Question Paper

Exam Date & Time: 27-Jul-2022 (02:00 PM - 05:00 PM)

MANIPAL ACADEMY OF HIGHER EDUCATION

FOURTH SEMESTER B.TECH END SEMESTER MAKEUP EXAMINATIONS, JULY - AUGUST 2022

OPERATING SYSTEMS [ICT 2258]

Marks: 50 **Duration: 180 mins.**

Answer all the questions.

1) A) Consider the design of a tetra-packed jeera juice machine that must satisfy the following properties: no one can buy a packet while someone else is using the machine; the delivery person must wait until there is free space before adding more packets; and the customer must wait until at least one packet is available. Given below are the incorrect code snippets for developing the machine with 20 slots, using three semaphores (binary mutex, emptyBuffers (number of empty slots), and fullBuffers (number of filled slots). Explain why the proposed solutions are incorrect by emphasising their drawbacks. (5)

Design a proper solution using the above semaphores (with suitable initialization code).

i)

Producer () {
wait(mutex);
//put 1 packet in the machine;
signal(mutex);
}
	Consumer () {
	wait(mutex);
	//take 1 packet from the machine;
	signal (mutex);
	}

ii)

Producer () {
wait(emptyBuffers);
//put 1 packet in machine;
signal(fullBuffers)
}
	Consumer () {
	wait(fullBuffers);
	//take 1 packet from machine;
	signal (emptyBuffers);
	}

iii)

Producer () {
wait(mutex);
wait(emptyBuffers);
//put 1 packet in machine;
signal(fullBuffers)
signal(mutex);
}
	Consumer () {
	wait(mutex);
	wait(fullBuffers);
	//take 1 packet from machine;
	signal (emptyBuffers);
	signal(mutex);
	}

B) Explain the monitor based solution to the producer-consumer problem. (3)

C) Describe in brief the shared memory and message-passing models of interprocess communication. (2)

2) A) Consider the set of processes and their burst time in milliseconds as given in the table Q.2A. Schedule the set of processes using the Round Robin algorithm with a time quantum of 1 millisecond. Draw the Gantt chart. Calculate the waiting time and turnaround time for each of the processes and also calculate the average waiting time and average turnaround time. Assume that all processes arrive at the same time in the following order: P1, P2, P3, P4, P5. (5)

Table Q.2A

Process	Burst time
P1	8
P2	6
P3	1
P4	9
P5	3

B) What is thrashing? List any two causes and preventive measures. (3)

C) Consider the following Resource Allocation Graph (Fig. 6) and identify whether the following system is in deadlock state or not. (2)

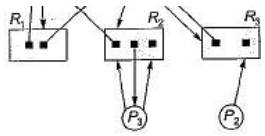

Fig. Q6

3) Consider the following scenario which has five processes and four resource types. (5)

A)

	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	

Draw the resource allocation graph for the above scenario. Using the Banker's algorithm, identify whether the system is in a safe state or not? If a request from process P1 arrives for (0,4,2,0), can the request be granted immediately?

B) Discuss with the help of a schematic diagram how dual mode of operation protects the operating system from errant users. (3)

C) Consider a paged virtual memory system. Suppose the page table for the process currently executing on the processor looks like the following Table Q.3C. All numbers are in decimal, everything is numbered starting from zero, and all addresses are memory byte addresses. The page size is 1024 bytes. (2)

Table Q.3C

Virtual page number	Valid bit	Reference bit	Modify bit	Page frame number
0	1	1	0	3
1	0	0	0	-
2	1	0	1	7
3	1	1	1	0
4	1	1	0	2
5	0	0	0	-

What physical address, if any, would each of the following virtual addresses correspond to? (If there would be a page fault, just indicate that one would take place. Do not try to handle it.)

a. 1052

b. 2221

4) With an example, explain the four necessary conditions for the occurrence of a deadlock. (5)

A)

B) Explain the three necessary conditions that a solution to the critical-section problem must satisfy. Consider two processes, P1 and P2, and provide the code snippets that violate each of these conditions. (3)

C) Explain the information associated with the process control block specific to a process. (2)

5) With a neat diagram, explain the steps taken to handle a Page fault. (5)

A)

B) An allocator uses a linked list to track free blocks. In the allocator, all blocks are a multiple of 4 bytes in length. Answer the following questions assuming that the free list contains just two blocks, of 28 and 16 bytes each, in that order. (3)

i. List a sequence of malloc() calls that would succeed given first-fit allocation, but fail with best fit.

ii. List a sequence that would succeed with best fit but fail with first fit.

iii. List a sequence that would succeed with worst fit but fail with best fit.

Justify the answers with necessary calculations.

C) A real-time system consists of three periodic tasks, S1 (6,2), S2 (8,3), and S3 (12,3), given in (period, execution) format. Check whether these tasks can be scheduled using EDF. Show the Gantt chart if the tasks can be scheduled using the EDF scheduling algorithm. (2)

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