



COMSATS University Islamabad
Department of Computer Science
Terminal Examination – Spring 2025

Class: (BS) CS/SE/AI

Course Code & Title: CSC323 Operating Systems

Time Allowed: 3 hrs

Instructors: Ms. Madiha, Mr. Yasir, Ms. Zahida, Dr. Memoona

Semester: 5th / 6th

Date: 8-7-2025

Max Marks: 50

Name: M. Hassan Roza

Registration # SP23-BC5056

Instructions

1. Mobile phones are strictly prohibited in examination hall.
2. Use black or blue ball-pen only. Markers/lead pencils are not allowed.

Question 1

CLO- 2

Marks [7+8+7]

CLO2: Analyze various operations performed by operating system for process management.

1) Consider the following process requests to acquire the CPU for completing their execution.

Process	Burst Time	Arrival Time
P1	15	0
P2	7	3
P3	9	4
P4	5	8
P5	3	9

Assign CPU to these processes using shortest-job first (SJF) preemptive.

- a) Calculate the total time taken by SJF, average waiting time of all processes, and SJF throughput while satisfying the requests.
- b) Assume the processes P1 and P3 are multi threaded with 3 and 2 threads respectively. Burst time for P1 threads is 5 and P3 threads is 4.5. Considering this multi threading scenario, again schedule the above requests and find out the average waiting time of all processes after applying SJF and RR with $t=6$. Compare scheduling performance of both scheduling algorithms.

- 2) Consider the sleeping barber problem. You need to provide a solution (pseudo code) to this synchronization problem using semaphores for coordinating the barber and customer activities in order to avoid deadlocks and starvation. Use mutex locks to acquire the lock for the shared resource. Keep track of available chairs and outside customers to assign them empty chairs.

There is a barber shop with one barber and 10 number of chairs for waiting customers. Customers arrive at random times and if there is an available chair, they take a seat and wait for the barber to become available. Customers arriving at the same time will be given chair according to their age. Older will get the priority. After a customer leaves, you need to increase the priority of young ones to avoid starvation. If there are no chairs available, the customer waits for the availability of chair standing outside the barber shop. A maximum of 5 customers can wait outside the shop. When the barber finishes with a customer, he checks if there are any waiting customers. If there are, he begins cutting the hair of the next customer in the queue. If there are no customers waiting, he goes to sleep.

- b. How test-and-set instruction is used to solve the synchronization problem?
- 3) Consider the following snapshot of a system in which four resources A, B, C and D are available. The system contains a total of 6 instances of A, 4 of resource B, 4 of resource C, 2 resource D.

	Allocation				Max				Need				Available			
	A	B	C	D	A	B	C	D	A	B	C	D	A	B	C	D
P_0	2	0	1	1	3	2	1	1					6	4	4	2
P_1	1	1	0	0	1	2	0	2								
P_2	1	0	1	0	3	2	1	0								
P_3	0	1	0	1	2	1	0	1								

Do the following problems using the banker's algorithm:

- Compute what each process might still request and fill this in under the column Need.
- Is the system in a safe state? Why or why not?
- Is the system deadlocked? Why or why not?
- If a request from P_3 arrives for (2,1,0,0), can the request be granted immediately.

Question 3**CLO- 3****Marks [7+3]**

CLO3: Analyze the memory management issues and techniques in the context of operating system.

- 4) Consider a program consists of five segments: $S_0 = 600$, $S_1 = 14$ KB, $S_2 = 100$ KB, $S_3 = 580$ KB, and $S_4 = 96$ KB. Assume at that time, the available free space partitions of memory are 1200–1805, 50 – 150, 220–234, and 2500–3180.

Find the following:

- Draw logical to physical maps and segment table?
- Allocate space for each segment in memory?
- Calculate the external fragmentation and the internal fragmentation?
- What are the addresses in physical memory for the following logical addresses:

(a) 0.580, (b) 1.17 (c) 2.66 (d) 3.82 (e) 4.20?

- 5) Consider the following page reference using three frames that are initially empty. Find the page faults using LRU algorithm, where the page reference sequence: 7,0,1, 2,0,3,0,4,2,3,0,3,2,1,2,0,1,7,0,1?

Question 4**CLO- 4****Marks [5+5+8]**

CLO4: State the concepts of file system, storage and security issues.

- 6) A university server system maintains large volumes of structured and unstructured files accessed concurrently by hundreds of users.

a) Explain how different file access methods (sequential, direct, indexed) can be applied to optimize performance for different types of files (e.g., student records vs. multimedia files).

b) Propose a directory organization and access method strategy that ensures efficient access and manageability for this system. Justify your answer with operating system concepts.

- 7) A real-time operating system is used in an industrial automation system where predictable disk response times are crucial.

a) Describe how disk scheduling algorithms like SSTF, SCAN, and C-LOOK operate in practice.

b) Which algorithm would you select for this scenario? Justify your choice with reference to disk arm movement and average seek time.

8) Explain the types of attacks and their prevention methods at the following four levels

- e. Physical Layer
- f. Application Layer
- g. Operating system
- h. Network level