quantum for round robin algorithm is 4ms. Identify which of the scheduling algorithm produces less amount of average response time, average waiting time and average turnaround time.

Processes	Arrival Time(ms)	Burst Time(ms)	Priority
P1	0	8	3
P2	1	7	2
P3	4	5	1
P4	7	3	4

4. Assume that there are 3 resources A,B and C. There are 4 processes P0 to P3. At time T_0, we have the following snapshot of the system.

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P0	1	0	1	2	1	1	2	1	1
P1	2	1	2	5	4	4			
P2	3	0	0	3	1	1			
P3	1	0	1	1	1	1			

Check whether the system is in safe state and also describe how will you recover the system from deadlock.

5. "Analyze the potential for a race condition in a banking system where multiple users (you, your father, and the banker) are concurrently accessing the account balance through deposit and withdraw functions. How can this situation lead to inconsistencies in the account balance? Evaluate various strategies to prevent race conditions in this scenario, and propose a robust solution that balances performance and data integrity. What broader implications do these solutions have for concurrent programming in financial applications?"

6. Critically assess various strategies for reducing both internal and external fragmentation in memory management systems. In your analysis, evaluate the effectiveness of techniques such as paging, segmentation, and dynamic memory allocation. Propose an integrated approach that combines multiple strategies to optimize memory utilization, and discuss the potential trade-offs involved in your solution.

7. Analyze the provided memory reference string:
5, 2, 4, 3, 5, 6, 7, 5, 3, 4, 5, 6, 4, 3, 7, 5, 6, 3, 0, 1.
Evaluate the number of page faults and replacements that occur under three different page replacement algorithms: FIFO with 5 frames, LRU with 6 frames, and Optimal with 5 frames. In your evaluation, discuss how each algorithm's design influences its performance in this scenario, and reflect on the broader implications of your findings for memory management strategies in operating systems.

8. Explore the different types of virtualization, such as hardware virtualization, operating system virtualization, and para virtualization. Analyze the unique benefits and challenges associated with each type, and evaluate their impact on system efficiency and resource management. In what scenarios might one type of virtualization be more advantageous than the others? Justify your recommendations with real-world examples.

9.a) Investigate the various types of directory structures used in file systems. Analyze the advantages and disadvantages of each type in terms of efficiency, usability, and scalability. How do these directory structures influence file retrieval and management in different operating systems? Propose a scenario where a specific type of directory would be most effective, and justify your choice based on system requirements.

OR

9.b) Examine the various file allocation methods. Analyze the trade-offs of each method in terms of disk space efficiency, access speed, and fragmentation. In what situations might one allocation method be preferred over the others? Discuss how your findings could impact the design of file systems in modern computing environments.

10.a) Given a disk with 200 tracks (0 to 199) and the current head position at track 150, analyze the total number of tracks traversed to satisfy a series of requests (120, 78, 90, 38, 160, 63, 198, 10, and 75) using different disk scheduling algorithms: FCFS, SSTF, SCAN, and C-SCAN. Evaluate how each algorithm's strategy influences the total distance travelled by the disk head. Based on your analysis, which algorithm would you recommend for optimizing performance in high-traffic scenarios, and why? Discuss the implications of your choice for system responsiveness and efficiency.

OR

10.b) Explore the concept of capability-based systems in the context of security and resource management. Analyze how capabilities differ from traditional access control mechanisms, and evaluate their advantages and disadvantages in real-world applications. In what scenarios would implementing a capability-based approach be more beneficial than conventional methods? Provide examples to support your analysis, and discuss the potential challenges organizations might face when transitioning to capability-based systems.

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