48450 Real Time Operating Systems
Assignment 3 (35 marks)

Deadline for submission: 23:59 PM, 27 May 2020

1. Introduction

This assignment will involve the development of some applications with CPU scheduling and Memory management. You are required to create a program that applies several key concepts of 48450 (RTOS) subject. A submission will be marked on its merits and may be awarded a mark that is less than 25 score if it is of modest quality. You are required to include a reflective self-assessment in the conclusion and submit it by the due date.

All programs are implemented in C language.

This assignment is marked out of **35 points** and comprises 35% of the total score for this course.

2. Assignment details

CPU Scheduling, FIFOs (Named Pipes), Memory Management and Signals

The program implementation will involve using the concepts of CPU scheduling, FIFOs, and Signal concepts. Your program is required to include two parts, namely **Program_1 and Program_2:**

(1) **Program_1 (15 points)**: You are required to use **CPU scheduling** and **FIFOs** (named Pipe) in the **Program_1**. It should include two threads, **Threads 1 and 2**.

Thread 1: In this thread, the **Program_1** is to simulate CPU scheduling by applying **Shortest-remaining-time-first algorithm (SRTF)**. Your program is required to measure the *average waiting time and turn-around time* in the **CPU scheduling**. After the CPU scheduling is completed, your program is required to define a FIFOs and write these *average waiting time and turn-around time* to CPU memory through the **FIFOs**. The input data involving the CPU scheduling are as follows:

Process ID	Arrive time	Bust time
1	8	10
2	10	3
3	14	7
4	9	5
5	16	4
6	21	6
7	26	2

Note:

1) You are required to draw a Gantt Chat to illustrate the schedules of process 1 to process 7 in your report.

Thread 2: In this thread, your program is required to read the *average waiting time and turn-around time* from the memory through **the FIFOs** (Named Pipes) as defined in the **Thread 1**. Then, your program is required to write those read data to a text file named "output.txt".

(2) **Program_2 (15 points):** You are required to use **Memory Management and Signal** in the **Program_2**. Your program is to simulate page-replacement for virtual memory management by using **First-In-First-Out** (FIFO) Algorithm. In the **Program_2**, your program is required to create **4 frames** and the reference string (Please refer to the slide 28 of online lecture) is as follows:

7,0,1,2,0,3,0,4,2,3,0,3,0,3,2,1,2,0,1,7,0,1,7,5

At each point, when a reference string enters into the frames, your program is required to check whether there is a page fault and output the current frame state including the page fault number (See the slides 28 of online lecture*) on your console (screen). When the whole reference string entering process is completed, your program is required to handle a "ctrl+c" **Signal**. Therefore, when you run your program, the program should wait for you to press the combined "ctrl+c" keys, your program will then print out the total number (how many) of fault pages on your console (screen).

(3) **Report (5 points): You are required to write a report to summarise your observation.**

***** L7-Chapters 8 Main Memory & 9 Virtual Memory (online lecture material)

Note:
The command line is required to run your Program_1 and Program_2.

For Program_1: the "output.txt" needs to be given from the command line.

For Program_2: the frame number needs to be given from the command line.

3. Assignment Deadline and Submission

The deadline to submit this assignment is 23:59 PM, 27 May 2020

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 file as well