

Operating Systems

University at Albany
Department of Computer Science
Chongqing University of Posts and Telecommunications
Computer Science, International College
ICSI 412

Assignment-4

Assigned: Tuesday, April 21st, 2025.

Due: To be determined by your co-instructor.

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:

- a) The source code of your modified *shopping.c* program and,
- b) Screenshots of the output of your solution illustrating the printing sequences produced.