JAYPEE UNIVERSITY OF INFORMATION TECHNOLOGY, WAKNAGHAT

TEST -2 EXAMINATION- 2024

B.Tech-IV Semester (CSE/IT)

COURSE CODE(CREDITS): 18B11CI411 MAX. MARKS: 25

COURSE NAME: Operating Systems

COURSE INSTRUCTORS: Dr. Hari Singh, Dr. Deepak Gupta, Dr. Anita, and Mr. Praveen Modi

MAX. TIME: 1 Hour 30 Minutes

Note: *(a)All questions are compulsory.*

(b)Marks are indicated against each question in square brackets.

(c) The candidate is allowed to make Suitable numeric assumptions wherever required for solving problems

Q1. Consider the following table of arrival time and burst time for four processes P1, P2, P3, and P4 and given Time Quantum = 2.

(a) Draw a Gantt chart. **[CO3] [1x3=03 Marks]**

(b)Calculate average waiting time

(c) Calculate average turnaround time for the Round-Robin CPU scheduling.

Process	Burst Time (ms)	Arrival Time (ms)
P1	5	0
P2	4	1
P3	2	2
P4	1	4

Q2. Consider three processes, all arriving at time zero, with total execution time of 10, 20 and 30 units. Each Process spends the first 20% of execution time doing I/O, next 70 % time doing computation, and the last 10%of time doing I/O again. The OS uses the shortest remaining compute time first algorithm, and schedules a new process either when the running process gets blocked on I/O or when the running process finishes its computer burst. Assume that all IO operations can be overlapped as much as possible. For what percentage of time does the CPU remain idle? **[CO3] [04 Marks]**

Q3. With reference to the classical Readers-Writes synchronization problem, write a program code for the Reader and Writer processes that provides a starvation free solution. **[CO4][2+1=03 Marks]**

Q4. Two processes, P1 and P2, need to access a critical section of code. Consider the following synchronization construct used by the processes. Here, wants1 and wants2 are shared variables, which are initialized to false. Check whether or not the following conditions are satisfied by providing a detailed explanation for each of these conditions: **[CO4][1+1+1=03 Marks]**

1) Mutual Exclusion
2) Progress
3) Bounded Waiting

/* Process P1 */	/* Process P2 */

while (true)
{
wants1 = true;
while (wants2 == true);
/* Critical Section */
wants1=false;
}
/* Remainder Section */
	while (true)
	{
	wants2 = true;
	while (wants1==true);
	/* Critical Section */
	wants2 = false;
	}
	/* Remainder Section */

Q5(a). Suppose we want to synchronize two concurrent processes P and Q using binary semaphores with initialization S=1 and T=0. The code for the processes P and Q is shown below. Synchronization statements can be inserted only at points W, X, Y, and Z. Which of the synchronization statements among Wait(S), Wait(T), Signal(S), and Signal(T) best fit at W, X, Y, and Z to ensure that the output string never contains a substring of the form 01n0 and 10n1 where n is odd? **[CO4][03 Marks]**

Process P	Process Q

while(1){
W:
print '0';
print '0';
X:
}
	while(1){
	Y:
	print '1';
	print '1';
	Z:
	}

Q5(b). Is Spinlock harmful or useful in a system? Comment. **[CO4][02 Marks]**

Q6. Describe the protocols that prevent the circular-wait i.e. if these protocols are used then the circular-wait condition cannot hold. Also provide a mathematical proof for it. **[CO5] [03 Marks]**

Q7(a). Consider the following snapshot of a system: **[CO5] [03 Marks]**

	Allocation	Max	Available
	A B C D	*A B C D*	*A B C D*
P0	0 0 1 2	0 0 1 2	1 5 2 0
P1	1 0 0 0	1 7 5 0	
P2	1 3 5 4	2 3 5 6	
P3	0 6 3 2	0 6 5 2	
P4	0 0 1 4	0 6 5 6	

Answer the following questions using the Banker's algorithm:

1) What is the content of the matrix Need?
2) Is the system in a safe state?
3) If a request from process*P1* arrives for (0,4,2,0), can the request be granted immediately?

Q7(b). In the context of recovering from deadlock using resource preemption, what are the three challenges that must be dealt with? **[CO5] [01 Mark]**