Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

End - Term Examinations – MAY 2025

Date: 26-05-2025 **Time:** 01:00 pm – 04:00 pm

School: SOCSE	**Program:** B. Tech-CBD/CDV/ISE	
Course Code: CSE3120	**Course Name:** Operating Systems with Linux Internals	
Semester: IV	**Max Marks**: 100	**Weightage**: 50%

CO - Levels	**CO1**	**CO2**	**CO3**	**CO4**
Marks	**24**	**26**	**26**	**24**

Instructions:

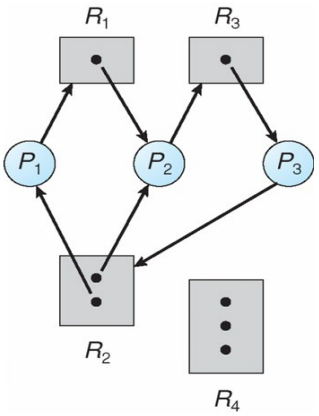
(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

Answer ALL the Questions. Each question carries 2marks. **10Q x 2M=20M**

1.	What are the three major activities of an operating system with regard to secondary storage management?	**2 Marks**	**L2**	**CO1**
2.	Some computer systems do not provide a privileged mode of operation in hardware. Is it possible to construct a secure operating system for these computer systems?	**2 Marks**	**L2**	**CO1**
3.	Illustrate the use of fork and exec system calls.	**2 Marks**	**L2**	**CO2**
4.	What are the use of job queues, ready queues and device queues?	**2 Marks**	**L2**	**CO2**
5.	Priority inversion is a condition that occurs in real time systems – Analyze and justify this statement	**2 Marks**	**L4**	**CO2**
6.	What is the meaning of the term busy waiting?	**2 Marks**	**L2**	**CO3**
7.	What are the different ways in which a thread can be cancelled?	**2 Marks**	**L4**	**CO3**
8.	What is the concept behind strong semaphore and spinlock?	**2 Marks**	**L2**	**CO3**
9.	Name two hardware instructions and their definitions which can be used for implementing mutual exclusion	**2 Marks**	**L2**	**CO4**

10.	Consider the given resource allocation graph and check whether deadlock occurs or not?  	**2 Marks**	**L3**	**CO4**

Part B

Answer the Questions. **Total Marks 80M**

11.	**a.**	Explain different operating system structures with neat sketch.	**10 Marks**	**L2**	**CO1**
	b.	Discuss the essential properties of the following types of systems, i) Time sharing systems ii) Multi-processor systems iii) Distributed systems	**10 Marks**	**L2**	**CO1**
		Or			
12.	**a.**	Explain the various types of system calls with examples.	**10 Marks**	**L2**	**CO1**
	b.	Explain in detail Inter Process Communication. How message passing is used in IPC.	**10 Marks**	**L2**	**CO1**

13.	**a.**	Explain any two preemptive scheduling algorithms in brief. Consider following processes with length of CPU burst time in milliseconds Process — Burst time P1 — 5 P2 — 10 P3 — 2 P4 — 1 All process arrived in order p1, p2, p3, p4 all time zero i) Draw Gantt charts illustrating execution of these processes for SJF and round robin (quantum=1). ii) Calculate waiting time for each process for each scheduling algorithm. iii) Calculate average waiting time for each scheduling algorithm.	**10 Marks**	**L3**	**CO2**
	b.	What are two differences between user-level threads and kernel-level threads? Under what circumstances is one type better than the other?	**10 Marks**	**L3**	**CO2**
		Or			
14.	**a.**	Consider following processes with length of CPU burst time in millisecond.	**10 Marks**	**L3**	**CO2**

		<table><tr><th>Process</th><th>Brust time</th><th>Priority</th></tr><tr><td>P1</td><td>10</td><td>3</td></tr><tr><td>P2</td><td>1</td><td>1</td></tr><tr><td>P3</td><td>2</td><td>3</td></tr><tr><td>P4</td><td>1</td><td>4</td></tr><tr><td>P5</td><td>5</td><td>2</td></tr></table> All processes arrived in order p1, p2, p3, p4, p5 all at time zero. i) Draw Gant charts illustrating execution of these processes for SJF, non preemptive priority (smaller priority number implies a higher priority) & round robin(quantum=1). ii) Calculate turnaround time for each process for scheduling algorithm. iii) Calculate waiting time for each scheduling algorithm. Explain the effect of increasing the time quantum to an arbitrary large Number and decreasing the time quantum to an arbitrary small number for round robin scheduling algorithm with suitable example?			
	b.	Compare and contrast Single-threaded and multi-threaded process.	**10 Marks**	**L3**	**CO2**

15.	**a.**	What is a process? Explain Process Control Block with the states that a process can exists.	**10 Marks**	**L2**	**CO3**
	b.	What are critical sections? Why mutual exclusion required? Explain any two methods of achieving mutual exclusion in detail. Show how to implement the wait() and signal() semaphore operations in multiprocessor environments using the test and set() instruction. The solution should exhibit minimal busy waiting.	**10 Marks**	**L2**	**CO3**
		Or			
16.	**a.**	Illustrate how a binary semaphore can be used to implement mutual exclusion among n processes	**10 Marks**	**L2**	**CO3**
	b.	Design an algorithm for a bounded-buffer monitor in which the buffers (portions) are embedded within the monitor itself. Also Provide an outline of a solution to the dining-philosophers problem using monitors. This problem will require implementing a solution using Pthreads mutex locks and condition variables.	**10 Marks**	**L2**	**CO3**

17.	**a.**	Illustrate the Algorithm to avoid deadlock occurrence in multiple instance of resource allocation.	**10 Marks**	**L3**	**CO4**
	b.	Consider the following snapshot of a system:	**10 Marks**	**L3**	**CO4**

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

Answer the following questions using the banker's algorithm:
i. What is the content of the matrix Need?
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 granted immediately?

Or

18.	**a.**	Suppose that a system is in an unsafe state. Show that it is possible for the processes to complete their execution without entering a deadlocked state.	**10 Marks**	**L3**	**CO4**
	b.	Consider the following snapshot of a system:	**10 Marks**	**L3**	**CO4**

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

Answer the following questions using the banker's algorithm:

i) Illustrate that the system is in a safe state by demonstrating an order in which the processes may complete.

ii) If a request from process P1 arrives for (1,1,0,0), can the request be granted immediately?

iii) If a request from process P4 arrives for (0,0,2,0), can the request be granted immediately?