**Operating Systems**

**University at Albany**

**Department of Computer Science**

**Chongqing University of Posts and Telecommunications**

**Computer Science, International College**

**ICSI 412**

**Assignment-4**

**Assigned: Saturday, April 22nd, 2023.**

**Due: Saturday, April 29th by 11:59 PM.**

**Student Name:**

## OBJECTIVES

## To develop a multithreading program with the use of the pthread library and semaphores*.*

## PROBLEM

You are to use any distribution of the Linux operating system to create a C program that uses two threads in an **interleaving way**. Your solution must include the *pthread* library and *semaphores*, and it must be based on the *shopping.c* program provided in this document. Your solution must modify both functions print\_produce(), and print\_dairy () such that *Salad* will always be printed before *Butter,*  and *Milk* will always be printed before *Apples*. The following syntax is used to express this requirement where the symbol **<** is used to indicate “*printed before”*.

Salad **<** Butter and Milk **<** Apples.

**SAMPLE CODE**

/\* shopping.c \*/

#include <stdio.h>

#include <unistd.h>

#include <pthread.h>

#include <semaphore.h>

void \*print\_produce( void \* );

void \*print\_dairy( void \* );

void \*print\_dairy(void \*items)

{

int i = 0;

char\*\* array = (void\*)items;

{

printf("got %s\n", (array[i++]) );

printf("got %s\n", (array[i++]) );

}

return( NULL );

}

void \*print\_produce(void \*items)

{

int i = 0;

char\*\* array = (void\*)items;

{

printf("got %s\n", (array[i++]) );

printf("got %s\n", (array[i++]) );

}

return( NULL );

}

int main()

{

char \*produce[] = { "Salad", "Apples", NULL };

char \*dairy[] = { "Milk", "Butter", NULL };

pthread\_t th1, th2;

pthread\_create( &th1, NULL, print\_produce, (void\*)produce);

pthread\_create( &th2, NULL, print\_dairy, (void\*)dairy);

pthread\_join(th1, NULL);

pthread\_join(th2, NULL);

}

## WHAT TO SUBMIT

The following are to be submitted to your co-instructor:

1. The source code of your modified *shopping.c* program and,
2. Screenshots of the output of your solution illustrating the printing sequences produced.