48450 Real Time Operating Systems

Assignment 2 (15 marks)

Deadline for submission: 11:59 PM, 6 April 2023

1. Introduction

This assignment will involve the development of some application programs with real time file reading and writing. You are required to create a program that applies several key concepts of 48450 (RTOS) subject.

All programs are implemented in C language. The C source files should be compiled by gcc under Redhat Linux or Ubuntu (Do not use Clang in MacOS or MinGW in Windows).

This assignment is marked out of 15 and comprises 15% of the total score for this course.

Note: This assignment is to be completed in groups with a maximum of **two** students. One student can also be a self-formed group (2 bonus marks might be considered in this case). If a group has two students, both students receive the same mark. Students can only register once for joining a group. Any changes for the group arrangement should be approved by the subject coordinator. Plagiarisms, including from any third-party implementation, are exhibited.

2. Assignment details

Topic: Pipe, Threads and Semaphore for Real Time File Reading/Writing – Mark 15

The program implementation will involve using the concept of threads and pipes. Your program is required to create three threads (A, B and C) for reading data from one file and writing the data to another file through the pipe-line concept. This is similar to an internet file transmission.

Your program is required to achieve the following operation goals:

1. Thread A writes one line of data from a given "data.txt" file to a pipe. Note: The "data.txt" text file contains two parts, the file header region and the content region. Each region is written with several lines.

2. Thread B reads data from the pipe and forwards the data to thread C

3. Thread C reads the data (line by line) from Thread B and detects whether the line of data is from the file header region (see Figure 1). This assignment requires to write the data from the content region of "data.txt" into the "output.txt" only. Therefore, if the line of data is from the file header, it will be discarded.

The three threads (A, B, C) run sequentially (only one thread runs at a time while the other two threads are blocked) and iteratively (process one line of data per each loop). When Thread A reaches the end of the "data.txt" file, your program needs to handle and complete Threads B and C to finish the A-B-C sequential loop.

Your program is required to include pipe, thread and semaphore whereby necessary. Please note: The three threads A, B and C must adopt a mutually exclusive strategy to achieve your program. Again, only the content region of data as shown in Figure 1 is written into the "output.txt" through the program. It is also required to use a 'struct' to pass the parameters to the threads. The "data.txt" file can be downloaded from UTSOnline.

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You are required to experiment: If you do not apply semaphore, what will be the results by only using the three threads and the pipe? You are required to summarise your analysis and observation in your assignment report.

3. Assignment Deadline and Submission

The deadline to submit this assignment is 11:59 PM, 6 April 2023 You are required to submit two formats of the assignment:

1. Upload your full assignment report.

2. Upload your 'C' code file

If you use Makefile for compiling your program, you are required to upload the Makefile files as well.

Figure 1. The "data.txt" file

```
ply
format ascii 1.0
comment VCGLIB generated
element vertex 5
property float x
property float y                        File header region
property float z
element face 0
property list uchar int vertex_indices
end_header

-0.962323 1.07845 16.0996
-0.411401 1.14165 15.803
-0.947731 1.09894 16.1129                Content region
-0.912823 1.11493 15.7939
-0.89709 1.10348 15.8929
```