**Assignment 2**

**CIS355** – Spring 2018

**Point Value**: 100 points

**Assignment Due Date**: **In class Thursday, Feb 15, 2018**

**Submission Instruction**

This assignment contains a written part and programming part. For the written part, please write the questions and your answers to those questions on a Microsoft Word document and convert it to a pdf file. The name of the file should be HW2\_YourLastname\_YourFirstname.pdf. For the programming part, please write a C++ program using pthread (POSIX) library in a C++ file. The name of the file should be HW2\_Programming\_YourLastname\_YourFirstname.cpp. Please zip both the pdf file and .cpp file into one zip file named HW2\_YourLastname\_YourFirstname.zip. Please submit the zip file on Schoology by 11:59pm and a hard copy of the pdf file to the instructor in lecture.

**Short answers**

1. What is a process (**5 points**) and what is the user address space of a process? (**5 points**)
2. What are the 5 states of a process (**5 points**)? Please draw the process state diagram.
3. What is a process context-switch **(5 points**)? Please explain what actions taken by the kernel when process 1 is replaced by process 2. (**5 points)**
4. What is long-term scheduler **(5 points**)? What is short-term scheduler? **(5 points**)
5. What are the possible reasons for a process to change from running state into the waiting state? Please list at least five reasons. **(10 points).**
6. What is a thread **(5 points**)? What are the components of program state are shared across threads in a multithreaded process? **(5 points**) What are the components are unique to each thread in a multithreaded Process **(5 points)**?
7. Is it possible to have concurrency, but not parallelism? Please explain your answer. **(10 points)**
8. Please design and write a C++ multithreaded program using POSIX thread library to find the number of prime numbers between 1 and 10,000,000 (10 million) and find out how many microseconds it takes in this computation process. Assume your computer has 4 CPUs and you create 4 threads from your main thread? **(30 points)**