PRANVEER SINGH INSTITUTE OF TECHNOLOGY KANPUR

Even Semester Session 2022-23 Pre-University

B. Tech. IVth Semester

Operating Systems (KCS-401)

CO Number	Course Outcome
CO1	Define [L1: Remember] the concept of different kinds of Operating system and associated terminology.
CO2	Explain [L2: Understand] the Operating system operations and its working principles/algorithms.
CO3	Applying [L3: Apply] scheduling and resource management algorithms to calculate various parameter of resource utilization.
CO4	Analyze [L4: Analyze] the different operating system algorithms.

Time: 3 Hrs. M. M. 100

Section A

Q1. Attempt all questions: **(2X10 =20 Marks)**

a) Define Operating system and list various services of operating system. CO1

b) Define Real time systems and its types. CO1

c) Explain wait-for-graph with suitable example. CO2

d) Explain belady's anomaly with suitable example. CO2

e) Explain the communication models of inter process communication. CO2

f) Define Monolithic and microkernel architectures. CO2

g) Explain two level directory structure with suitable diagram. CO2

h) Define the term catching with suitable example. CO2

i) Define various system calls related to process creation and process termination. CO1

j) Explain starvation problem and its solution with suitable example. CO1 CO2

Section B

Q2. Attempt all questions. **(10X3 = 30 Marks)**

(a) Suppose the following disk request sequence (track numbers) for a disk with 100 tracks is given: 45, 20, 90, 10, 50, 60, 80, 25, 70. Assume that the initial position of the R/W head is on track 50. Determine how much farther the R/W head will travel if the Shortest Seek Time First (SSTF) algorithm is employed instead of the Elevator algorithm. (Assume that elevator algorithm moves towards track 100 when it starts execution) CO4

b-(i) Explain the term file system management and file structure. Explain various file access mechanisms with their operations. CO2

OR

(ii) Explain the term RAID and its characteristics. Also, explain various RAID levels with suitable diagram. CO2

c-(i) Explain Dekker's solution and Peterson's solution for critical section problem. CO2

OR

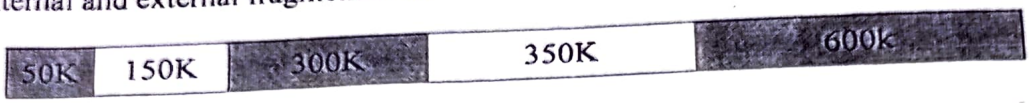
(ii) Explain producer consumer problem in detail. Also, propose the solution of producer consumer problem using semaphore. CO2

Section C

(10X5 = 50 Marks)

Q3. Attempt all questions:

a i) Consider the following heap in which white regions are not in use which gray regions are in use. The sequence of requests for blocks of size 300, 25, 125, 50. Apply various allocation techniques and identify which algorithm supports the optimal allocation. Also, explain the terms internal and external fragmentation. CO3



OR

ii) a) Consider a paging hardware with a TLB. Assume that the entire page table and all the pages are in the physical memory. It takes 10 milliseconds to search the TLB and 80 milliseconds to access the physical memory. If the TLB hit ratio is 0.6, then calculate the effective memory access time. CO3

b) Consider a system having logical address space of 256 MB, Physical address is represented using 27 bits and physical address space is divided among total 4 KB frames. Calculate the number of pages in logical address space.

b i) Explain the concept of multithreading along with its advantages. Also, explain various types of multithreading models. CO2

OR

ii) Explain the concept of memory segmentation with suitable diagram. Also, explain hardware support for segmentation with suitable diagram. CO2

c i) a) A demand paging system takes 100 time units to service a page fault and 300 time units to replace a dirty page. Memory access time is 1 time unit. The probability of a page fault is p. In case of a page fault, the probability of page being dirty is also p. Calculate the value of 'p' if it is observed that the effective access time is 3 time units. CO3

b) Suppose an instruction takes 'a' microseconds to access the memory and a page fault takes an additional 'b' microseconds, calculate the effective instruction time if on an average a page fault occurs after every 'c' instruction.

OR

ii) Consider the given snapshot of a system. CO3

Process	ALLOCATION				MAX				AVAILABLE			
	A	B	C	D	A	B	C	D	A	B	C	D
P-1	0	0	1	2	0	0	1	2	1	5	2	0
P-2	1	0	0	0	1	7	5	0				
P-3	1	3	5	4	2	3	5	6				
P-4	0	6	3	2	0	6	5	2				
P-5	0	0	1	4	0	6	5	6				

Apply Banker's Algorithm to answer the followings:

a) Calculate need matrix.
b) Is system in safe state?
c) Can the request from P-1 arrives for (0,4,2,0) be granted immediately? Show the new system state.

d i) Consider the following **reference string** of referenced page numbers: CO4

7, 0, 1, 2, 0, 3, 0, 4, 2, 3, 0, 3, 2, 1, 2, 0, 1, 7, 0, 1

Compare the performance of FIFO, LRU and Optimal page replacement algorithms w.r.t number of page faults. (Assume page frame size=4).

OR

ii) Consider the following 6 processes along with their arrival time and burst time. Compare the performance of SRTF scheduling and round robin scheduling algorithm (quantum=2) w.r.t average turnaround time. CO4

Process Id	Arrival time	Burst time
P1	0	7
P2	1	5
P3	2	3
P4	3	1
P5	4	2
P6	5	1

e i) Explain dinning philosopher problem in detail. Also, propose the solution of dinning philosopher problem using semaphore. CO2

OR

ii) Explain sleeping barber problem in detail. Also, propose the solution of sleeping barber problem using semaphore. CO2