Due Date: 14.12.2017

CENG 313 – Operating Systems
Homework #2

In this homework you are expected to cover four concepts of OS given below;

- Threads
- Synchronization
- Deadlocks and Starvation

Implement a C program that is explained below using Unix. You should implement a multi-threaded program that operates files that are filled with random numbers. Your program requires three types of threads:

A. Cutting and Pasting threads.
B. Prime number removing threads.
C. Negative number removing threads.

For your program; you will be given two types of resources (files).

Resource type 1: Filled with integer numbers initially. Responsible threads should read and cut the content of a line of this file.

Resource type 2: Empty initially. Responsible threads should append this file by pasting the lines that they already cut from Resource type 1.

Type "**A**" threads should use two resources (any of one "**Resource type 1**" type file and one "**Resource type 2**" type file) at the same time. Without having both of "resources type 1" and "Resource type 2" thread cannot perform its task. Type "**A**" thread should cut and paste a **single line** at each time. Each type "**A**" thread should decide the total number of lines its going to cut/paste randomly. The random decision shouldn't be less then 1 and greater than 10.

Type "**B**" and "**C**" threads are responsible of cleaning the negative and prime numbers in the files. These files could be **"Resource type 1" or "Resources type 2"** type of files. Therefore, thread types "**B**" and "**C**" can use "**Resource type 1**" and" **Resource type 2**" at any time. However, these threads should consume only one resource at a time.

NOTE 1: It is important that "**Resource type 2**" is going to be the file that has all the contents of "**Resource type 1**" type files and at the end all the "**Resource type 1**" type files should be empty. In addition, "**Resource type 2**" should be free of negative and prime numbers. This is the termination condition for your process.

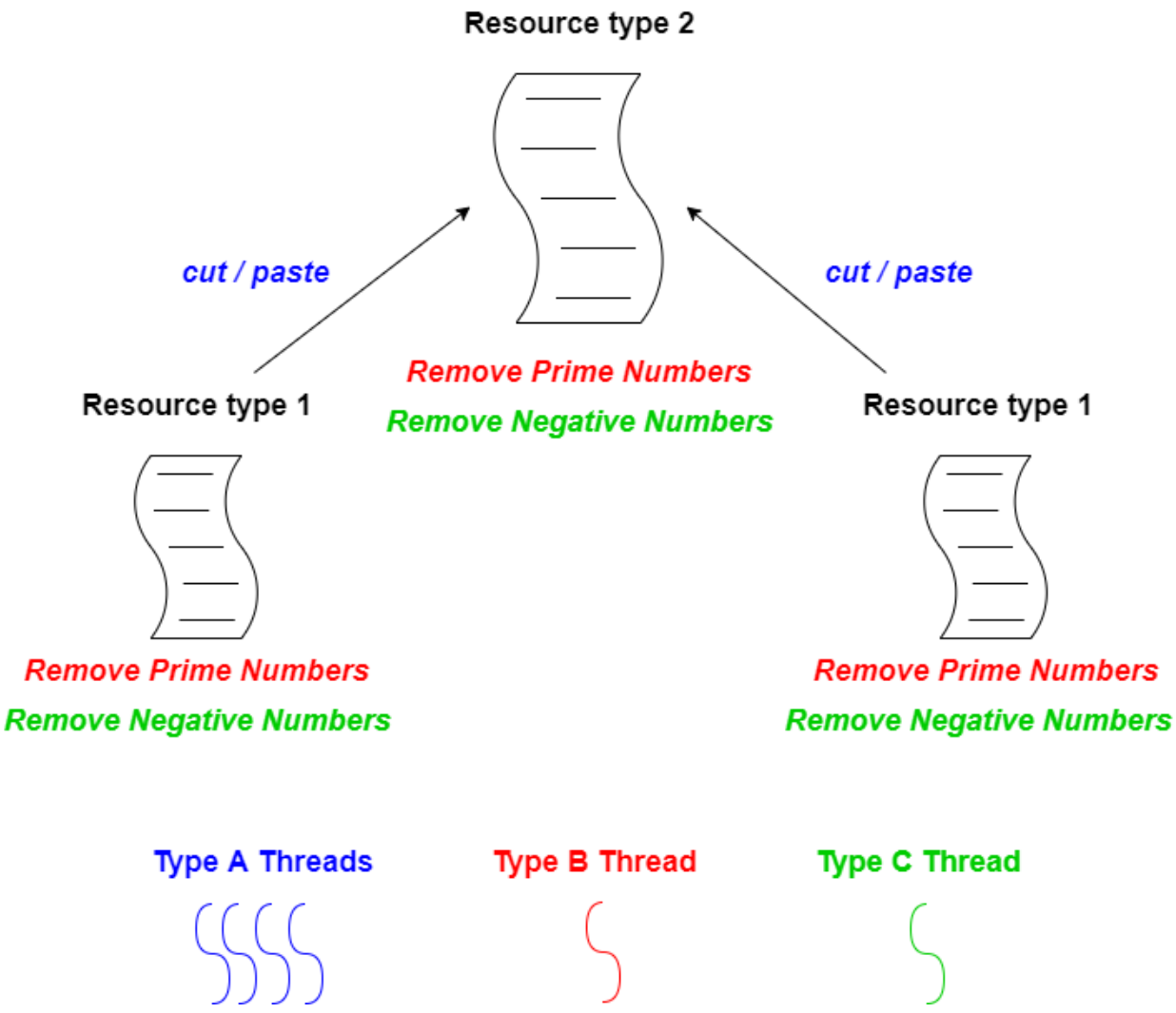
The amount of Resource types is given below;

- Resource Type 1 = **2 files**
- Resource Type 2 = **1 file**

The amount of thread types is given below;

- Thread Type A = **4 threads**
- Thread Type B = **1 thread**
- Thread Type C = **1 thread**

NOTE 2: You must prevent any possible deadlocks and starvation in this homework and please also recall that this is like a Readers/Writers problem. Therefore, make sure that you follow synchronization methodologies (i.e. semaphore, mutex).



ASSIGNMENT RULES!

- Cheating will **NOT** be tolerated!
- For any detected cheating will be **graded as 0**.
- Late Submissions will not be allowed.

GRADE REDUCTIONS

Since you are Junior students you are expected that you are aware of; error handlings, controls, software design etc. This lecture should be taken seriously and will take a crucial part in your work lives. Please code your programs wisely. Possible grade reductions,

- Lack of comment usage!
- Missing controls!
- No error handling!
- Unused/dead codes!
- Naming conventions!

Please do not discuss with us why your grades decreased just because you have done the programming sins listed above!

NOTE: Do not ask from us about the possible errors that could occur. From this lecture and labs, you are expected to be aware of the possible errors.