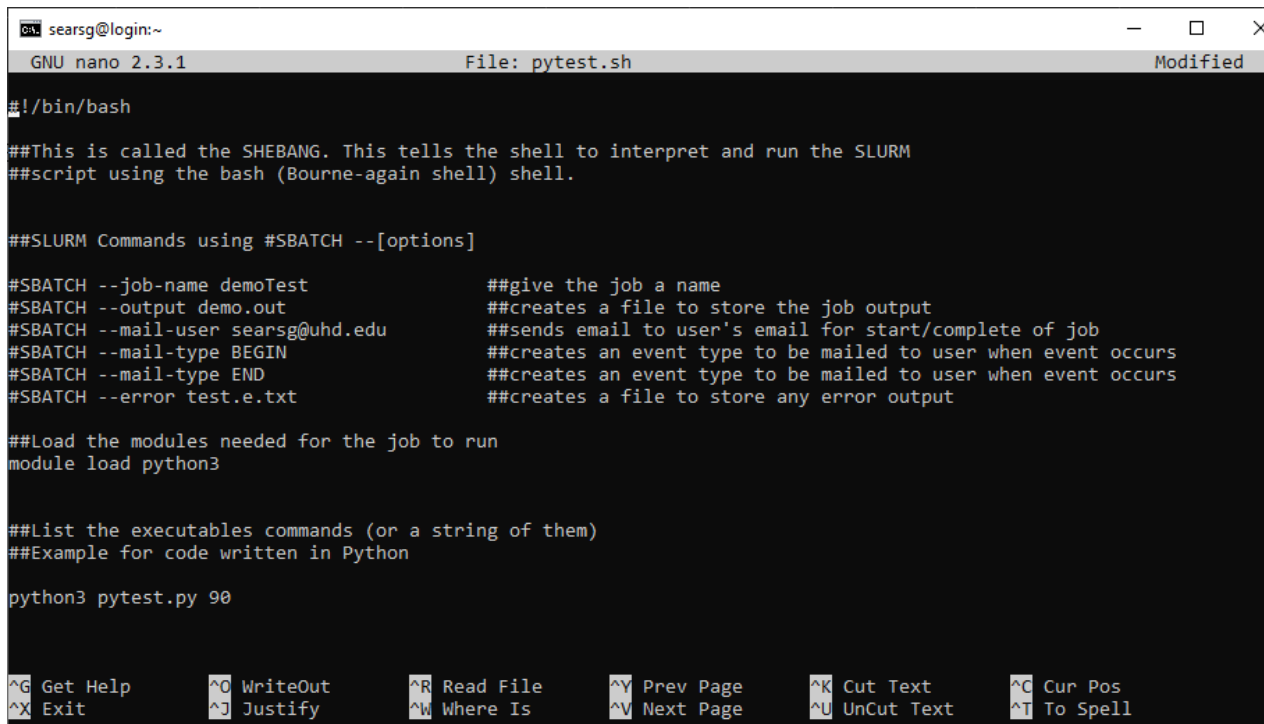


By group

[100 pts] General Instructions: The first part of your emulator is the process multiplexer and your command-line interpreter (CLI).



```
searsg@login:~
GNU nano 2.3.1 File: pytest.sh Modified

#!/bin/bash

##This is called the SHEBANG. This tells the shell to interpret and run the SLURM
##script using the bash (Bourne-again shell) shell.

##SLURM Commands using #SBATCH --[options]

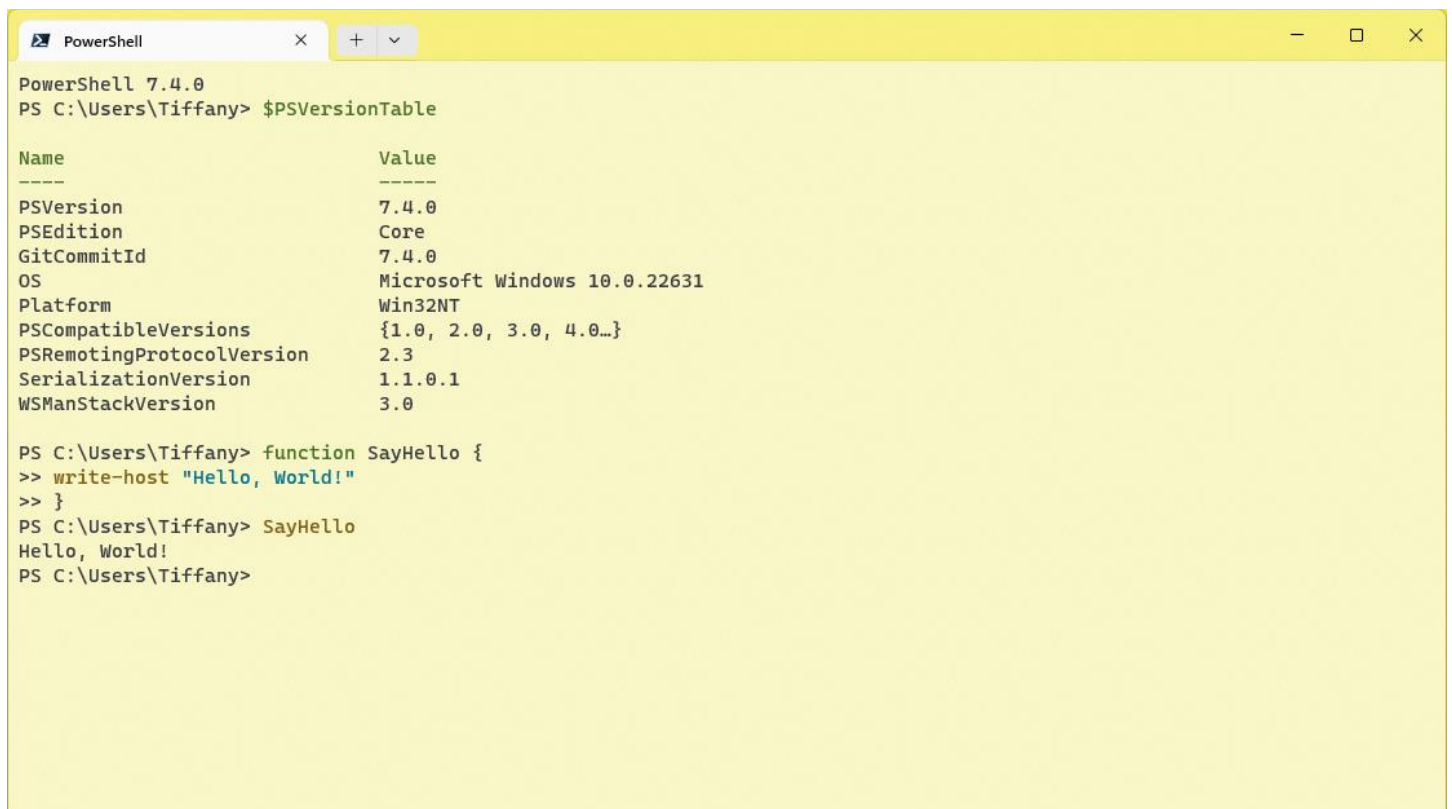
#SBATCH --job-name demoTest           ##give the job a name
#SBATCH --output demo.out             ##creates a file to store the job output
#SBATCH --mail-user searsg@uhd.edu    ##sends email to user's email for start/complete of job
#SBATCH --mail-type BEGIN             ##creates an event type to be mailed to user when event occurs
#SBATCH --mail-type END               ##creates an event type to be mailed to user when event occurs
#SBATCH --error test.e.txt            ##creates a file to store any error output

##Load the modules needed for the job to run
module load python3

##List the executables commands (or a string of them)
##Example for code written in Python

python3 pytest.py 90

^G Get Help      ^O WriteOut      ^R Read File     ^Y Prev Page     ^K Cut Text      ^C Cur Pos
^X Exit          ^J Justify       ^W Where Is     ^V Next Page     ^U UnCut Text   ^T To Spell
```



```
PowerShell 7.4.0
PS C:\Users\Tiffany> $PSVersionTable

Name                           Value
----                           -
PSVersion                      7.4.0
PSEdition                      Core
GitCommitId                    7.4.0
OS                              Microsoft Windows 10.0.22631
Platform                       Win32NT
PSCompatibleVersions           {1.0, 2.0, 3.0, 4.0...}
SerializationVersion           1.1.0.1
WSManStackVersion              3.0

PS C:\Users\Tiffany> function SayHello {
>> write-host "Hello, World!"
>> }
PS C:\Users\Tiffany> SayHello
Hello, World!
PS C:\Users\Tiffany>
```

Shell Reference


Please refer to a general Linux/Windows powershell/Windows command line. This serves as a strong reference for the design of your command-line interface.

For the process multiplexer, refer to the Linux “screen” command on its behavior:

<https://www.geeksforgeeks.org/screen-command-in-linux-with-examples/>

Checklist of Requirements

Your system must have ALL the following features implemented properly.

Requirement	Main menu console
Description	<div><pre>1 2 3 4 5 6 7 8 9 10 11 12 13 14 15</pre></div> <p>A main menu console for recognizing the following commands:</p> <ul style="list-style-type: none">“initialize” – initialize the processor configuration of the application. This must be called before any other command could be recognized, aside from “exit”.“exit” – terminates the console.“screen” – see additional details.“scheduler-test” – continuously generates a batch of dummy processes for the CPU scheduler. Each process is accessible via the “screen” command.“scheduler-stop” – stops generating dummy processes.“report-util” – for generating CPU utilization report. See additional details.
Requirement	“screen” command support
Description	From the main menu, the user can perform the following: <ul style="list-style-type: none">• Create a new process via “screen -s <process name>” command.• Lists all running processes via “screen -ls” command.
Requirement	Generation of CPU utilization report
Description	The console should be able to generate a utilization report whenever the “report-util” command is entered.
Requirement	Configuration setting
Description	The “initialize” commands should read from a “config.txt” file, the parameters for your CPU scheduler and process attributes.

The “screen” command specifications

The “screen” command emulates the screen multiplexer of Linux OS. Below is a CLI mockup of the screen command:

```

1 | Process: My own process
2 | ID: 1
3 |
4 | Current instruction line: 153
5 | Lines of code: 1240
6 |
7 | root:\> process-smi
8 |
9 | Process: My own process
10 | ID: 1
11 |
12 | Current instruction line: 769
13 | Lines of code: 1240
14 |
15 | root:\> process-smi
16 |
17 | Process: My own process
18 | ID: 1
19 |
20 | Finished!
21 |
22 | root:\>

```

When the user types “**screen -s <process name>**” from the main menu console, the console will clear its contents and “move” to the process screen (lines 1 – 7). From there, the user can type the following:

- “process-smi” – Prints a simple information of the process (lines 9 – 13). The process contains dummy instructions that the CPU executes in the background. Every time the user types “process-smi”, it provides the updated details (e.g. lines 15 – 20). If the process has finished, simply print “Finished!” after the process name and ID has been printed (e.g. lines 17 – 20).
- “exit” – Returns the user to the main menu.

The range of instruction length per process, can be set through the “config.txt”

At any given time, any process can finish its execution. If this happens, the user can no longer access the screen after exiting.

The user can access the screen anytime by typing “**screen -r <process name>**” in the main menu. If the process name is not found/finished execution, the console simply prints “Process <process name> not found.”

Note that for the purpose of debugging/validating the correctness of your program, all finished and currently running processes must be reported in the “report-util” command.

The “scheduler-test” and “scheduler-stop” commands

To facilitate and stress-test the capabilities of your console, we should provide support for generating a batch of dummy processes.

“scheduler-test” – The behavior is as follows: Every X CPU cycles, a new process is generated and put into the ready queue for your CPU scheduler. This frequency can be set in the “config.txt.” As long as CPU cores are available, each process can be executed and be accessible via the “screen” command.

“scheduler-stop” – Stops generating dummy processes.

These commands are only accessible in the main menu console.

You must generate human-readable process names for the processes generated by the “scheduler-test” command to conveniently access them using the “screen -s <process name>” command described earlier. E.g.: p01, p02, ..., p1240.

The “screen -ls” and “report-util” commands

These commands should be similar. The only difference is that “report-util” saves this into a text file – “csopesy-log.txt.” See sample mockup:

```

25      / \_/_/_/_/_/_/_/_/_/_/_/_/_/_/_\ v /
26      |   |   |   |   |   |   |   |   |
27      |___|___|___|___|___|___|___|___|
28      |   |   |   |   |   |   |   |   |
29      \___/\___/\___/\___/\___/\___/\___/
-----
30 Welcome to CSOPESY Emulator!
31
32 Developers:
33 Del Gallego, Neil Patrick
34
35 Last updated: 01-18-2024
36
37 root:\> screen -ls
38 CPU utilization: 100%
39 Cores used: 4
40 Cores available: 0
41
42 -----
43 Running processes:
44 process05    (01/18/2024 09:15:22AM)     Core: 0       1235 / 5876
45 process06    (01/18/2024 09:17:22AM)     Core: 1         3 / 5876
46 process07    (01/18/2024 09:17:45AM)     Core: 2        9 / 1000
47 process08    (01/18/2024 09:18:58AM)     Core: 3       12 / 80
48
49 Finished processes:
50 process01    (01/18/2024 09:00:21AM)     Finished    5876 / 5876
51 process02    (01/18/2024 09:00:22AM)     Finished    5876 / 5876
52 process03    (01/18/2024 09:00:42AM)     Finished   1000 / 1000
53 process04    (01/18/2024 09:00:53AM)     Finished     80 / 80
54 -----
55
56 root:\> report-util
57 root:\> Report generated at C:/csopesv-log.txt!
```

The “screen-ls” commands should list the CPU utilization, cores used, and cores available, as well as print a summary of the running and finished processes (lines 38 – 54). The “report-util” command saves the same info in the csopesv-log.txt file.

The scheduler

Your CPU scheduler is real-time and will continuously schedule processes as long as your console is alive. The scheduler algorithm will be set through the “initialize” command and through the “config.txt” file.

The CPU cycle

For simplicity, assume that the CPU cycle is an integer counter that tallies the number of CPU ticks. See pseudocode below:

```
196 int main() {
197     int cpuCycles = 0;
198
199     while(<OS is running>) {
200         cpuCycles++;
201     }
202 }
```

The config.txt file and “initialize” command

The user must first run the “initialize” command. No other commands should be recognized if the user hasn’t typed this first. Once entered, it will read the “config.txt” file, which is space-separated in format, containing the following parameters.

Parameter	Description
num-cpu	Number of CPUs available. The range is [1, 128].
scheduler	The scheduler algorithm: “fcfs” or “rr”.
quantum-cycles	The time slice is given for each processor if a round-robin scheduler is used. Has no effect on other schedulers. The range is [1, 2^{32}].
batch-process-freq	The frequency of generating processes in the “scheduler-test” command in CPU cycles. The range is [1, 2^{32}]. If one, a new process is generated at the end of each CPU cycle.
min-ins	The minimum instructions/command per process. The range is [1, 2^{32}].
max-ins	The maximum instructions/command per process. The range is [1, 2^{32}].
delays-per-exec	Delay before executing the next instruction in CPU cycles. The delay is a “busy-waiting” scheme wherein the process remains in the CPU. The range is [0, 2^{32}]. If zero, each instruction is executed per CPU cycle.

The default parameters and sample “config.txt” can be seen below:

```
60 num-cpu 4
61 scheduler "rr"
62 quantum-cycles 5
63 batch-process-freq 1
64 min-ins 1000
65 max-ins 2000
66 delay-per-exec 0
```

ASSESSMENT METHOD

Your CLI emulator will be assessed through a black box quiz system in a time-pressure format. This is to minimize drastic changes or “hacking” your CLI to ensure the test cases are met. You should only modify the parameters and no longer recompile the CLI when taking the quiz.

Test cases, parameters, and instructions are provided per question, wherein you must submit a video file (.MP4), demonstrating your CLI. Some questions will require submitting PowerPoint presentations, such as cases explaining the details of your implementation.

IMPORTANT DATES

See AnimoSpace for specific dates.

Week 7	Mockup test case and quiz
Week 8	Actual test case and quiz

Submission Details

Aside from video files for the quiz, you need to prepare some of the requirements in advance, such as:

- SOURCE - Contains your source code. Add a README.txt with your name and instructions on running your program. Also, indicate the entry class file where the main function is located. An alternative can be a GitHub link.
- PPT – A technical report of your system containing:
 - Command recognition
 - Console UI implementation
 - Command interpreter implementation
 - Process representation
 - Scheduler implementation

Grading Scheme

- You are to provide evidence for each test case, recorded through video. Each test case will have some points allocated. The test cases will be graded as follows:

Robustness		
No points	Partial points	Full points
The CLI did not pass the test case. NO WORKAROUND is available to produce the expected output.	The CLI did not pass the test case. A workaround is available to produce the expected output.	The CLI passed the test case using varying inputs and produced the expected output.