Discrete Event Process Scheduling Simulator

Harshaan Dargan   Ribhav Gaur

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Problem Statement and Abstract

In this assignment we first generate a set of jobs through a Poisson Process, then schedule them using various mechanisms such as First In First Out (FIFO), Shortest Job First (SJF), Shortest Job to Completion First (SJCF), Round Robin (RR) and Multi-level Feedback Queue. The mechanisms are then compared wrt to their average turnaround times and average response time for different inputs and their trend compared by varying the parameters for each scheduling mechanism.

Note: $T_{Turnaround} = T_{completion} - T_{arrival}$; $T_{Response} = T_{firstrun}$ - $T_{arrival}$

Mechanisms

First In First Out

The job that comes in the system first is scheduled to be run first irrespective of the other properties of this job and the other jobs. It is a very primitive and an inefficient mechanism and leads to very high response time. In some cases it might give a reasonable turnaround time.

Shortest Job First

In this mechanism at any given point if a job is not running, then out of all the possible jobs which can be chosen, the job with the shortest duration is chosen. This job is now run till its completion. It leads to a high response time. It performs better than FIFO wrt turnaround time but is still not optimal.

Shortest Job to Completion First

At any given time the job with the shortest time remaining is prioritized over all other jobs. This is optimum wrt turnaround time but might still lead to a high response time.
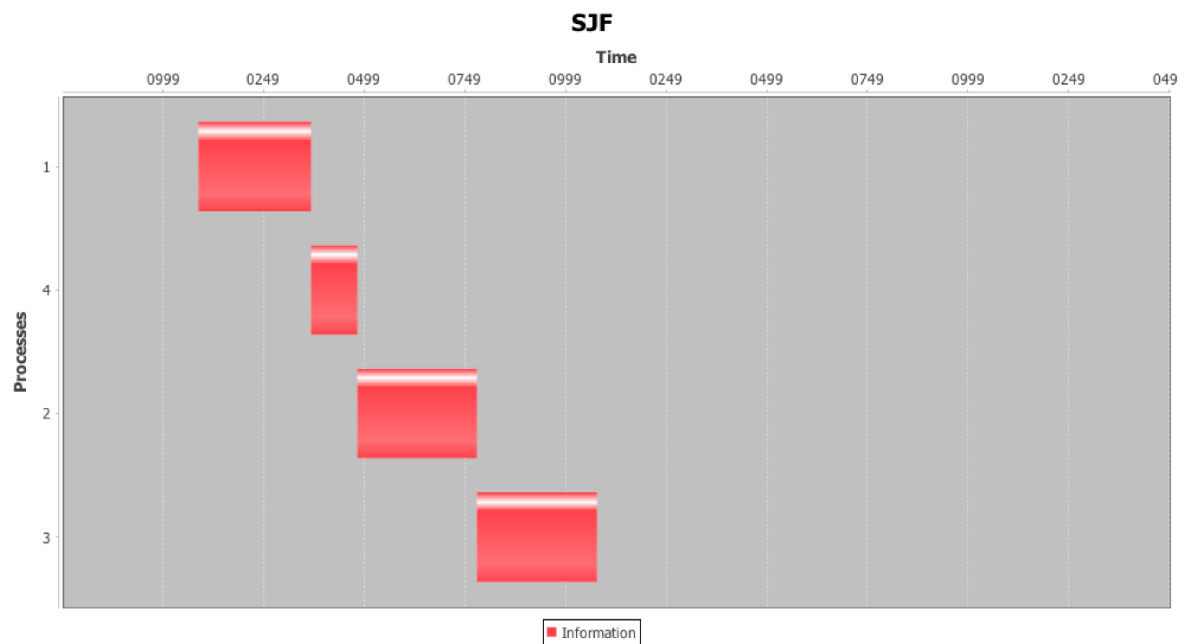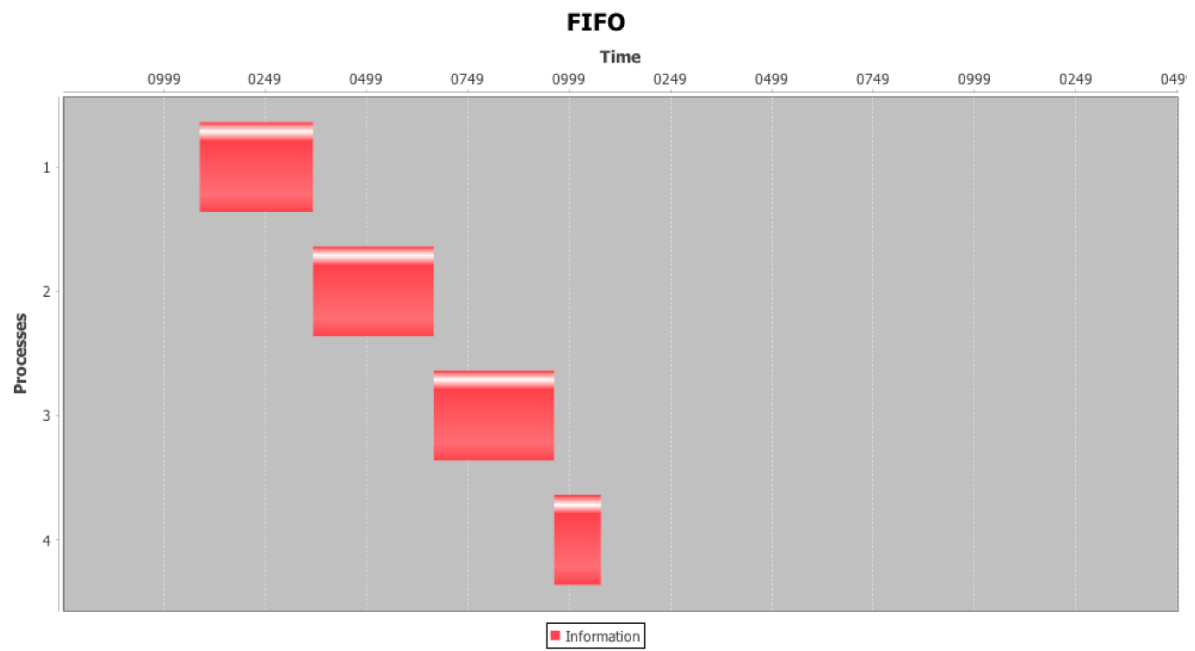
Round Robin

In this mechanism jobs are fed in a queue and run for a fixed time which is called the time slice. When a job has run for a given time slice, it is added to the back to the queue allowing the other jobs to be run. This is optimal for response time, whereas might lead to a high turnaround time.
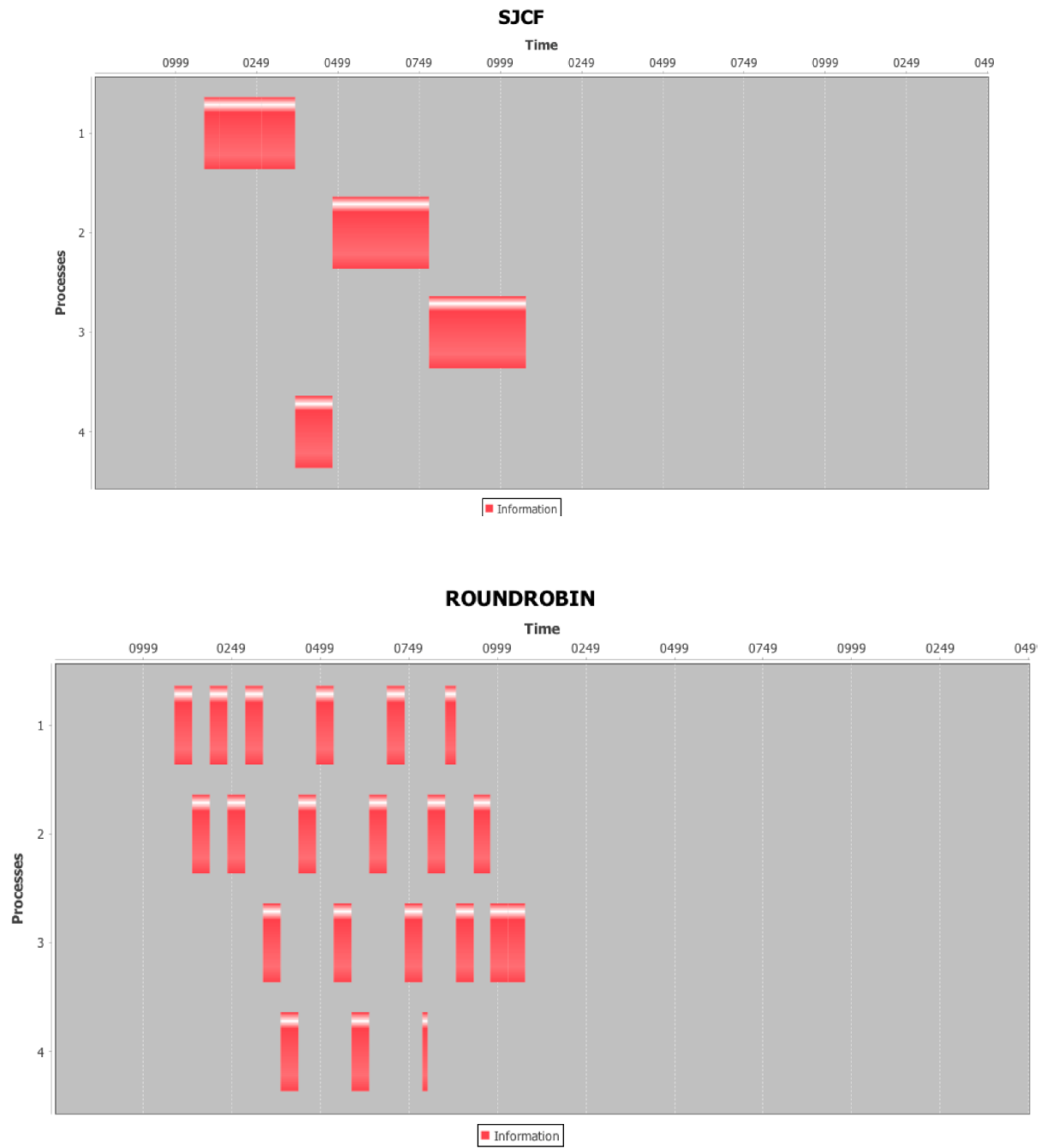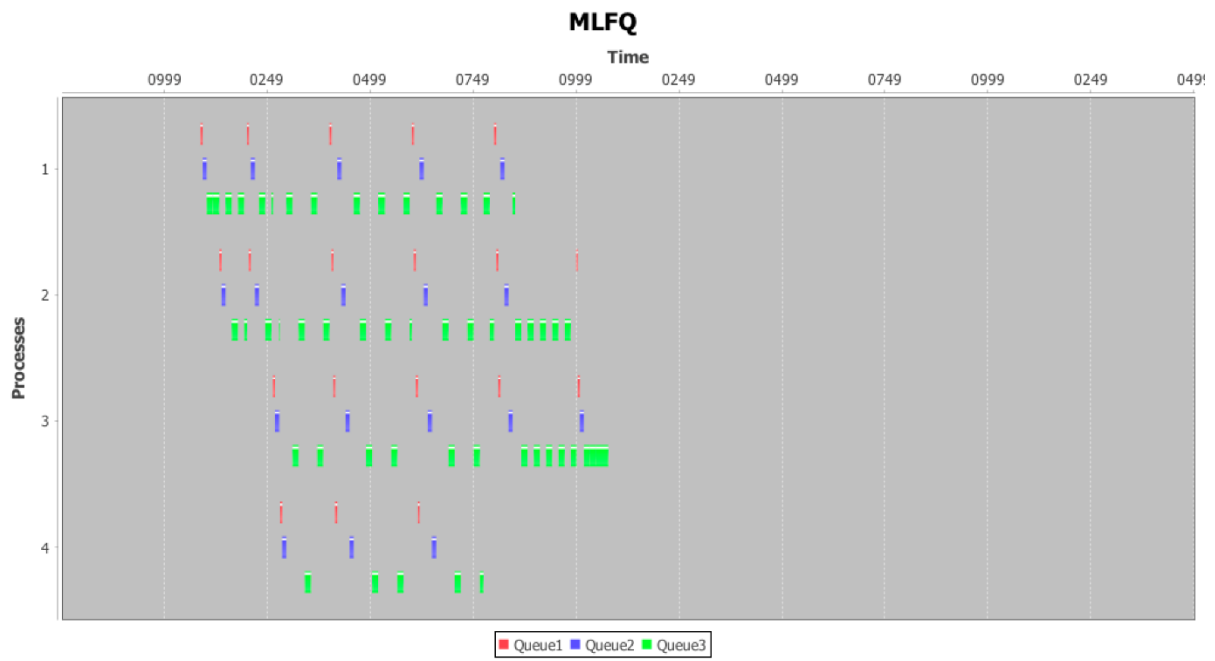
Multi-Level Feedback Queue

In this mechanism, jobs are assigned priority and have the highest priority when they enter the system. Each priority has a queue associated with it. Jobs with the highest priority are always run first and jobs with equal priority are run in RR. Each queue has a time slice associated with it and the priority of the job is decreased when it completes a time slice in a given queue. Also, the priority of all the jobs is reset at a periodic time interval to prevent starvation. This system is preferred when the finishing times for jobs
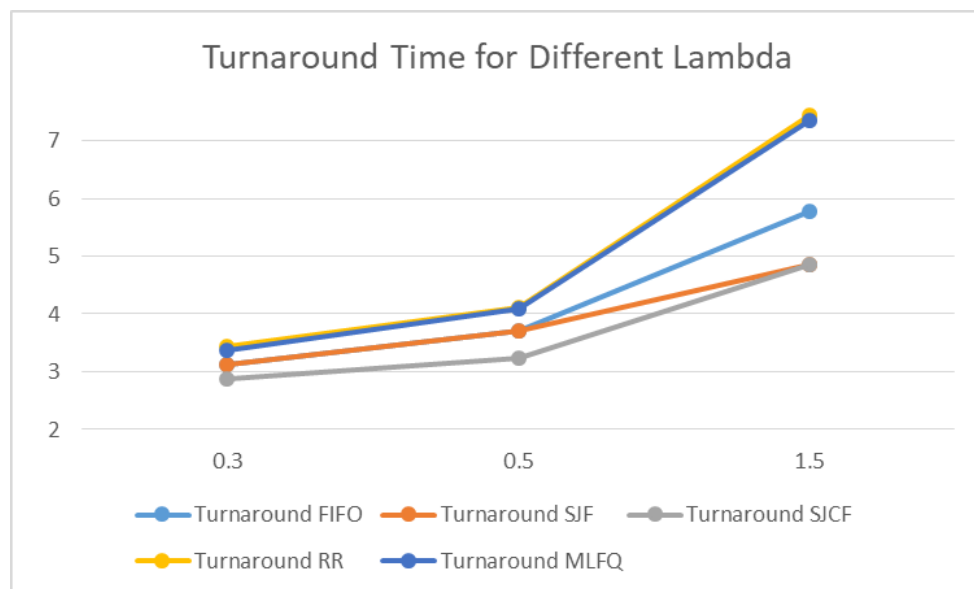
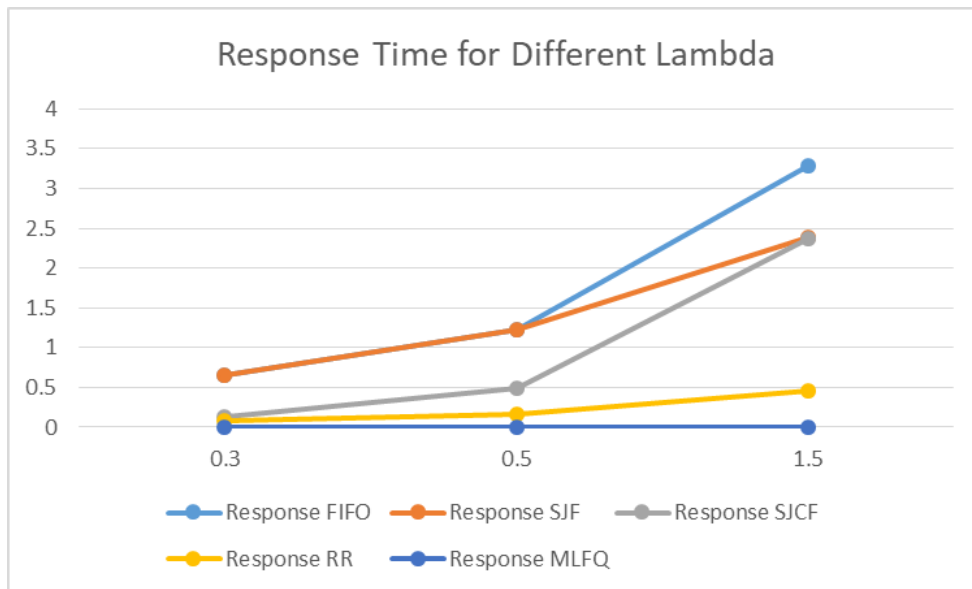are not known

Sample Screenshots of Gantt Charts

FIFO

SJF

SJCF

Information

ROUNDROBIN

Time

Information

3

MLFQ

Queue1 Queue2 Queue3

Changing the Parameter of the Distribution

Turnaround Time for Different Lambda

Turnaround FIFO Turnaround SJF Turnaround SJCF
Turnaround RR Turnaround MLFQ

Response Time for Different Lambda

Increasing Lambda leads to jobs coming at a faster rate, which decreases their arrival time. The distribution of duration remains same, hence we observe and increase in turnaround as well as response time. Also, notice SJCF has the best turnaround time whereas RR has the worst. RR has the second best response time. Zero response time in MLFQ is observed because the time slice of MLFQ is such that the first queue is always empty when other jobs arrive and hence the current job is interrupted and it is always run.

Changing the Time Slice of Round Robin

Turnaround and Response Times for RR for varying Time Slice
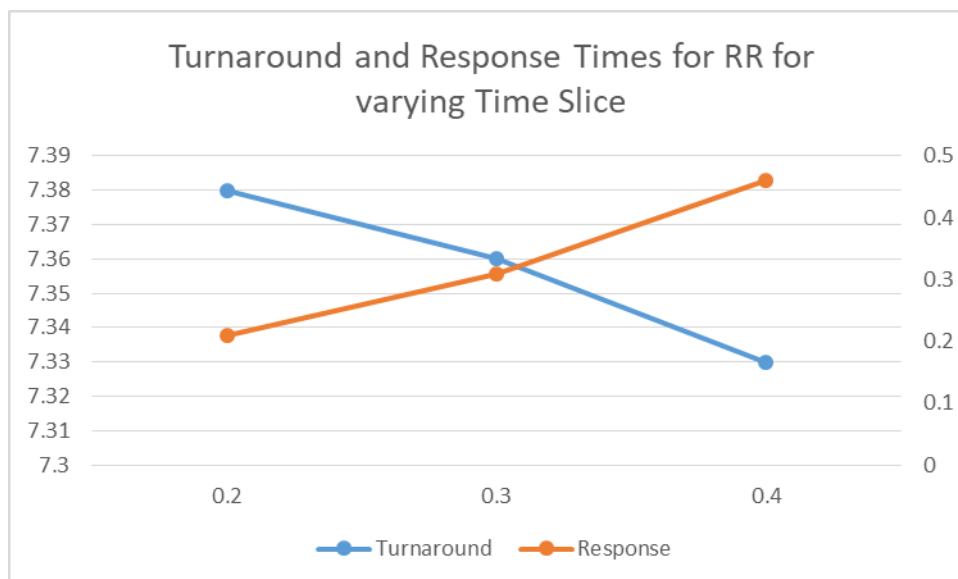
Expectedly, increasing the time slice of RR makes it approach towards FIFO, hence the response time increases and the turnaround times.

Changing the Time Slices of MLFQ

Turnaround and Response Time for varying Time Slice for Q1
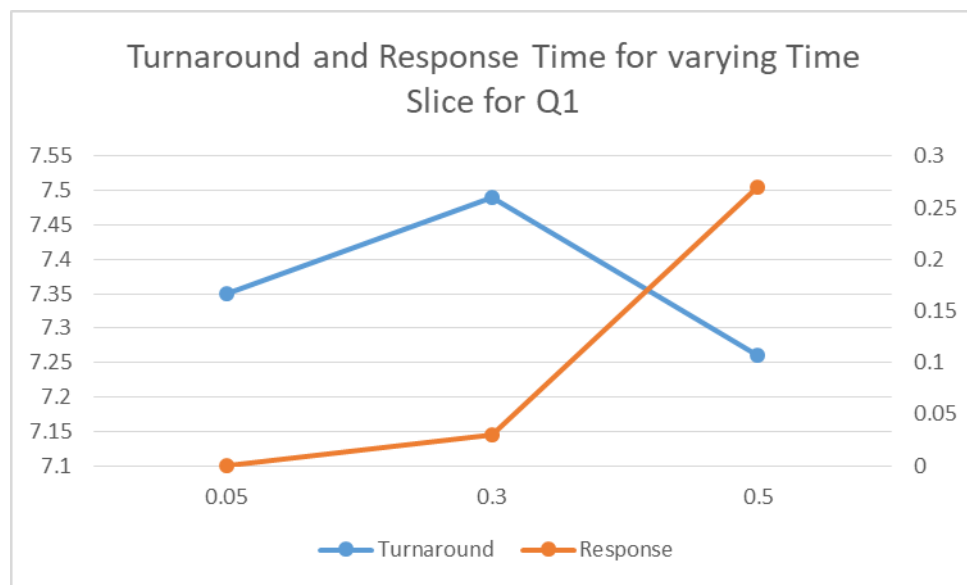
Increasing the time slice of the first queue increases the response time as now there is a job in the topmost queue when another job arrives and it is not immediately run. However it has no significant impact on Turnaround Time.