Curtin University – Department of Computing

Assignment Cover Sheet / Declaration of Originality

Complete this form if/as directed by your unit coordinator, lecturer or the assignment specification.

Last name:	Chitete	Student ID:	20169321
Other name(s):	Tanaka		
Unit name:	Operating Systems	Unit ID:	COMP2006
Lecturer / unit coordinator:	Sie Teng Soh	Tutor:	N/A
Date of submission:	10/05/2021 at 16:00	Which assignment?	(Leave blank if the unit has only one assignment.)

I declare that:

- The above information is complete and accurate.
- The work I am submitting is *entirely my own*, except where clearly indicated otherwise and correctly referenced.
- I have taken (and will continue to take) all reasonable steps to ensure my work is *not accessible* to any other students who may gain unfair advantage from it.
- I have *not previously submitted* this work for any other unit, whether at Curtin University or elsewhere, or for prior attempts at this unit, except where clearly indicated otherwise.

I understand that:

- Plagiarism and collusion are dishonest, and unfair to all other students.
- Detection of plagiarism and collusion may be done manually or by using tools (such as Turnitin).
- If I plagiarise or collude, I risk failing the unit with a grade of ANN ("Result Annulled due to Academic Misconduct"), which will remain permanently on my academic record. I also risk termination from my course and other penalties.
- Even with correct referencing, my submission will only be marked according to what I have done myself, specifically for this assessment. I cannot re-use the work of others, or my own previously submitted work, in order to fulfil the assessment requirements.
- It is my responsibility to ensure that my submission is complete, correct and not corrupted.

Signature: TANAKA CHITETE Date of signature: 03/04/2021

(By submitting this form, you indicate that you agree with all the above text.)

Mutual Exclusion and Access of Shared Resources

The threads which accessed shared resources where the parent thread and the threads executing the `ppscheduler` and `srtfscheduler` programs. With this in mind, mutual exclusion was achieved via the use of mutexes (in combination with condition variables).

`pthread_mutex_t buffer1Lock`
This lock was used by the parent thread to prevent the PP Scheduler and SRTF Scheduler threads from attempting to read from `buffer1` while no filename was retrieved from the user.

`pthread_mutex_t buffer2Lock`
This lock was used by the child threads to prevent the parent thread from attempting to read from `buffer2` while no results were stored in it.

`pthread_mutex_t executionLock`
This mutex was used to ensure that only one thread at a time would be in execution. This prevented race conditions as the children threads would not be able to execute simultaneously and then attempt to write/overwrite `buffer2`, which only had enough space to store on thread's results at a time. In addition, this lock was also used to prevent the parent thread from attempting to read from `buffer2` when the the children threads hadn't unlocked the executionLock (i.e. hadn't finished executing).

`int buffer1IsFull`
This condition variable was used by the child threads to trigger a `pthread_cond_wait()` call while the parent thread was waiting to retrieve a filename from the user (i.e. hadn't put any filename into `buffer1`).

`int buffer2IsFull`
This condition variable was used by the parent thread to trigger a `pthread_cond_wait()` call while the current child thread was still executing (i.e. hadn't put any results into `buffer2`).

`int PpSchedulerIsFinished`
This condition variable was used by the SRTF Scheduler thread to trigger a `pthread_cond_wait()` call until the PP Scheduler finished execution (in order to prevent the threads from potentially overwriting each other's results stored in buffer2).

`pthread_cond_t buffer1IsFullCond`
This condition variable was used by the parent thread to signal to the child threads to reevaluate the truth value of the `buffer1IsFull` condition variable and if True, read from `buffer1`.

`pthread_cond_t buffer2IsFullCond`
This condition variable was used by the child threads to signal to the parent thread to reevaluate the truth value of the `buffer2IsFull` condition variable and if True, read from `buffer2`.

`pthread_cond_t PpSchedulerThreadIsFinishedCond`
This condition variable was used by the parent thread to signal to the SRTF Scheduler thread to reevaluate the truth value of the `PpSchedulerThreadIsFinished` condition variable and if True, begin execution.

Testing

`ppscheduler`, `srtfscheduler` and `scheduler` were tested using a variety of different input files which were made using examples of process tables and their associated Gantt charts that I sourced externally. After executing each program with its suite of input files, their results were verified by comparing the output of the program to the expected Gantt chart for the processes denoted by the input files. Each of the programs passed the provided test cases. In conclusion, *based on the test cases* which these programs were subjected to, they work as expected. However, this is not reason to say that they work *perfectly* as verifying this is essentially impossible as all programs have their vulnerabilities.

Sample Inputs and Outputs

`ppscheduler`

Sample #1

```
./ppscheduler
PP simulation: p1.txt
P2                    P4        P3                        P1
0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
ATT: 15.25, AWT:  9.25
```

Sample #2

```
./ppscheduler
PP simulation: p2.txt
P2    P1                                                  P4    P3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
ATT: 21.25, AWT: 13.25
```

Sample #3

```
./ppscheduler
PP simulation: p3.txt
P1  P2  P3  P2                  P4                                                              P1    P5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
ATT: 21.60, AWT: 14.00
```

Sample #4

```
./ppscheduler
PP simulation: QUIT
```

srtfscheduler

Sample #1

```
./srtfscheduler
SRTF simulation: p1.txt
P4       P1                P3                          P2
0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
ATT: 13.00, AWT:  7.00
```

Sample #2

```
./srtfscheduler
SRTF simulation: p2.txt
P4  P2    P3           P1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
ATT: 12.50, AWT:  4.50
```

Sample #3

```
./srtfscheduler
SRTF simulation: p3.txt
P1      P3  P2  P5  P2                      P4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
ATT: 11.20, AWT:  3.60
```

Sample #4

```
./srtfscheduler
SRTF simulation: QUIT
```

scheduler

Sample #1

```
./scheduler
Simulation: p1.txt
PP
P2                      P4        P3                          P1
0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
SRTF
P4       P1                P3                          P2
0  1  2  3  4  5  6  7  8  9  10  11  12  13  14  15  16  17  18  19  20  21  22  23  24
PP:   ATT: 15.25, AWT:  9.25
SRTF: ATT: 13.00, AWT:  7.00
```

Sample #2

```
./scheduler
Simulation: p2.txt
PP
P2    P1                                                  P4    P3
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
SRTF
P4  P2    P3           P1
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
PP:   ATT: 21.25, AWT: 13.25
```

```
SRTF: ATT: 12.50, AWT:  4.50
```

Sample #3

```
./scheduler
Simulation: p3.txt
PP
P1  P2  P3  P2                  P4                                                              P1    P5
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
SRTF
P1      P3  P2  P5  P2                      P4
0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38
PP:   ATT: 21.60, AWT: 14.00
SRTF: ATT: 11.20, AWT:  3.60
```

Sample #4

```
./scheduler
Simulation: QUIT
PP
terminated
SRTF
terminated
```