

**Operating Systems Laboratory**  
**Spring Semester 2018-19**

**Assignment 3**

**Simulation of CPU Scheduling Algorithms**

**Assignment given on:** January 29, 2019

**Assignment deadline:** February 04, 2019

The objective of this assignment is to evaluate various process scheduling strategies. This is achieved by generating random arrival times and CPU bursts for a set of processes following some probability distribution, and determining the performances of the chosen scheduling algorithms through simulation. The specifications for the problem are as follows.

- a) Read the number of processes  $N$ , and generate the arrival times and CPU bursts of the processes using some probability distribution. The first process is assumed to arrive at time 0; for all subsequent processes the *inter-arrival time* is generated as a random variable (between 0 and 10) following exponential distribution with some given mean. Also the CPU bursts of the processes are generated as uniform random variables (between 1 and 20). Save the generated table in a file.

***Hint:** If  $R$  is a uniform random number in the range  $(0, 1)$ , a random variable from an exponential distribution with mean  $\lambda$  can be generated as:*

$$(-1.0 / \lambda) * \ln R$$

- b) Simulate the following CPU scheduling algorithms on the process arrival trace as generated in (a) above, and compute the average turnaround times (ATN) for the processes:
- (i) Non-preemptive First Come First Serve (FCFS)
  - (ii) Non-preemptive Shortest Job First
  - (iii) Pre-emptive Shortest Job First
  - (iv) Round Robin with time quantum  $\delta = 2$  time units
  - (v) Highest response-ratio next (HRN)
- c) Run the simulation for  $N = 10, 50$  and  $100$ , ten times for each value of  $N$  using a shell script (bash/python), and generate the plot comparing the average values of ATN obtained for various scheduling techniques for different values of  $N$ .
- d) For FCFS (non-preemptive) determine the theoretically expected lower bound on the turn-around time and check whether that is satisfied by your simulation.

**Submission Guideline:**

- Create the program as a single file as **a3\_<groupno>.c** or **.cpp**. Create the plot file as **a3\_plot\_<groupno>.pdf**. Upload the two files.

**Evaluation Guidelines:**

While entering marks, the partwise break up should also be entered according to the marking guidelines given below. There is a separate component for individual assessment, based on how the student answers questions.

Sl	Items	Marks
(a)	Random number generation (uniform, exponential)	8
(b)	Maintaining job queues for scheduling	8
(c)	Simulation of five scheduling strategies	15
(d)	Generation of results and plots	15
(e)	Shell script for running the jobs	4
(f)	Theoretical analysis of FCFS	5
	<b>Total</b>	55