VIT
Vellore Institute of Technology

REG.NO.:

SLOT: F1

SCOPE

CONTINUOUS ASSESSMENT TEST – II

FALL SEMESTER 2024-2025

Programme Name & Branch : **B.Tech. Computer Science and Engineering and Business systems (in collaboration with TCS)**
Course Code and Course Name : **Principles of Operating Systems & CBS1006**
Faculty Name(s) : **Dr Geraldine Bessie Amali / Dr Padmavathy T**
Class Number(s) : **VL2024250103938 / VL2024250103940**
Date of Examination : **18.10.2024**
Exam Duration : **90 minutes** **Maximum Marks: 50**

General instruction(s):

- **Answer All Questions**
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- **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	CO	BL
1.	Consider the following snapshot of the system a. Determine the content of the Need Matrix. [2 Marks] b. Is the system in safe state? [4 Marks] c. If a request from process P1 arrives for additional resources of (0,5,2), can the Banker's algorithm grant the request immediately? [4 Marks]	10	4	3
2.	a) Given two processes with a shared variable, "counter". Give a software based solution to enforce synchronization among these two processes in updating the "counter".	5	4	3
	b) State any five differences between the user and the kernel threads.	5		

3.	a) Consider the heap allocation by the following segment of code.
	void *a = malloc(128);
	void *b = malloc(384);
	void *c = malloc(128);
	void *d = malloc(128);
	void *e = malloc(256);
	void *f = malloc(128);
	free(b); free(c); free(e);
	
	I. Show the sequential allocation of memory.
	II. Evaluate first-fit and best-fit strategies to serve the new allocations that arrive in the following order? void *x = malloc(128); void *y = malloc(500); void *z = malloc(100);
		6	5	3

	Max	Allocation	Available
	A B C	A B C	A B C
P_0	0 0 1	0 0 1	
P_1	1 7 5	1 0 0	
P_2	2 3 5	1 3 5	
P_3	0 6 5	0 6 3	
Total		2 9 9	1 5 2

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	b) State the limitations of contiguous memory allocation and the various ways by which the limitations can be overcome?	4		

2.	The algorithm below was proposed by Peterson. It provides a solution to the critical section for two processes. Read the algorithm carefully.
	shared variables :
	flag : array of 2 booleans; turn : integer
	Initialization:
	flag[0] ← false
	flag[1] ← false
	turn ← 0
	
	P0
	I1:while (true) {
	I2: flag[0] = TRUE;
	I3: turn = 1;
	I4: while (flag[1] == true && turn == 1);
	CRITICAL SECTION
	I5: flag[0] = FALSE;
	REMAINDER
	}
	
	P1
	J1: while (true) {
	J2: flag[1] = TRUE;
	J3: turn = 0;
	J4: while (flag[0] == true && turn == 0);
	CRITICAL SECTION
	J6: flag[1] = FALSE;
	REMAINDER
	}
	
	Let P0 and P1 be two processes. Let the initial value of turn be 0. Assume instructions are executed as follows:
	T0:Process 0 executes I1 .loses processor
	T1: Process 1 executes J1. loses processor
	
	A) List the set of instructions which will be executed next in order (both should enter their CS). Assume the process gets pre-empted when it is busy waiting. (3 marks)
	B) Which process will enter the critical section first, why? Justify (2 marks)
	C) What happens to the other process? In which instruction will it be waiting? (2 marks)
	D) When will the other process enter the critical section? How is mutual exclusion implemented? (3 marks)
		10	4	3

5.	An organization's Safety Office is worried about congestion on stairs and has decided to implement a semaphore-based traffic control system. Most connections between floors have two flights of stairs with an intermediate landing (see figure). The constraints the Safety Office wishes to enforce are  a. Only 1 person at a time on each flight of stairs b. A maximum of 3 persons on landing c. No deadlock (a particular concern if there's bidirectional travel) Assume stair traffic is unidirectional: once on a flight of stairs, people continue up or down until they've reached their destination floor (no backing up!), although they may pause at the landing. There are three semaphores: they control the upper flight of stairs (SU), the landing (L), and the lower flight of stairs (SL). Provide appropriate initial values for these semaphores and the procedures for Up() and Down() with necessary wait() and signal() on the semaphores S,L,SL.	10	4	3