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VIT

Vellore Institute of Technology

SCHOOL OF COMPUTER SCIENCE AND INFORMATION SYSTEMS

CONTINUOUS ASSESSMENT TEST - II

FALL SEMESTER 2024-2025

Programme Name & Branch	: B.Tech. (IT)
Course Code and Course Name	: BITE303L - Operating Systems
Faculty Name(s)	: MEENATCHI S, KUMAR P J, PRIYA M
Class Number(s)	: VL2024250103342, VL2024250103311, VL2024250103324
Date of Examination	: 13.10.2024
Exam Duration	: 90 minutes

Maximum Marks: 50

	Answer All Questions (5*10 = 50)	M	CO	BL
1.	Consider the following system snapshot using data structures in the Banker's algorithm with resources A, B, C, and D, and process P0 to P4:	10	CO 2	BL 3

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

Using Banker's algorithm answer the following questions.

i. Identify the total number of instances of resources type A, B, C, and D are there?

ii. Identify the contents of the Need matrix?

iii. If a request from process P_4 arrives for additional resources of (1,2,0,0,), can the Banker's algorithm grant the request immediately? Is the system in a safe state? Show the new system state and other criteria.

2.	A programmer has a program with two processes that need to both access a critical section of code. They hope that their solution satisfies all the desirable properties of critical sections. Their solution is:	10	CO 3	BL 3

```
// shared variable: int turn;
// private variables: int me, other;
// - in each process, me is that process's ID,
// other is the other process's ID
        void doCriticalSection()
        {
        turn = other;
        while (turn != me) {;}
        //
        // Code for critical section here
```

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```
// (no code in here modifies turn)
//
turn = other;
}
```

(i). Does this solution satisfy the requirement for mutual exclusion? Why or why not?

(ii). Is this solution fair? Why or why not?

(iii). Would you use it in your own program that contained a critical section? Why or why not?

(iv). If your answer in (ii) was no, how would you change the code to make it work? If your answer in (ii) was yes, is there anything you could do to it to improve it?

3. A semaphore S is defined with two atomic operations, P(S) and V(S).

```
P(S): if S >= 1 then S := S - 1
      else block the process on the semaphore queue;

V(S): if some processes are blocked on the semaphore S
      then unblock a process
      else S:= S + 1
```

With three semaphores, X, Y, and Z, the following code solves the producer-consumer problem. A set of producer processes (producer) generate data items and put them into shared buffer. A set of consumer processes (consumer) receive data items from shared buffer and uses them. All the processes communicate using a shared buffer of maximum size, N.

producer:	consumer:
P(X);	P(Y);
P(Z);	P(Z);
Put item into shared buffer;	Remove item from shared buffer;
V(Z);	V(Z);
V(Y);	V(X);

10 | CO 3 | BL 3

(i). What are the initial values of the three semaphores for correct execution and maximum performance?

(ii). Explain the function of each semaphore.

(iii). In the implementation of a P() operation, some processors continuously execute an atomic instruction (spinlock) instead of

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	blocking the process. Provide the advantages and disadvantages of this spinlock implementation.			
4.	Consider a system with paging-based memory management whose architecture allows for a 40GB virtual address space for processes. The size of logical pages and physical frames is 5GB. The system has 15GB of main memory. A process with 8 physical pages numbered 0–7. The process accesses pages in the following sequence: **0, 1, 0, 4, 1, 0, 6, 0, 7, 1, 2, 3, 3, 0, 2, 0, 1, 2, 3, 0**. Assume that the main memory is initially empty and that there is no other process executing on the system. i. Assuming the demand paging system is using a FIFO replacement policy, how many page faults do the 20-page accesses above generate? Indicate the accesses that cause the faults. **[5 Marks]** ii. Assuming the demand paging system is using an LRU replacement policy, how many page faults do the 20-page accesses above generate? Indicate the accesses that cause the faults. **[5 Marks]**	10	CO 4	BL 3
5.	A computer has **25000KB** of main memory. The processes arrive and terminate in the following sequence: Process 1 requiring 1000KB arrives Process 2 requiring 1500KB arrives Process 3 requiring 5000KB arrives Process 4 requiring 2500KB arrives Process 5 requiring 2000KB arrives Process 6 requiring 1000KB arrives Process 7 requiring 3000KB arrives Process 8 requiring 3000KB arrives Process 1 terminates Process 3 terminates Process 5 terminates Process 7 terminates Allocate and deallocate memory space for the above processes and identify the memory holes. Apply First-fit, Best-fit, and Worst-fit algorithms and illustrate how would each of the algorithms place processes of **2100KB, 4100KB, 1100KB, 1000KB, and 4200KB** (in order)? Identify which algorithm makes the most efficient use of memory.	10	CO 4	BL 3

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