Birla Institute of Technology & Science, Pilani, Hyderabad Campus

Programming Assignment

Operating System (CS F372)

(Total Marks 4*15= 60 Marks)

Students are required to do this assignment in groups of 4 students. Form groups among yourselves. **The deadline for this assignment is April, 29, 2020.**

There are 4 questions totally in this assignment and each carries 15 marks. The goal of the programming assignments is to get every student to understand and implement the functionality of shell, process communication, CPU process scheduling and multithreading. Each of the questions are provided below:

1. **Shell:** Write a C program to implement the command line shell that does the following:
   - A prompt should be displayed upon starting the execution of a program and it should allow the user to type basic linux commands one after the other. The program must support at least any 6 commands such as **pwd, ls, cd, mkdir, rmdir, rm,cp, etc.**
   - For each of the user's commands entered, a separate child process should be created to execute the command and display the output if any.

   Note: Execution should be terminated only when the user types the command **exit** on prompt.

2. **Interprocess Communication:** Write two programs, i.e., Program1.c, and Program2.c that communicate with each other through a shared memory. Both the programs must be run indefinitely. For each line of the input (e.g., a sequence of alphanumeric strings) entered for program 1, program2 should display the number of words and number of numerical digits of the input.

3. **CPU Process Scheduling:** Implement the process scheduling algorithms such as First Come First Serve, Shortest Job First, Nonpreemptive Priority (a larger priority number implies a higher priority), and Round Robin (quantum = 2) using C. Burst time, Arrival time (in milliseconds) and Priority of the five processes are given in the below table. Display the turnaround time and waiting time of each process for each of the scheduling algorithms. Also, display the average turnaround time and waiting time of all processes for each algorithm. Then, plot graphs showing average waiting time and

turnaround time of these algorithms and mention which algorithm performs better than the others and why?

Process	Arrival Time	Burst Time	Priority
P1	1	2	2
P2	1	1	1
P3	3	8	4
P4	2	4	2
P5	4	5	3

4. **Multithreading:**

a) Write a multithreaded C program that calculates various statistical values for a list of numbers. This program will be passed a series of numbers on the command line and will then create three separate worker threads. One thread will determine the average of the numbers, the second will determine the maximum value, and the third will determine the minimum value. For example, suppose your program is passed the integers

90 81 78 95 79 72 85

The program will report
The average value is 82
The minimum value is 72
The maximum value is 95

The variables representing the average, minimum, and maximum values will be stored globally. The worker threads will set these values, and the parent thread will output the values once the workers have exited.

b) Extend the above program by creating additional threads that determine other statistical values, such as median and standard deviation and also the total number of integers passed.

Submission Instructions:

- Create one main folder that contains four sub folders, which represent the source code of above four questions respectively. Each of the sub folders should contain the source code, one MS word document capturing the screenshots of the output and the observation if any. Each subfolder should also contain a read file specifying instructions to compile and run and shall also specify which program to be run first in order to see the expected output from your programs.
- The main folder must contain one main word file that should include the group information,i.e., student name, roll no and email id of each student.
- Zip the main folder and upload the zip file in CMS by **April 29, 2020 23.59 pm.**

Demonstrations:

You will be required to give the demonstration after you come back to the institute. Each member of the group is required to be presented at the time of demonstration and will be evaluated individually. The modalities of the demonstration will be informed to you later based on the situation of the COVID19 pandemic.

Note:

- Plagiarism software would be used to check the similarity scores. If a higher match is found between the submissions of two or more groups, they will be awarded a grade penalty accordingly.
- The submission link for uploading zip file in CMS would be enabled soon and you will be informed about it through CMS.

You can drop me a mail for any other queries in this regard.