मोतीलाल नेहरू राष्ट्रीय प्रौद्योगिकी संस्थान इलाहाबाद
प्रयागराज 211004(भारत)
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Department of Computer Science & Engineering
Mid Semester Examination Session 2024-25 (Even)

Programme:	*B.Tech*	**Branch:**	*CSE*	**Semester:**	*VI*
Course Name:	*Operating System*				
Course Code:	*CSN14401*	**Max. Marks:**	25		
Time:	*90 Minutes*	**Registration No.:**			

Instructions (related to question paper):
1. *All questions are compulsory and Attempt the questions strictly in sequential order.*
2. *Calculator is allowed.*
3. ***Write assumptions correctly (in case you feel data is missing)***

Q1 Consider the following CPU scheduling scheme. When a process is created, or has become ready after a wait, it is added to the end of the ready queue. When the scheduler runs, it selects a ready process with the highest priorities (ties are broken using FCFS ordering) and gives the CPU to this process, a maximum of 5 ms. At the end of 5 ms (or earlier, if the process wants, e.g., do an I/O), the scheduler runs again. If the process is pre-empted, it is added to the end of the ready queue. The priority of a process is calculated using the following rules. (The lower the number, the higher the priority.)

- The initial priority of all processes is 5.
- At the end of a CPU burst, the priority of the process that was running is updated using the formula:

$$new\ priority = old\ priority + 2 * (5 - duration\ of\ CPU\ burst\ just\ completed)$$

Processes P1, P2, P3, and P4 are created simultaneously in the said order. Their CPU-burst and I/O-burst time spans are given in the following table. Assume that all I/O requests are for different devices.

Process		CPU	I/O	CPU	I/O	CPU
P1	5	2	1	2		
P2	5	7	3	4		
P3	5	2	3	5	4	8
P4	5	6	1	4	2	1

A. Draw the **Gantt chart** for the processes. Show also the changes to the ready queue at each stage. **[4 Marks]**

B. Calculate the **cumulative waiting time** and **turnaround time** for each process. **[4 Marks]**

Q2 Based on the discussions in class, answer the following questions briefly:

a. Can two processes be concurrently executing the same program executable? **[1 mark]**

b. Can two running processes share the complete process image in physical memory (not just parts of it)? **[1 mark]**

c. Consider a parent process P that has forked a child process C. Now, P terminates while C is still running.

i. Will C immediately become a zombie? **[1 mark]**

ii. Will P immediately become a zombie, until reaped by its parent? **[1 mark]**

d. Consider a parent process that has forked a child in the code snippet below.

```
int count = 0;
ret = fork();
if(ret == 0) {
printf("count in child=%d\n", count);
}
else {
count = 1;
}
```

The parent executes the statement "count = 1" before the child executes for the first time. Now, what is the value of count printed by the code above? Explain briefly. **[1 mark]**

e. Explain step by step procedure of executing "ls" command on linux command prompt. You have to clearly explain the role of all the system calls which are required for this. **[3 marks]**

Q3

A. Discuss the role and significance of inodes within a file system. Additionally, compare and contrast different disk allocation methods, highlighting their respective advantages and disadvantages. **[3 marks]**

B. Consider a disk with cylinders numbered from 0 to 199. The disk head is initially at cylinder 53 and is moving towards higher-numbered cylinders. The queue of pending requests in the order they arrived is: 98, 183, 41, 122, 14, 124, 65, 67

i. Using the C-SCAN, C-Look and SSTF scheduling algorithms, determine the sequence in which the requests are serviced. **[3 Marks]**

ii. Calculate the total number of cylinders the disk head moves to service all the requests for above scheduling algorithms. **[3 Marks]**

---ALL THE BEST---

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Department of Computer Science & Engineering
End Semester Examination Session 2024-25 (Even)

Programme:	*B.Tech*	**Branch:**	*CSE*	**Semester:**	*VI*
Course Name:	*Operating System*				
Course Code:	CSN14401	**Max. Marks:**	50		
Time:	*150 Minutes*	**Registration No.:**	2022068		

Instructions (related to question paper):
1. *All questions are compulsory and attempt the questions strictly in sequential order.*
2. *Calculator is allowed.*
3. ***Write assumptions correctly (in case you feel data is missing)***

		Marks
Q1	A. Consider a logical address space of 8 pages, where each page contains 1024 bytes. The system uses byte-addressable memory and maps the logical address space onto a physical memory consisting of 32 frames.How many bits are required in the logical address? How many bits are required in the physical address? B. Five batch jobs — A, B, C, D, and E — arrive at a computer processor nearly simultaneously. Their estimated execution times (in minutes) are 10, 6, 2, 4, and 8, respectively. Their priorities are assigned as 3, 5, 2, 1, and 4, where a higher number indicates a higher priority (i.e., priority 5 is the highest). Using the following CPU scheduling algorithms, compute the **turnaround time** and **waiting time** for each job. Ignore any overhead from process switching. Identify which scheduling algorithm results in the **minimum average waiting time**. 1. **Round Robin** (Assume a multiprocessing environment with a time quantum of 2 minutes, and all jobs get equal CPU time in turns). 2. **Priority Scheduling** (Assume a single-processor system where only one job runs at a time until completion. Jobs are scheduled in order of decreasing priority). 3. **First-Come, First-Served (FCFS)** (Assume a single-processor system. Since all jobs arrive almost simultaneously, use the order A, B, C, D, E). 4. **Shortest Job First (SJF)** (Assume a single-processor system. Jobs are scheduled in ascending order of execution time). All jobs are entirely CPU-bound (i.e., there is no I/O blocking).	[2+8]
Q2	Suppose that a disk drive has 5000 cylinders, numbered 0 to 4999. the drive currently services a request at cylinder 143, and the previous request was at cylinder 125. the queue of pending request in FIFO order is 86,1470,913,1774,948,1509,1022,1750,130 Starting from the current position, what is the total distance(in cylinders) that the disk arm moves to satisfy all pending requests, for each of the following algorithms i)FCFS ii) SSFT iii) SCAN iv) LOOK v) C-SCAN. Eloborate and justify the optimal disk schdeuling stretegy in context of above.	[10

Q3	**Answer the following in brief.** a) What is the role of a semaphore in process synchronization? b) Which CPU scheduling algorithm may cause starvation of low-priority processes? c) Name one disadvantage of the FCFS disk scheduling algorithm. d) In UNIX, what does the inode contain? e) What is paging in memory management? f) Which memory allocation method may cause external fragmentation? g) What is a critical section in process synchronization? h) What is the purpose of the page table in virtual memory? i) What is the main objective of disk scheduling algorithms? j) What is mutual exclusion in the context of synchronization?	**[10]**
Q4	Three processes share access to a singly-linked list: searchers, inserters and deleters. Searchers merely examine the list; hence they can execute concurrently with each other. Inserters add new items to the end of the list; insertions must be mutually exclusive to preclude two inserters from inserting new items simultaneously. However, one insert can proceed in parallel with any number of searches. Finally, deleters remove items from anywhere in the list. At most one deleter process can access the list at a time, and deletion must also be mutually exclusive with searches and insertions. Write code, using semaphores, for searchers, inserters and deleters that enforce this kind of three-way categorical mutual exclusion.	**[10]**
Q5	**Answer the following questions:** a. By taking suitable example pseudo code, explain the control flow of fork() system call highlighting how two values can be returned while returing from fork(). b. Explain briefly the interaction among scheduler, interupt handler and dispatcher. Why saving context of process is nontrivial and how it can be done successfully? c. What will be the ps listing in the following cases: (i) If you run ps within 2 minutes of the execution. (ii) If you run ps after the 2 minutes of the execution. What are your observations? (Hint: Think about zombie, The ps command in Linux is used to display a snapshot of the currently running processes.)	**[3+3+4**

---ALL THE BEST---