BENNETT UNIVERSITY
THE TIMES GROUP

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END-TERM EXAMINATION, EVEN SEMESTER MAY 2024

COURSE CODE: CSET209 **MAX. DURATION** **2 HRS**
COURSE NAME: OPERATING SYSTEMS
PROGRAM: B.Tech **TOTAL MARKS** **40**

Mapping of Questions to Course and Program Outcomes										
Q. No.	A1	A2	A3	A4	A5	B1	B2	B3	C1	C2
CO	2	2	1	1	1	2	3	2	2	2
PO	1	1	2	2	3	1	3	2	2	2
BTL*1	1	4	1	2	5	3	5	5	5	5

GENERAL INSTRUCTIONS: -

1. Do not write anything on the question paper except **name, enrolment number** and **department/school.**
2. Carrying mobile phones, smartwatches and any other non-permissible materials in the examination hall is an act of **UFM.**

COURSE INSTRUCTIONS:

a) All questions are compulsory. There are three sections A, B and C. Attempt all questions of each section at one place.

b) Write your **Group number and batch number on the top of your answer sheets.**

SECTION A **Max Marks: 15**

A1. Define the following in one or two lines. **(1*3 = 3 Marks)**

1. Hypervisor
2. Belady's anomaly
3. Deadlock ignorance

A2. Consider a system with 3 processes P1, P2, and P3 each requiring 3 tape drives. What is the minimum number of tape drives such that deadlock will never arise? **(2 Marks)**

A3. Write at least four parameters by which a multilevel feedback queue scheduler is defined. **(2 Marks)**

A4. Examine the key differences between fixed partitioning and the dynamic partitioning memory management schemes in terms of: partitioning approach, constraints on process size, degree of multiprogramming and the fragmentation. **(4 Marks)**

A5. (a). A counting semaphore S is initialized to 10. Then, 6 P operations and 4 V operations are performed on S. What is the final value of S? **(1 Mark)**

(b) 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, the effective memory access time (in milliseconds) is? **(1 Mark)**

(c) Draw a neat and clean diagram depicting the translation of a logical address into physical address when TLB is used in the paging scheme. **(2 marks)**

SECTION B

Max Marks: 15

B1. (a) Describe the Readers-Writers problem. If the structure of the Reader process is as shown below then what will be the structure of the Writer process? **(3 Marks)**

The structure of a reader process

```
do {
    wait(mutex);
    read_count++;
    if (read_count == 1)        //Line 4
        wait(rw_mutex);
    signal(mutex);

    /* reading is performed */

    wait(mutex);
    read count--;
    if (read_count == 0)        //Line 10
    signal(rw_mutex);
    signal(mutex);
} while (true);
```

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(b) In line 4 of reader process, suppose "`read_count == 1`" is replaced with "`read_count == 50`" then how many maximum number of readers can enter into their critical section when one writer is already executing in its critical section? Justify your answer. **(2 Marks)**

B2. (a) Consider a demand-paged virtual memory system with a main memory size of 3-page frames, initially empty. The virtual page reference string is given as follows:

1, 2, 3, 2, 4, 1, 3, 2, 4, 1

Determine the number of page faults using the following page replacement policies: LRU (Least Recently Used), and OPTIMAL. Show each page fault clearly for each policy. **(2 Marks)**

(b) Describe the structure of a Remote Procedure Call (RPC) and briefly explain how parameter passing is handled in this context. **(3 Marks)**

B3. (a) Describe the deadlock situation along with the necessary conditions for deadlock to occur in a system. **(3 Marks)**

(b) Considering a machine with 128 KB logical address space, 512 KB physical address space and page size used is of 16 KB, calculate the following. **(0.5+0.5+1 = 2 Marks)**

i. No. of bits used for the logical address.
ii. No. of bits used for the physical address.
iii. Size of the page table in bytes.

SECTION C

Max 10 Marks

C1. (a) Consider a disk queue with requests for I/O to blocks on cylinders 47, 38, 121, 191, 87, 11, 92, 10. The C-LOOK scheduling algorithm is used. The head is initially at cylinder number 63 moving towards larger cylinder numbers on its servicing pass. The cylinders are numbered from 0 to 199. With a suitable disk scheduling time-line diagram, calculate the total number of head movements. **(2 Marks)**

(b) Consider the set of 5 processes whose arrival time and burst time are given below. If the CPU scheduling policy is Round Robin with time quantum = 2 unit,

i Draw a Gantt chart depicting the scheduling of processes.
ii Calculate the average turnaround time.
iii Calculate average waiting time. **(1+1+1=3 Marks)**

Process id	Arrival Time	Burst Time
P1	0	5
P2	1	3
P3	2	1
P4	3	2
P5	4	3

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C2 a) To manage the allocation of three resources X, Y, Z, an operating system is using Banker's algorithm. At any point of time, three processes are running in the system P1, P2 and P3. The current system state is as follows. **(1+2=3 Marks)**

Processes	Allocation (X Y Z)	Max (X Y Z)
P1	0 0 1	8 4 3
P2	3 2 0	6 2 0
P3	2 1 1	3 3 3

Currently, 3 instances of X, 2 instances of Y and 2 instances of Z are still available. Based on this data answer the following questions.

i Is the system currently in safe state? If yes, give at least one safe sequence.

ii Suppose, at this point of time, a request by P1 comes for X, Y, and Z as (0, 0, 2). Determine whether this request will be accepted or not.

b) Given fixed memory partitions of 100 K, 500 K, 200 K, 300 K and 600 K (in order). Fill the following table based on how would worst-fit algorithms place processes of 212 K, 417 K, 112 K and 426 K (in order)? **(2 Marks)**

Process no.	Process size	Block size	Fragment
1	212 K		
2	417 K		
3	112 K		
4	426 K		

-ALL THE BEST-