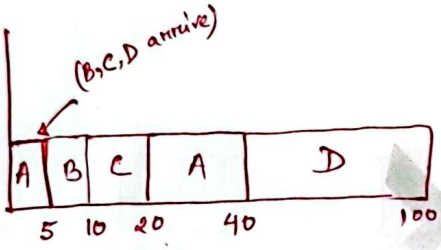
United International University
Course: Operating Systems, Class Test 2

Name		ID		Section	

1. Why does Shortest Time to Completion First (STCF) perform poorly in terms of response time? Explain with an example. [4 marks]

As STCF algorithm schedules larger process later and if no new process comes, it lets a process run to completion, therefore, results in poor performance for response time.

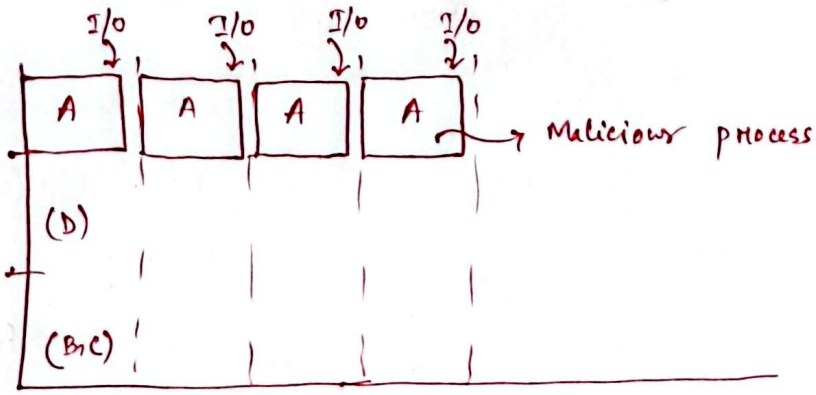


$$\therefore \text{Avg response time} = \frac{0+0+(10-5)+(40-5)}{4}$$

$$= 10 \text{ s}$$

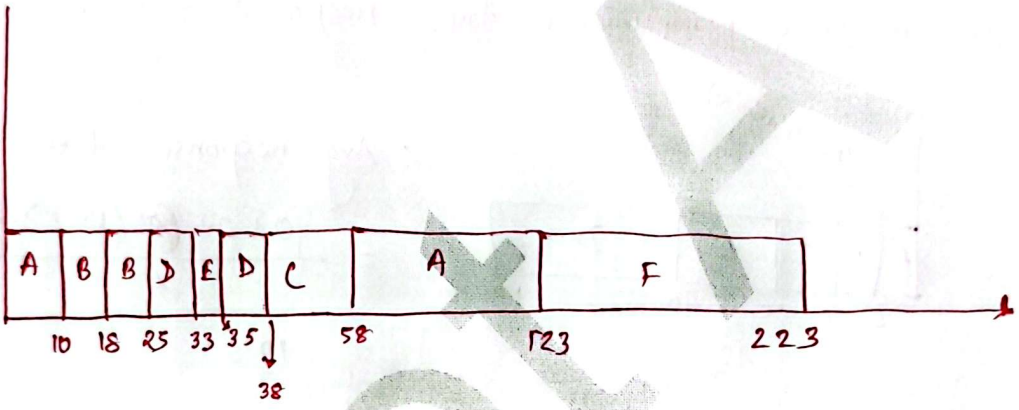
2. Consider the following two rules of MLFQ:
   Rule 4a: If a job uses up an entire time slice while running, its priority is reduced (i.e., it moves down one queue).
   Rule 4b: If a job gives up the CPU before the time slice is up, it stays at the same priority level.
   How can these rules be manipulated to trick the scheduler? Give an example. [4 marks]

If a process is designed such that it uses CPU for 99% of time slice and performs an I/O for the remaining 1% of time slice, then only this process will be using CPU for every time slice.



3. Use the following data to draw a gantt chart using **STCF algorithm** and find the **average turnaround time.** **[5 marks]**

Process	A	B	C	D	E	F
Arrival (nth ms)	0	10	18	25	33	33
Duration (in ms)	75	15	20	11	2	100



A - 65
B - ~~15~~ 0
C - ~~20~~
D - ~~25~~ 3
E - ~~2~~
F - 100

Avg. turnaround time

$$= \frac{(123-0)+(25-10)+(58-18)+(38-25)+(35-33)+(223-33)}{6}$$

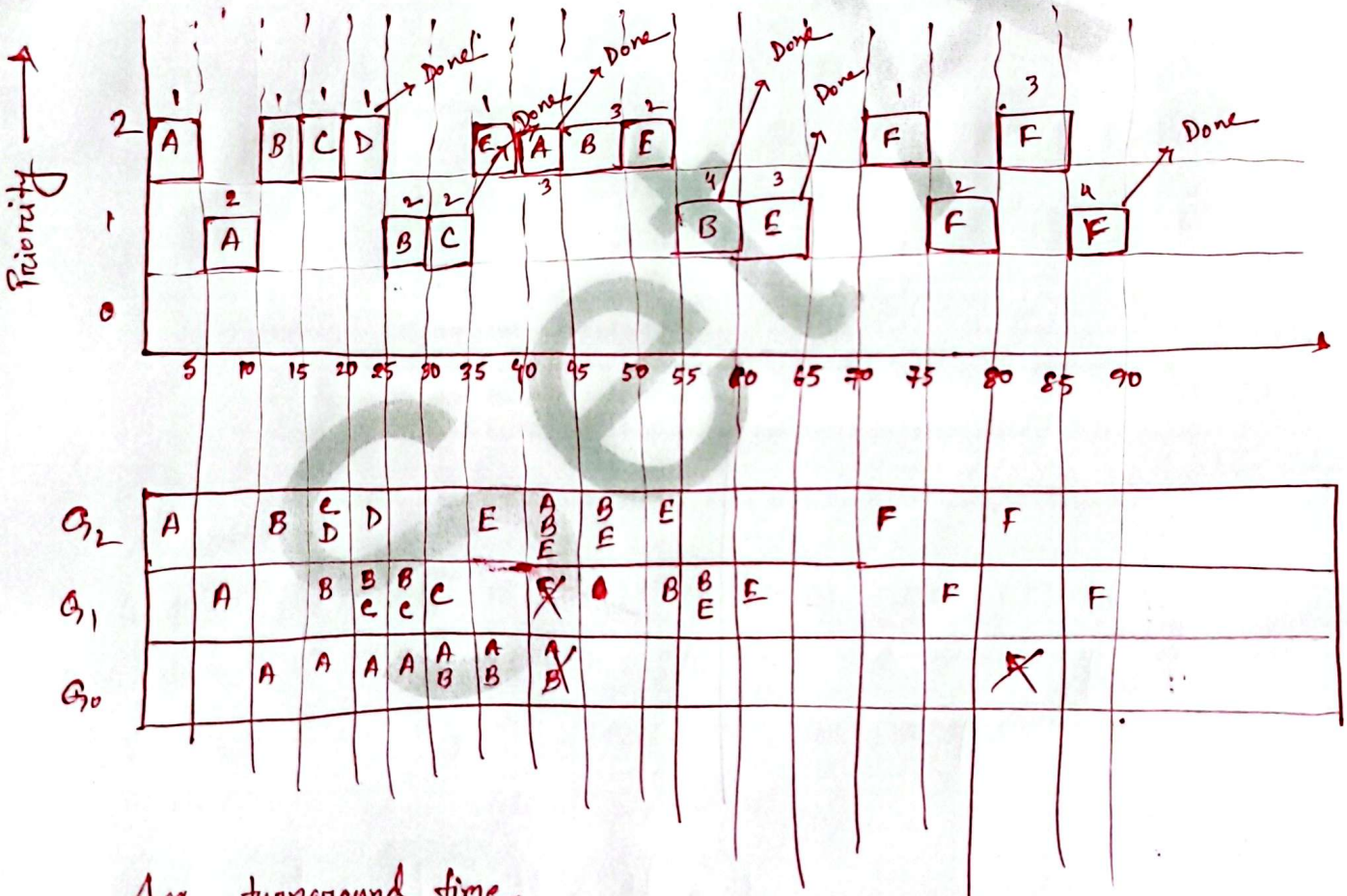
$$= 63.83 \text{ ms}$$

Ans..

4. Use the following data to draw a gantt chart using **MLFQ** algorithm and find the **average turnaround time and average response time.** **[3+2+2 = 7 Marks]**
There are 3 priority queues: Q0, Q1 and Q2 where priority order: **Q2 > Q1 > Q0.**
Priority boost occurs after every 40 ms.
Time slice is 5 ms.

Process	A	B	C	D	E	F
Arrival	0	8	12	12	33	67
Duration	15	20	10	5	15	20

$\frac{15}{5}=3$ $\frac{20}{5}=4$ $\frac{10}{5}=2$ $\frac{5}{5}=1$ $\frac{15}{5}=3$ $\frac{20}{5}=4$ যার মান বড়ো complete



Avg. turnaround time

$$= \frac{(45-0)+(60-8)+(35-12)+(25-12)+(65-33)+(90-67)}{6}$$

$= 31.33$ ms.

Average Response time

$$= \frac{(0-0)+(10-8)+(15-12)+(20-12)+(35-33)+(70-67)}{6}$$

$$= 3 \text{ ms}$$ Ans.

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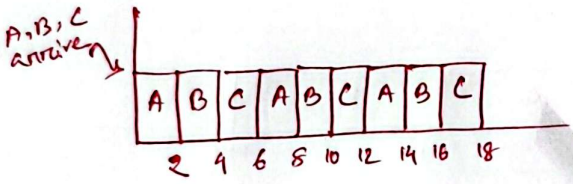
1. Why does **Round Robin** perform poorly in terms of turnaround time? Explain with an example. **[4 marks]**

As Round Robin runs another process in every time slice, therefore it takes longer time for each process to complete. Thus average turnaround time increases for this algorithm.



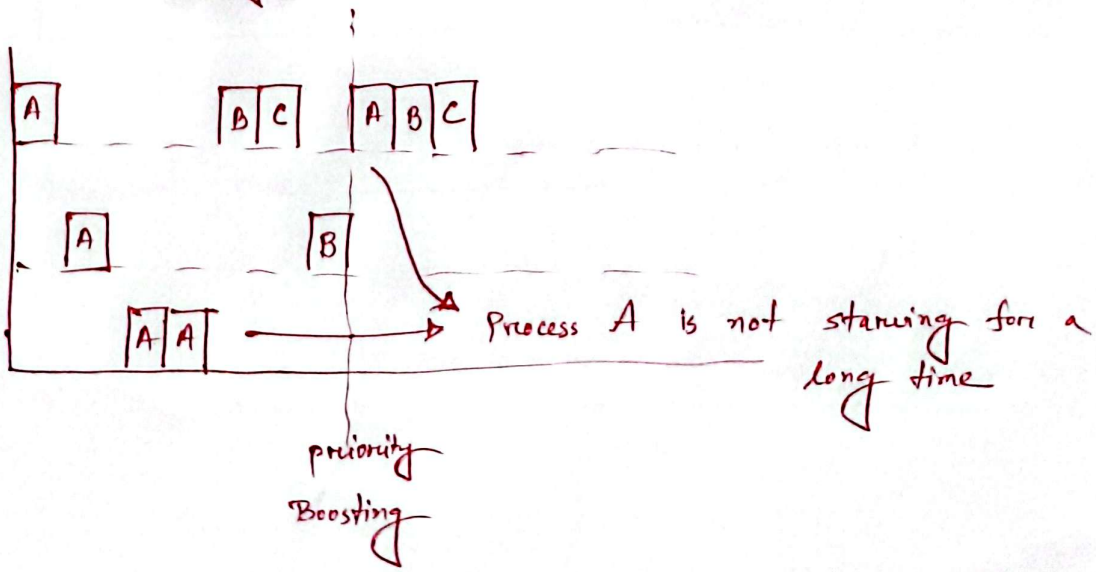
Avg turnaround time

$$= \frac{(14-0)+(16-0)+(18-0)}{3} = 16 \text{ ms}$$

where each process only needs 6ms to complete.

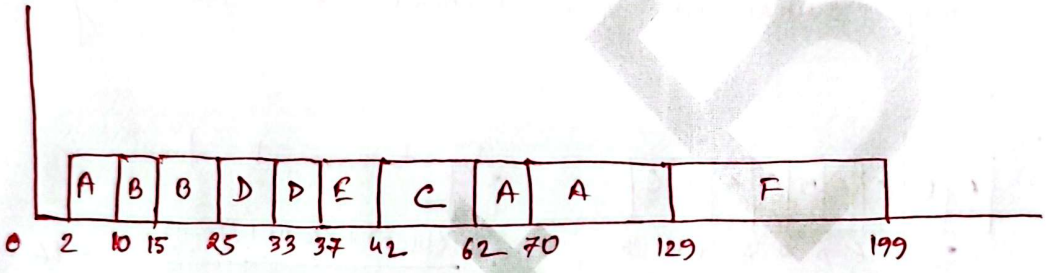
2. How is the problem of **starvation** solved in the **Multi-Level Feedback Queue (MLFQ)**? Show with a proper example **[4 marks]**

Starvation can be solved using priority boosting. After every fixed duration S, a priority boosting will move all the processes to the topmost priority queue. Then every process will be scheduled at least once, overcoming the starvation.



3. Use the following data to draw a gantt chart using **STCF algorithm** and find the **average turnaround time.** **[5 marks]**

Process	A	B	C	D	E	F
Arrival (nth ms)	2	10	15	25	33	70
Duration (in ms)	75	15	20	12	5	70



A - ~~67~~ 59
B - ~~15~~ 0
C - ~~20~~ 0
D - ~~QXL~~ 0
E - ~~5~~

Average turnaround time

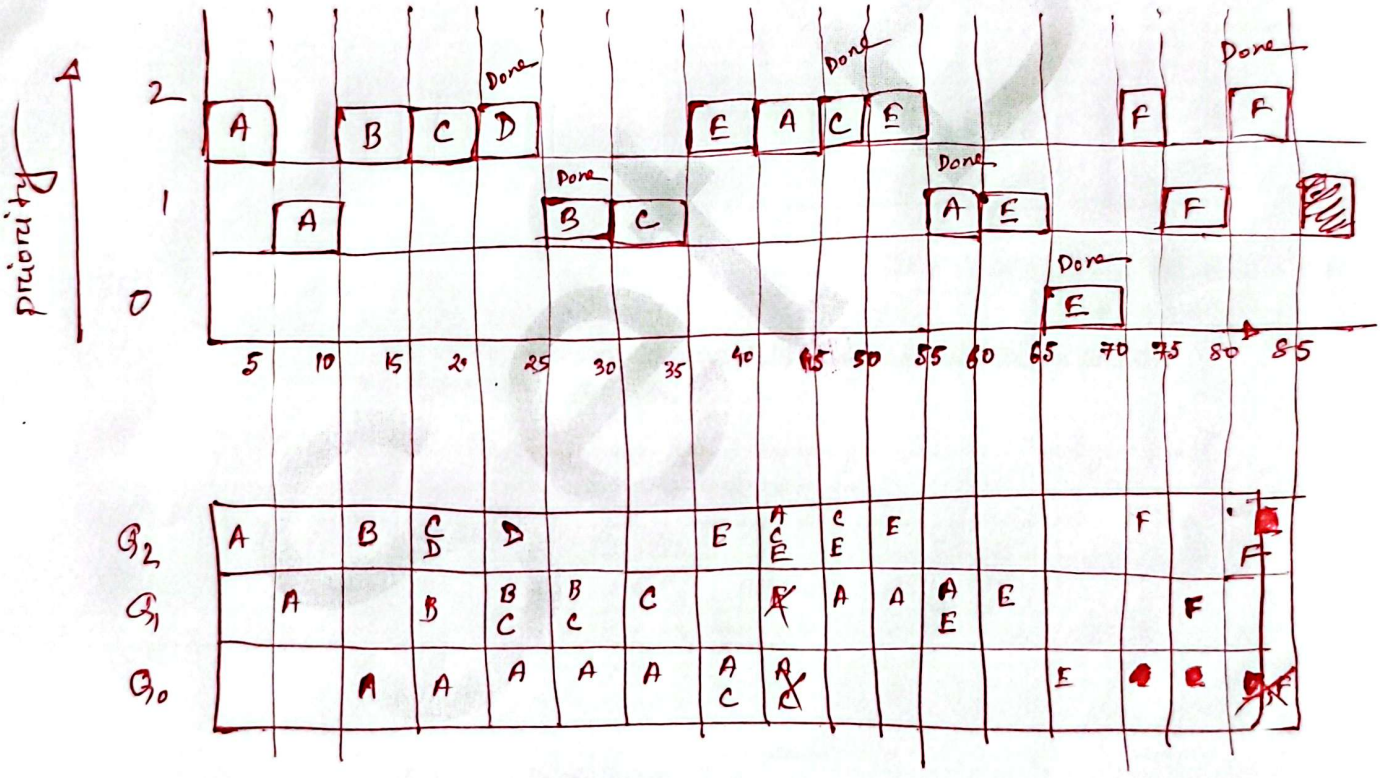
$$= \frac{(129-2)+(95-10)+(62-15)+(37-25)+(42-33)+(199-70)}{6}$$

$$= 56.5 \text{ ms}$$

Ans.

4. Use the following data to draw a gantt chart using **MLFQ** algorithm and find the **average turnaround time and average response time.** **[3+2+2 = 7 Marks]**
There are 3 priority queues: Q0, Q1 and Q2 where priority order: **Q2 > Q1 > Q0.**
Priority boost occurs after every 40 ms.
Time slice is 5 ms.

Process	A	B	C	D	E	F
Arrival	0	8	12	12	33	67
Duration	20	10	15	5	20	15



Avg turnaround time = $\frac{(60-0)+(30-8)+(50-12)+(25-12)+(70-33)+(85-67)}{6}$

$= 31.33$

Avg response time = $\frac{0+(10-8)+(15-12)+(20-12)+(35-33)+(70-67)}{6}$

$= 3$

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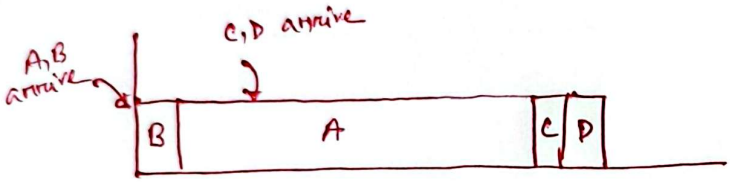
1. What is the **Convoy Effect**? Show an example that Shortest Job First (SJF) algorithm suffers from convoy effect. **[4 marks]**

Convoy Effect: A number of relatively short potential consumers of a resource get queued behind a heavy-weight resource consumer.

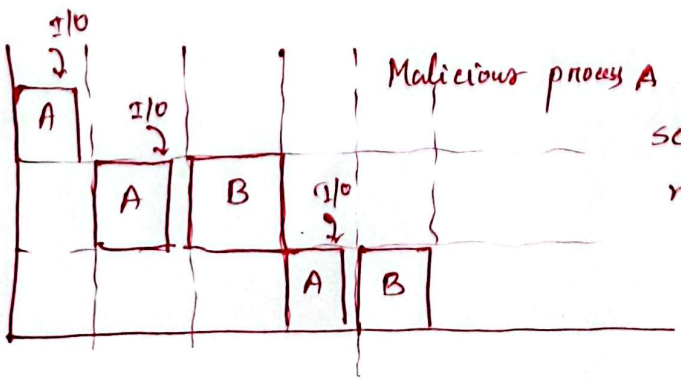


C, and D are queued being heavy resource consumer A.

2. Consider the following two rules of MLFQ:
   Rule 4a: If a job uses up an entire time slice while running, its priority is reduced (i.e., it moves down one queue).
   Rule 4b: If a job gives up the CPU before the time slice is up, it stays at the same priority level.
   How can these rules be modified to solve the problem of "Game the scheduler"? Give an example with your proposed rule. [4 marks]

Instead of Rule 4a, 4b, we can add the following rule:-

Once a job uses up its time allotment at a given level (regardless of how many times it has given up the CPU), its priority is reduced.



Malicious proces A can't manipulate the scheduler with the modified rule.

3. Use the following data to draw a gantt chart using **STCF algorithm** and find the **average turnaround time.** **[5 marks]**

Process	A	B	C	D	E	F
Arrival (nth ms)	2	10	15	25	33	70
Duration (in ms)	75	15	20	12	5	70

Same as set (B)

4. Use the following data to draw a gantt chart using **MLFQ** algorithm and find the **average turnaround time and average response time.** **[3+2+2 = 7 Marks]**
There are 3 priority queues: Q0, Q1 and Q2 where priority order: **Q2 > Q1 > Q0.**
Priority boost occurs after every 40 ms.
Time slice is 5 ms.

Process	A	B	C	D	E	F
Arrival	0	8	12	12	33	67
Duration	20	10	15	5	20	15

Same as set (B)

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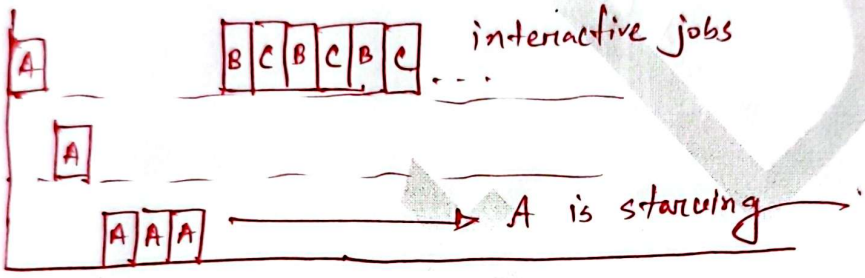
1. Why is **priority boosting** needed in MLFQ? What problem may arise without priority boosting? Show an example. [4 marks]

Priority Boosting is needed to solve the problem of starvation. Without priority boosting, CPU intensive jobs may starve for interactive jobs.



1. Consider the following two rules of MLFQ:
   Rule 4a: If a job uses up an entire time slice while running, its priority is reduced (i.e., it moves down one queue).
   Rule 4b: If a job gives up the CPU before the time slice is up, it stays at the same priority level.
   How can these rules be manipulated to trick the scheduler? Give an example.
   [4 marks]

same are set (A)

2. Use the following data to draw a gantt chart using **STCF algorithm** and find the **average turnaround time.** **[5 marks]**

Process	A	B	C	D	E	F
Arrival (nth ms)	0	10	18	25	33	33
Duration (in ms)	75	15	20	11	2	100

Same as set A

3. Use the following data to draw a gantt chart using **MLFQ** algorithm and find the **average turnaround time and average response time.** **[3+2+2 = 7 Marks]**
There are 3 priority queues: Q0, Q1 and Q2 where priority order: **Q2 > Q1 > Q0.**
Priority boost occurs after every 40 ms.
Time slice is 5 ms.

Process	A	B	C	D	E	F
Arrival	0	8	12	12	33	67
Duration	15	20	10	5	15	20

Same as set A