

Programme Name & Branch : B.Tech. Computer Science and Engineering and Business systems

Course Code and Course Name : Principles of Operating Systems & CBS1006

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Class Number : VL2024250103939

Date of Examination : 18.10.2024

Exam Duration : 90 minutes

Maximum Marks: 50

Course Outcomes : CO4 – Apply and explore the communication between inter process and synchronization techniques.

CO5 – Implement memory placement strategies, replacement algorithms related to main and virtual memory techniques.

Q. No	Question	M	C O	BL
1.	Lamport's bakery algorithm is given below: Shared variables: boolean flag choosing[i] initially false; integer num[i] initially 0 The entry and exit codes for process i are: <pre> entry(i) { i.1: choosing[i] := TRUE ; i.2: num[i] := max(num[0], num[1], ... , num[N-1]) + 1 ; i.3: choosing[i] := FALSE ; for p := 0 to N-1 do { // p is local to process i i.4: while choosing[p] do skip ; i.5: while num[p] != 0 and (num[p],p)<(num[i],i) do skip ; } exit(i) { i.6: num[i] := 0 ; } </pre> Assume a system has five processes P0 – P4. At time T0 P4 is executing in the critical section with num[4] = 10. Assume that the following events happen in the given order: T1: P0 executes i.1 T2: P0 executes i.2 loses processor T3: P1 executes i.1 T4: P1 executes i.2 T5: P1 executes i.3 loses processor T6: P0 executes i.3 T7: P0 executes i.4 loses processor T8: P2 executes i.1 T9: P2 executes i.2 T10: P2 executes i.3 loses processor Answer the following questions: A) What will be the value of num for P0, P1 and P2? (2 marks) B) Which process will be the first to enter the critical section and why? Assume P0 acquires the processor at T11. (2 marks) C) Which process will the second to enter the critical section and why? (2 marks) D) Is mutual exclusion and progress implemented in the algorithm? how? (4 marks)	10	4	3
2.	Let a system consist of 3 resources which is being shared by 5 processes at time T0. The resources allocated to the various processes are presented below	10	4	3

x=0
while (x < 7) {
while (x < 1
}
++;

Allocation matrix				Max Matrix				Available <0 0 1>		
	R1	R2	R3		R1	R2	R3			
P0	1	0	1	P0	1	0	2			
P1	1	1	0	P1	2	1	0			
P2	0	1	0	P2	0	2	0			
P3	0	1	0	P3	0	1	0			
P4	0	0	0	P4	0	2	1			
T0: Determine if the system is in the safe state. T1: P1 requests for one instance of R1. Can it be granted? T2: P0 requests for one instance of R2. Can it be granted? T3: P4 requests for one instance of R3. Can it be granted?										
3.	A) Let the initial value of count be 15. What will be final value of count if the instructions are executed in the following order: T1; S1; T2; S2;S3;U1;T3; S1; U2;T1; T2;V1; S2; V2; V3; U3. (list the value of count and the registers after each instruction)								4	3
	Process P0: { S1: register1=count; S2: register1=register1 - 5 S3: count=register1 }	Process P1: { T1: register2=count; T2: register2=register2 X 5 T3: count=register2 }	Process 2: { U1: register3=count; U2: register3=register3 + 5 U3: count=register3 }	Process 3: { V1: register4=count; V2: register4=register4 X 2 V3: count=register4 }	5					
	B) Assume at time T0: Philosopher 0 & 4 have executed wait on their left chopstick At time T1: Philosopher 1 & 3 have executed wait on their left chopstick At time T2: Philosopher 1 has executed wait on right chopstick At time T3: Philosopher 3 has executed wait on right chopstick At time T4: Philosopher 0 has executed wait on right chopstick At time T5: Philosopher 4 has executed wait on right chopstick (i)What will be the status of the all the 5 philosophers at time T5? Justify your answer. (ii)Which philosopher would be the first to eat? (iii)Give a scenario when philosopher 0 starves.								4	3
									5	
4.	A) Synchronize 'n' processes using "swap" atomic function. Ensure that the solution provides mutual exclusion, progress and bounded waiting. Justify your answer.								4	3
									5	
	B) Explain the various thread models with suitable diagrams								4	3
									5	
5.	A) What is the difference between logical and physical address space? What is the role of the Memory Management Unit?								5	3
									5	
	B) Given five memory partitions of 200Kb, 500Kb, 400Kb, 150Kb, 400Kb, 250kb (in order), how would the first-fit, best-fit, and worst-fit algorithms place processes of 312 Kb, 317 Kb, 222 Kb, and 326 Kb , 200 kb(in order)? Which algorithm makes the most efficient use of memory?								5	3
									5	

Total Marks: 100