SRM Institute of Science and Technology
College of Engineering and Technology
School of Computing
SRM Nagar, Kattankulathur – 603203, Chengalpattu District, Tamilnadu **SET-2**
Academic Year: 2022-23 (EVEN)

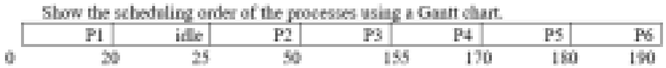
Test: CLA-T2 Date: 28-03-2023 Course Code & Title: **18CSC205J & Operating Systems**
Duration: 2 Hours Year & Sem: **II Year / V Sem** Max. Marks: 50

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								

Part – B
(5 x 10= 50 Marks)
Instructions: Answer any Five Questions

Q. No	Question	Marks	BL	CO	PO	PI Code

1	Consider the following set of processes with their arrival and burst times that uses First-Come, First Served scheduling (FCFS) policy. *Process Arrival Time Burst Time* P1 0 20 P2 25 25 P3 30 105 P4 60 15 P5 100 10 P6 105 10 i. Show the scheduling order of the processes using a Gantt chart. ii. Evaluate the average waiting time of processes. iii. Evaluate the average turnaround time of processes. **<u>Solution</u>** **Gantt chart (4)**  **Find out the average waiting time of processes. (3)** Waiting time for processes are - P1=0, P2=0, P3=20, P4=95, P5=70, P6=75 Therefore, average waiting time= (0+0+20+95+70+75)/6= 43.33 ms **Find out the average turnaround time of processes. (3)** Turnaround time for processes is – P1=20, P2=25, P3=125, P4=110, P5=80, P6=85 Therefore, average turnaround time=(20+25+125+110+80+85)/6= 74.17 ms	10	4	2	PO 2	2.5.3

<table>
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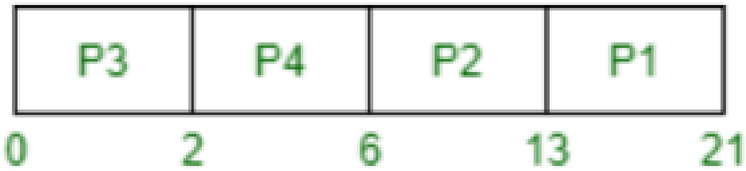
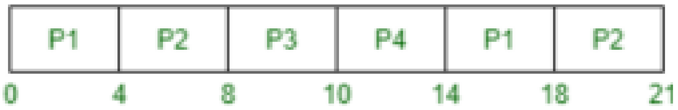
<td>2</td>
<td>Consider the following set of processes, assumed to have arrived at time 0. Consider the CPU scheduling algorithms Shortest Job First (SJF) and Round Robin (RR). For RR, assume that the processes are scheduled in the order P_1, P_2, P_3, P_4. If the time quantum for RR is 4 ms, then calculate
the absolute value of the difference between the average turnaround times (in ms) of SJF and RR (round off to 2 decimal places).
Processes P_1 P_2 P_3 P_4
Burst Time
8 7 2 4
(in ms)

Solution:

Therefore, Average Turn Around Time (TAT) is,
= {(21 - 0) + (13 - 0) + (2 - 0) + (6 - 0)} / 4
= 10.5

Therefore, Average Turn Around Time (TAT) is,
= {(18 - 0) + (21 - 0) + (10 - 0) + (14 - 0)} / 4
= 15.75
Hence,
= SJF (TAT) – RR(TAT)
= 10.5 – 15.75
= 5.25</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>PO 2</td>
<td>2.5.3</td>
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<td>3</td>
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A computer system uses the Banker’s Algorithm to deal with deadlocks. Its current state is shown in the tables below, where P0, P1, P2 are processes and R0, R1, R2 are resource types.

<table>
<tr><td></td><td>Maximum Need</td><td></td><td></td><td></td><td>Current Allocation</td><td></td><td></td><td>Available</td><td></td><td></td></tr>
<tr><td></td><td>R0</td><td>R1</td><td>R2</td><td></td><td>R0</td><td>R1</td><td>R2</td><td>R0</td><td>R1</td><td>R2</td></tr>
<tr><td>P0</td><td>4</td><td>1</td><td>2</td><td>P0</td><td>1</td><td>0</td><td>2</td><td>2</td><td>2</td><td>0</td></tr>
<tr><td>P1</td><td>1</td><td>5</td><td>1</td><td>P1</td><td>0</td><td>3</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>P2</td><td>1</td><td>2</td><td>3</td><td>P2</td><td>1</td><td>0</td><td>2</td><td></td><td></td><td></td></tr>
</table>

(a) Show that the system can be in safe state.
(b) What will the system do on a request by process P0 for one unit of resource type R1?

<u>Solution:</u>

(a)System is in the safe state. The safe state is "P1,P2,P0" (b) By granting the request of P0, the system goes into unsafe state so system would delay the request
</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>PO 2</td>
<td>2.5.3</td>
</tr>
</table>

<table>
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<td>4</td>
<td>
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?

alloc 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

<u>Solution:</u>
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 }

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.
</td>
<td>10</td>
<td>4</td>
<td>2</td>
<td>PO 2</td>
<td>2.5.3</td>
</tr>
</table>

5	a. Draw the multi programming fixed size partitioning of size 10KB, 23KB, 28KB, 6KB, 13KB, 8KB in partitioning in the main memory and in that allocate the processor of 9KB, 18KB, 24KB, 3KB, 4KB, 5KB. Find the wastage in the given partitioning and determine the total wastage in the main memory. **Solution** 9KB process is allocated to 10KB partition, 18KB to 23KB partition and so on.. So the wastage of space is (10-9) + (23-18) + (28-24) + (6-3) + (13- 4) + (8-5) = 1 + 5 + 4 + 3 + 9 + 3 = 25 b. In a computer system where the 'best fit' algorithm is used for allocating 'jobs' to 'memory partition', the following situation was encountered. Partition size in KB 4 KB, 8 KB, 20 KB, 2 KB Jobs 2 KB, 14 KB, 3 KB, 6 KB, 10 KB, 20 KB, 2 KB Execution Time (for the above Jobs in order) 4, 10, 2, 1, 1, 8, 6 When will the 20KB job complete?	5 5	4 4	3 3	PO 2 PO 2	2.5.3 2.5.3

Solution:

4K	3K (0 – 2)		
8K	6K (0 – 1)	2K (1 – 7)	
20K	14K (0 – 10)	10K (10 – 11)	20K (11 – 19)
2K	2K (0 – 4)		

Here we allocated the job as per best fit and also mention the execution time of the proc
also assume that it FCFS Scheduling.

So, as per table 20 K job complete at time 19.

<table>
<tr>
<td>6</td>
<td>The following program consists of 3 concurrent processes and 3 binary semaphores. The semaphores are initialized as S0 = 1, S1 = 0, S2 = 0.
<table>
<tr><th>Process P0</th><th>Process P1</th><th>Process P2</th></tr>
<tr><td>while (true) {
wait (S0);
print ‘0’;
release (S1);
release (S2);
}</td><td>wait (S1);
release (S0);</td><td>wait (S2);
release (S0);</td></tr>
</table>
Find,
i) Minimum number of times P0 printing 0 (ZERO)
ii) Maximum number of times P0 printing 0 (ZERO)
Justify your Answer with explanation.

<u>Solution:</u>
a) Initially only P0 can go inside the while loop as S0 = 1, S1 = 0, S2 = 0. Minimum no. of time 0 printed is twice when execute in this order (p0 -> p1 -> p2 -> p0)
b) Maximum no. of time 0 printed is thrice when execute in this order (p0 -> p1 -> p0 -> p2 -> p0).</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>PO 1</td>
<td>1.6. 1</td>
</tr>
<tr>
<td>7</td>
<td>Consider a system with byte-addressable memory, 32-bit logical addresses, 4KB page size and page table entries of 4 bytes each. Calculate the process size and the size of page table.
<u>Solution</u>
Given:
• Number of bits in logical address = 32 bits
• Page size = 4KB
• Page table entry size = 4 bytes

Process Size
Number of bits in logical address = 32 bits
Thus, Process size = 232 B = 4 GB

Number of Entries in Page Table
Number of pages the process is divided = Process size / Page size = 4 GB / 4 KB = 220 pages

Thus, Number of entries in page table = 220 entries</td>
<td>10</td>
<td>3</td>
<td>3</td>
<td>PO 2</td>
<td>2.5. 3</td>
</tr>
</table>

<table>
<tr>
<td></td>
<td>Page Table Size
Page table size = Number of entries in page table x Page table entry size
= 220 x 4 bytes = 4 MB</td>
<td></td>
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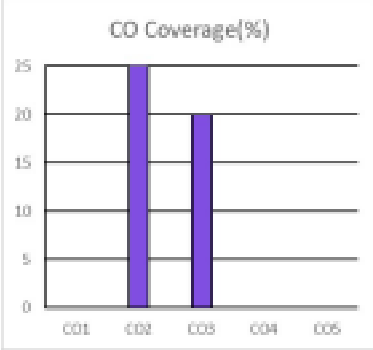
*Program Indicators are available separately for Computer Science and Engineering in AICTE examination reforms policy.

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



Approved by the Audit Professor/Course Coordinator