SRM Institute of Science and Technology
College of Engineering and Technology
School of Computing
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu

SET-4 Academic Year: 2022-23 (EVEN)

Test: CLA-T1 Date: 28-Mar-2023 Course Code & Title: 18CSC205J & Operating Systems Duration: 2 Hours Year & Sem: II Year / V Sem Max. Marks: 50

Course Articulation Matrix:

S.No.	Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
1	CO1	3		3									
2	CO2	2	1	3									
3	CO3	3	2	2									
4	CO4	3	2	2									
5	CO5	3		2	2								

Q. No	Question	Marks
1	a. Explain the concept of Semaphores. A counting semaphore S is initialized to 9. Then, 22 wait() operations and 17 signal() operations are performed on S. What is the final value of S? <u>Answer</u> P operation also called as wait operation decrements the value of semaphore variable by 1. V operation also called as signal operation increments the value of semaphore variable by 1. Thus, Final value of semaphore variable S = 9 – (22 x 1) + (17 x 1) = 9 – 22 + 17 = 4 b. What is the meaning of the term busy waiting? What other kinds of waiting are there in an operating system? Can busy waiting be avoided altogether? Explain your answer <u>Answer</u> Busy waiting means that a process is waiting for a condition to be satisfied in a tight loop without relinquishing the processor. One strategy to avoid busy waiting temporarily puts the waiting process to sleep and awakens it when the appropriate program state is reached, but this solution incurs the overhead associated with putting the process to sleep and later waking it up.	5 5

2	a. Discuss the advantages and disadvantages of increasing and decreasing the size of time quantum in Round Robin scheduling. Advantages: 1. Every process gets an equal share of the CPU. 2. RR is cyclic in nature, so there is no starvation. Disadvantages: 1. Setting the quantum too short increases the overhead and lowers the CPU efficiency, but	3 7

setting it too long may cause a poor response to short processes.

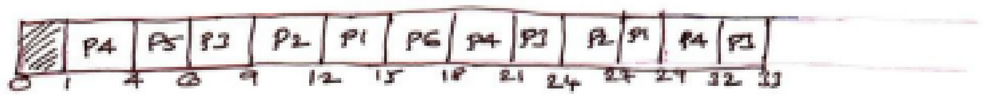
2. The average waiting time under the RR policy is often long.

3. If time quantum is very high then RR degrades to FCFS.

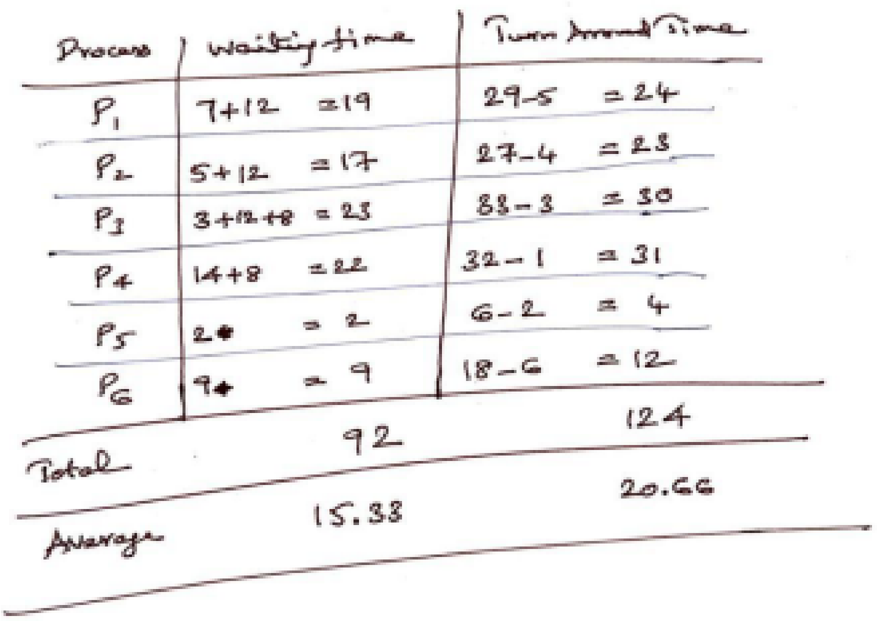
b. Consider the set of 6 processes whose arrival and burst times are given below. If the CPU scheduling policy Round Robin with time quantum =3, calculate the average waiting time and average turnaround time.

Process ID	Arrival Time	Burst Time
P1	5	5
P2	4	6
P3	3	7
P4	1	9
P5	2	2
P6	6	3

Solution
Round robin algorithm – Time Quantum : 3



CPU Idle from 0 to 1 unit time



Process	waiting time	Turn Around Time
P_1	7+12 = 19	29-5 = 24
P_2	5+12 = 17	27-4 = 23
P_3	3+12+8 = 23	33-3 = 30
P_4	14+8 = 22	32-1 = 31
P_5	2 = 2	6-2 = 4
P_6	9 = 9	18-6 = 12
Total	92	124
Average	15.33	20.66

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a. A single processor system has three resource types X, Y and Z, which are shared by three processes. There are 5 units of each resource type. Consider the following scenario, where the column alloc denotes the number of units of each resource type allocated to each process, and the column request denotes the number of units of each resource type requested by a process in order to complete execution. Which of these processes will finish LAST?

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	Allocation			Request		
	X	Y	Z	X	Y	Z
P0	1	2	1	1	0	3
P1	2	0	1	0	1	2

P2 2 2 1 1 2 0

Solution

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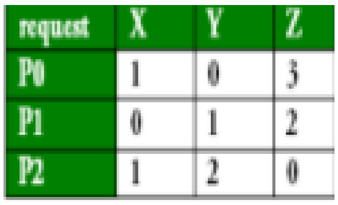
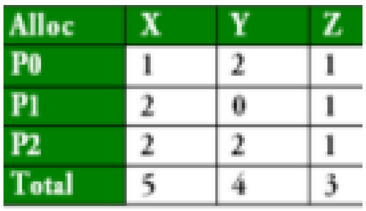
- A single processor system has three resource types X, Y and Z, which are shared by three processes. There are 5 units of each resource type.
- So, the resource instances which are left being unallocated = <0,1,2> { unallocated resources= total resources-allocated resources }



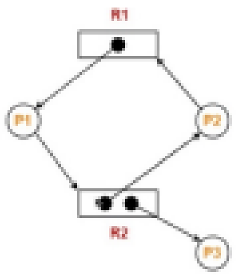
request	X	Y	Z
P0	1	0	3
P1	0	1	2
P2	1	2	0



Alloc	X	Y	Z
P0	1	2	1
P1	2	0	1
P2	2	2	1
Total	5	4	3

- now, from the request table, you can say that only request of P1 can be satisfied. So P1 can finish its execution first. Once P1 is done, it releases 2, 0 and 1 units of X, Y and Z respectively which were allocated to P1.So, Now unallocated resource instance are = <0,1,2> +<2,0,1> = <2,1,3>
- Now Among P0 and P2, needs of P0 can only be satisfied. So P0 finishes its execution. <2,1,3> + <1,2,1> = <3,3,4>. Finally, P2 finishes its execution. So, P2 is the process which finishes in end.

b. Consider the resource allocation graph given in the figure.



Check whether the system is in safe state and also find the sequence if the system is safe.

Solution:
Yes, The system is in safe state.
Safe sequence -> P2 - P0 - P1 - P3

4	In a system, there are three types of resources: E, F and G. Four processes P0, P1, P2 and P3 execute concurrently. At the outset, the processes have declared their maximum resource requirements using a matrix named Max as given below. For example, Max[P2,F] is the maximum number of instances of F that P2 would require. The number of instances of the resources allocated to the various processes at any given state is given by a matrix named Allocation. Consider a state of the system with the Allocation matrix as shown below, and in which 3 instances of E and 3 instances of F are the only resources available. Allocation Maximum E F G E F G P0 1 0 1 4 3 1 P1 1 1 2 2 1 4 P2 1 0 3 1 3 3 P3 2 0 0 5 4 1 Check whether the system is safe. If so, find the safe sequence. Answer : System is in Safe State.	10

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a. Consider six memory partitions of sizes 200 KB, 400 KB, 600 KB, 500 KB, 300 KB and 250 KB, where KB refers to kilobyte. These partitions need to be allotted to four processes of sizes 357 KB, 210 KB, 468 KB and 491KB in that order. If the best fit algorithm is used, which partitions are NOT allotted to any process?

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b. Explanation on how first fit, best fit and worst fit perform memory allocation in the main memory?

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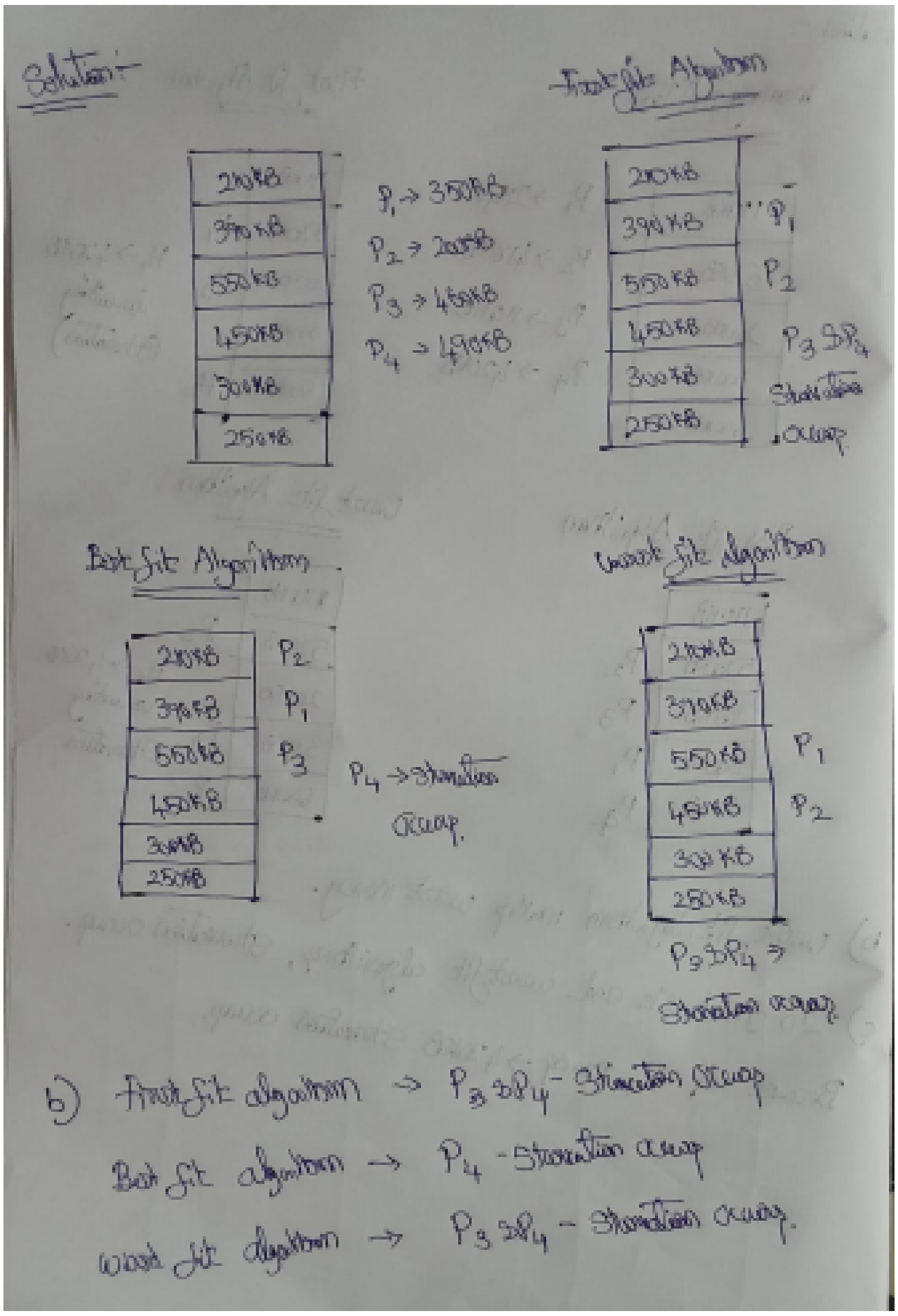
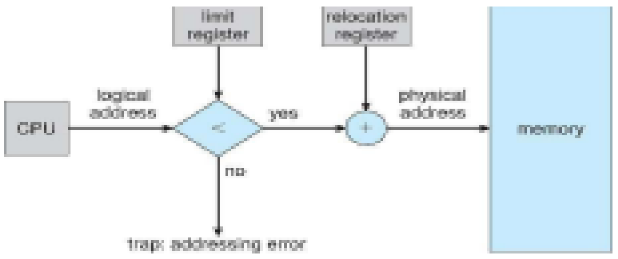


b) First fit algorithm → P_3 & P_4 - Starvation occur

Best fit algorithm → P_4 - Starvation occur

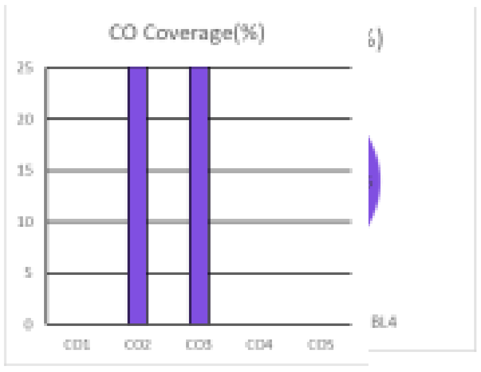
Worst fit algorithm → P_3 & P_4 - Starvation occur.

6	a. How hardware can be checked based on the values in the base and limit register with a justified representation? Solution • The OS allocates one contiguous span of primary memory to a process P. • The base register lowest address allocated to P. • The limit register number of bytes in the allocation. • Any attempt in user mode to access memory out of bounds results in a trap. • Changing base or limit registers are privileged instructions. • The kernel gets unrestricted access to all memory a necessity for performing system tasks such as loading jobs and fetching parameters of system calls.	5 5

	 limit register relocation register CPU logical address < yes + physical address memory no trap: addressing error b. Calculate the number of bits required in the address for memory having size of 16 GB. Assume the memory is 4-byte addressable. Let ‘n’ number of bits are required. Then, Size of memory = 2^n x 4 bytes. Since, the given memory has size of 16 GB, So we have 2^n x 4 bytes = 16 GB $2^n \times 4 = 16$ G $2^n \times 2^2 = 2^{34}$ $2^n = 2^{32}$ $\therefore n = 32$ bits	
7	In a virtual memory system, size of virtual address is 32-bit, size of physical address is 30-bit, page size is 4 Kbyte and size of each page table entry is 32-bit. The main memory is byte addressable. Which one of the following is the maximum number of bits that can be used for storing protection and other information in each page table entry Solution Given: • Number of bits in virtual address = 32 bits • Number of bits in physical address = 30 bits • Page size = 4 KB • Page table entry size = 32 bits Size of Main Memory Number of bits in physical address = 30 bits Thus, Size of main memory = 2^{30} B = 1 GB Number of Frames in Main Memory Number of frames in main memory = Size of main memory / Frame size = 1 GB / 4 KB = 2^{30} B / 2^{12} B = 2^{18} Thus, Number of bits in frame number = 18 bits Number of Bits used for Storing other Information Maximum number of bits that can be used for storing protection and other information = Page table entry size – Number of bits in frame number = 32 bits – 18 bits = 14 bits	10

*Program Indicators are available separately for Computer Science and Engineering in AICTE examination reforms policy.

Course Outcome (CO) and Bloom's level (BL) Coverage in Questions



Approved by the Audit Professor/Course Coordinator