

Course: B. Tech. Computer Science and Engineering (AI/ML)
Subject: Operating Systems, Subject Code: ETCS-202
Semester: IV

Time: 03 Hours

Max Marks: 70

Instructions to the Students:

1. This Question paper consists of two Sections. All sections are compulsory.
2. Section A comprises 10 questions of short answer type. All questions are compulsory. Each question carries 02 marks.
3. Section B comprises 8 long answer type questions out of which students must attempt any 5. Each question carries 10 marks.
4. Do not write anything on the question paper.

Q. No.	SECTION -A (SHORT ANSWER TYPE QUESTIONS)	Marks
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| 1. | a | Distinguish between the client-server and peer-to-peer models of distributed systems | (2) |
| | b | What are the five major activities of an operating system with regard to process management? | (2) |
| | c | Explain the difference between pre-emptive and nonpreemptive scheduling | (2) |
| | d | Why is it important for the scheduler to distinguish I/O-bound programs from CPU-bound programs? | (2) |
| | e | Describe two kernel data structures in which race conditions are possible. Be sure to include a description of how a race condition can occur. | (2) |
| | f | Why are page sizes always powers of 2? | (2) |
| | g | List three examples of deadlocks that are not related to a computer system environment | (2) |
| | h | Discuss the hardware support required to support demand paging. | (2) |
| | i | What are the advantages and disadvantages of providing mandatory locks instead of advisory locks whose use is left to users' discretion? | (2) |
| | j | What are the advantages and disadvantages of supporting memorymapped I/O to device control registers? | (2) |

SECTION -B (LONG ANSWER TYPE QUESTIONS)

2. a. Describe the differences between symmetric and asymmetric multiprocessing. What are three advantages and one disadvantage of multiprocessor systems? (5)
2. b. What is the main advantage of the layered approach to system design? What are the disadvantages of the layered approach? (5)
3. Suppose that the following processes arrive for execution at the times indicated. Each process will run for the amount of time listed. In answering the questions, use nonpreemptive scheduling, and base all decisions on the information you have at the time the decision must be made. (10)

Process	Arrival Time	Burst Time
P ₁	0.0	8
P ₂	0.4	4
P ₃	1.0	1

- a. What is the average turnaround time for these processes with the FCFS scheduling algorithm?
- b. What is the average turnaround time for these processes with the SJF scheduling algorithm?
- c. The SJF algorithm is supposed to improve performance, but notice that we chose to run process P1 at time 0 because we did not know that two shorter processes would arrive soon. Compute what the average turnaround time will be if the CPU is left idle for the first 1 unit and then SJF scheduling is used. Remember that processes P1 and P2 are waiting during this idle time, so their waiting time may increase. This algorithm could be called future-knowledge scheduling.

4. Consider the following page reference string: (10)

1, 2, 3, 4, 2, 1, 5, 6, 2, 1, 2, 3, 7, 6, 3, 2, 1, 2, 3, 6.

How many page faults would occur for the following replacement algorithms assuming one, two, three, four, five, six, and seven frames? Remember that all frames are initially empty, so your first unique pages will cost one fault each.

- LRU replacement
- FIFO replacement
- Optimal replacement

5. Consider a logical address space of 8 pages of 1024 words each, mapped on to a physical memory of 32 frames. how many bits are there in the logical address? How many bits are there in the physical address? (10)

6. What is virtual memory? Explain Suppose we have a demand paged memory. The page table is held in registers. it takes 8ms to service a page fault if an empty page is available or the replaced page is not modified, and 20ms if the replaced page is modified. memory access time is 100ns. Assume that the page to be replaced is modified 70% of the time. what is the maximum acceptable page fault rate for an effective access time of no more than 200ns? (10)

7. Consider the following snapshot of a system: (10)

	<u>Allocation</u>	<u>Max</u>	<u>Available</u>
	ABCD	ABCD	ABCD
P ₀	0 0 1 2	0 0 1 2	1 5 2 0
P ₁	1 0 0 0	1 7 5 0	
P ₂	1 3 5 4	2 3 5 6	
P ₃	0 6 3 2	0 6 5 2	
P ₄	0 0 1 4	0 6 5 6	

Answer the following questions using the banker's algorithm:

a. What is the content of the matrix Need?

b. Is the system in a safe state?

c. If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately?

8. a. When multiple interrupts from different devices appear at about the same time, a priority scheme could be used to determine the order in which the interrupts would be serviced. Discuss what issues need to be considered in assigning priorities to different interrupts. (5)
- b. What are the various kinds of performance overhead associated with servicing an interrupt? (5)

9. Explain Window NT architecture and file system. (10)

===END OF PAPER===