Question Paper

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER EXAMINATIONS, MAY 2024

OPERATING SYSTEMS [CSE 2226]

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

Answer all the questions.

Instructions to Candidates: Answer ALL questions Missing data may be suitably assumed

1) A)	Explain four benefits of multithreading. Point out two examples in which multithreading provides better performance than a single-threaded solution. Identify and explain the system calls that needs to be executed by a command interpreter or shell in order to start a new process with different code.	(5)
B)	Differentiate the two communication methods with respect to its operation, primitives, and properties of communication link in message passing system associated with naming feature.	(3)
C)	Identify the associated queues, required scheduler and the state of process when the process needs to be (a) Executed by CPU (b) Loaded into main memory.	(2)

2) A) Assume that the following processes are scheduled using round robin scheduling algorithm with a time quantum of 2 milliseconds.   (5)

Process	Arrival Time	Burst Time
P2	0	6
P4	0	1
P3	5	3
P6	5	4
P5	6	9
P1	7	15

(a) Show the scheduling order of the processes using ready queue and Gantt chart.

(b) Determine the turnaround time and waiting time for each process.

(c) Mention the number of context switches.

B) For the table given below, use Banker's Algorithm and identify safe sequence   (3)

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

| P4 | 0 6 3 2 | 0 6 5 2 | |
| P5 | 0 0 1 4 | 0 6 5 6 | |

C) Show how semaphore can be used to control access to a resource with finite number of instances by multiple processes with an example. (2)

3)

A) (i) Assume a demand-paged memory. Consider memory access time of 100 nanoseconds. It take 8 milliseconds to service a page fault if an empty page is available or the replaced page is not modified. What is the maximum acceptable page-fault rate for an effective access time of no more than 200 nanoseconds? (2Marks) (5)

(ii) Consider the following page reference string:4, 3, 2, 1, 2, 1, 5, 4, 6, 7, 2, 3, 1, 6, 4, 3, 1, 3, 4, 6. How many page faults would occur for the following replacement algorithms, with three page frames? Remember that all frames are initially empty. Show the frame contents in each step. (3marks)

(a) LRU replacement

(b) Optimal algorithm

B) Consider a page table with Translation look-aside buffer(TLB) added, explain how the TLB will improve the memory access time with a neat labelled diagram. Also, calculate the effective memory reference time for a page table with TLB and 75 percent of all page-table references are found in the TLBs. Assume that finding a page-table entry in the TLBs takes 2 nanoseconds, if the entry is present. (3)

C) Define stub and explain its role in implementing the dynamic linking feature of Operating system. (2)

4)

A) a) Sketch a neat diagram depicting segmentation hardware. Consider the segmentation table given below. (5)

Segment No.	Base	Limit
0	1400	1000
1	6300	400
2	4300	400
3	3200	1100
4	4700	1000

Which of the following references will produce trap addressing error? Provide justification for each.

(i) segment 2, byte 53

(ii) segment 0, byte 1222

b) Consider a computer system with a 64-bit logical address and 4KB page size. The system supports upto 256KB of physical memory. How many entries are there in each of the following tables? Justify your answer.

(i) A conventional single-level page table

(ii) An inverted page table

B) Suppose that a disk drive has 200 cylinders, numbered 0 to 199. The drive is currently serving a request at cylinder 50. The queue of pending requests, in order, is: 82,170,43,140,24,16,190. Starting from the current head position, calculate what is the total distance (in cylinders) that the disk arm moves to satisfy all the pending requests for SSTF disk-scheduling algorithm? Explain how the SSTF algorithm works and depict the sequence in a graph. (3)

C) Consider three domains (D1, D2, D3) and four files (f1,f2, f3, f4). Represent the set of access rights (2)

using an access matrix for the following

(a) Any file can be read by a process running in the D1 domain and can only be written into f1.

(b) A process in D2 can write to f1 and f3 and can execute f4.

(c) A process executing in domain D2 can switch to domain D1 or to domain D3.

(d) A process executing in domain D3 can copy the read operation into any entry associated with file f2

5)   Explain different information associated with an open file.   (4)

A)

B)   With an appropriate diagram write a short note on Tree-Structured Directories.   (3)

C)   Explain the MULTICS system's protection domain ring structure and how it supports the domain switching.   (3)

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