Name:

Enrolment No:

UPES

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES

End Semester Examination, December 2018

Programme: B.Tech (CSE)-All IBM Courses | **Semester:** III

Course: Operating Systems | **Course Code:** CSEG 2007

Time: 03 hrs. | **Max. Marks:** 100

Instructions: Attempt all questions carefully.

SECTION A

S. No.		Marks	CO
Q 1	What is external fragmentation? How the problem of external fragmentation can be solved?	4	CO4
Q 2	Differentiate between multi-programming, multiprocessing and multitasking systems.	4	CO1
Q 3	How many processes are created by fork () fork () fork ()? Explain your answer too.	4	CO2
Q 4	What are semaphores? Explain binary and counting semaphores with suitable examples.	4	CO3
Q 5	What is file system? Which is better NTFS or FAT32 and why?	4	CO5

SECTION B

S. No.		Marks	CO
Q 6	We wish to schedule three processes P1, P2 and P3 on a uniprocessor system. The priorities, CPU time requirements and arrival times of the processes are as shown below: **Process** — **Priority** — **CPU Time Required** — **Arrival time** (hh:mm:ss) P1 — 10(highest) — 20 sec — 00:00:05 P2 — 9 — 10 sec — 00:00:03 P3 — 8 (lowest) — 15 sec — 00:00:00 We have a choice of preemptive or non-preemptive scheduling. In preemptive scheduling, a late-arriving higher priority process can preempt a currently running process with lower priority. In non-preemptive scheduling, a late-arriving higher priority process must wait for the currently executing process to complete before it can be scheduled on the processor. What are the turnaround times of P2 using preemptive and non-preemptive scheduling respectively?	10	CO2

Process	Priority	CPU Time Required	Arrival time (hh:mm:ss)
P1	10(highest)	20 sec	00:00:05
P2	9	10 sec	00:00:03
P3	8 (lowest)	15 sec	00:00:00

Q 7

Describe the banker's algorithm. For the following snapshot, find the safe sequence using Banker's algorithm.

	Allocation			Max			Available		
	A	B	C	A	B	C	A	B	C
P_0	0	0	2	0	0	4	1	0	2
P_1	1	0	0	2	0	1			
P_2	1	3	5	1	3	7			
P_3	6	3	2	8	4	2			
P_4	1	4	3	1	5	7			

I) Is the system in safe state? If yes, show safe sequence.
II) If a request from process P_2 arrives for (0, 0, 2), Can the request be granted immediately?

10 | **CO3**

Q 8

a) Discuss the booting process sequence in order to explain how operating system takes control on computer system.
b) Compare and Contrast between timesharing and real time systems

10 | **CO1**

Q 9

Consider the following page reference string -1, 2, 3, 4, 5, 5, 3, 4, 1, 6, 7, 8, 7, 8, 9, 7, 8, 9, 5, 4, 5, 4, 2. How many page faults would occur for the following replacement algorithm, assuming three frames? (all frames are initially empty)
I) FIFO Replacement II) LRU Replacement III) Optimal Replacement

OR

Describe the segmented paging scheme of memory management and the hardware required to support the system. Suppose that a total of 64 MB memory is available in a system. This memory space is partitioned in to 8 fixed size slot of 8 MB each. Assume 8 processes are currently requesting memory usage with sizes indicated as below : 2 MB, 4 MB, 3 MB,7 MB, 9 MB, 1 MB, 8 MB
Calculate the size of memory wasted due to external and internal fragmentation.

10 | **CO4**

SECTION-C

Q 10

I) Assuming a 1 KB page size, what are the page numbers and offsets for the following address references (provided as decimal numbers):

a. 2375
b. 19366
c. 30000
d. 256
e. 16385

II) Consider 100 Hz CPU, three processes, which require 10, 20 and 30 secs and arrive at times 0, 2 and 6 secs respectively. How many context switches are needed if the operating system implements a shortest remaining time first (SRTF) scheduling algorithm? Do not count the context switches at time zero

20 | **CO4/ CO2**

	and at the end. Consider cycles elapsed for one context switch is 10 cycles. Compute percentage of time spent in context switching.		
Q 11	Consider the disk queue with I/O requests on the following cylinders in their arriving order: 67, 12, 15, 45, 48, 50, 109, 89, 56, 59, 34, 88, 130, 24. The disk head is assumed be at cylinder 80 and moving in the direction of increasing number of cylinders. The disk consists of total 150 cylinders. (a) Show the disk head movement with diagram using FCFS, SSTF, LOOK and C-SCAN scheduling algorithms. Calculate the total head movements. (b) Requests on cylinders 60, 85, and 90 arrive while processing at 50. What will happen to these new requests according to all the above scheduling algorithms? **OR** Consider a disk has 200 cylinders, numbered from 0 to 199. At some time the disk arm is at cylinder 100, and moving towards right direction. There is a queue of disk access requests for cylinders 30, 85, 110, 100, 105, 126, 135,55 and 195. Show the disk head movement with diagram using FCFS, SSTF, C-LOOK and C-SCAN scheduling algorithms. Calculate the total head movements.	**20**	**CO6**

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SECTION A

S. No.		Marks	CO
Q 1	Define Operating System. List the objectives of an operating system.	4	CO1
Q 2	With a neat diagram, explain various states of a process. Explain about various fields of Process Control Block.	4	CO2
Q 3	What is the cause of thrashing? How does the system detect thrashing? Once it detects thrashing, what can the system do to eliminate this problem?	4	CO4
Q 4	What is the meaning of the term busy waiting? What other kinds of waiting are there in an operating system? Can busy waiting be avoided altogether?	4	CO3
Q 5	What are the different methods to handle deadlocks? Discuss deadlock prevention method.	4	CO3

SECTION B

S. No.		Marks	CO
Q 6	Consider the following CPU processes with arrival times (in milliseconds) and length of CPU bursts (in milliseconds) except for process P4 as given below: **Process Arrival Time Burst Time** P1 0 5 P2 1 1 P3 3 3 P4 4 x If the average waiting time across all processes is 2 milliseconds and pre-emptive shortest remaining time first scheduling algorithm is used to schedule the processes, then find the value of x?	10	CO2
Q 7	Consider the following snapshot of a system **Allocation** (A B C D) / **Max** (A B C D) / **Available** (A B C D) P0 0 0 1 2 / 0 0 1 2 / 1 5 2 0 P1 1 0 0 0 / 1 7 5 0 P2 1 3 5 4 / 2 3 5 6 P3 0 6 3 2 / 0 6 5 2 P4 0 0 1 4 / 0 6 5 6 i) Obtain the Need Matrix. ii) Is the system in a safe state? iii) If a request from process P1 arrives for (0, 4, 2, 0), can the request be immediately granted?	10	CO3
Q 8	Let a disk drive has 5000 cylinders from 0 to 4999. Currently drive is at	10	CO6

	143rd cylinder, and the previous request was at cylinder 125. Queue of pending request in FIFO order I 86, 1470, 913, 1774, 948, 1509, 1022, 130. What is the total distance the disk arm moves to satisfy all the pending requests for each of the following disk scheduling algorithms from current position I) FCFS II) SCAN III) LOOK.		
Q 9	Consider the virtual page reference string 1, 2, 3, 2, 4, 1, 3, 2, 4, 1 On a demand paged virtual memory system running on a computer system that main memory size of 3 pages frames, which are initially empty. How many page faults occur with LRU than with the optimal page replacement policy? **OR** Assume that a main memory with only 4 pages, each of 16 bytes, is initially empty. The CPU generates the following sequence of virtual addresses and uses the Least Recently Used (LRU) page replacement policy: 0, 4, 8, 20, 24, 36, 44, 12, 68, 72, 80, 84, 28, 32, 88, 92. How many page faults does this sequence cause? What are the page numbers of the pages present in the main memory at the end of the sequence?	**10**	**CO4**
SECTION-C			
Q 10	Consider a uniprocessor system executing three tasks T1, T2 and T3, each of which is composed of an infinite sequence of jobs (or instances) which arrive periodically at intervals of 3, 7 and 20 milliseconds, respectively. The priority of each task is the inverse of its period and the available tasks are scheduled in order of priority, with the highest priority task scheduled first. Each instance of T1, T2 and T3 requires an execution time of 1, 2 and 4 milliseconds, respectively. Given that all tasks initially arrive at the beginning of the 1st milliseconds and task preemptions are allowed, find out the completion time of first instance of T3.	**20**	**CO2**
Q 11	In a virtual memory system, size of virtual address is 32-bit, size of physical address is 30-bit, page size is 4 Kbyte and size of each page table entry is 32-bit. The main memory is byte addressable. Find out the maximum number of bits that can be used for storing protection and other information in each page table entry? **OR** Consider a system with a two-level paging scheme in which a regular memory access takes 150 nanoseconds, and servicing a page fault takes 8 milliseconds. An average instruction takes 100 nanoseconds of CPU time, and two memory accesses. The TLB hit ratio is 90%, and the page fault rate is one in every 10,000 instructions. What is the effective average instruction execution time?	**20**	**CO4**