# Gebze Technical University

# Computer Engineering

## CSE344 – 2020 Spring

## System Programming

## HOMEWORK #4 REPORT

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# 1 INTRODUCTION

## 1.1  Problem Definition

There are 6 chefs and they will prepare güllaç. For preparing güllaç,4 ingredients are needed that are milk,flour,walnuts and sugar.Each chef has endless supply of two distinct ingredients and lacks of the remaining two.A wholesaler delivers 2 distinct ingredients for chefs according to reading file.In each line of file there are 2 distinct letter that symbolize ingredients.Wholesaler reads each line,takes ingredients and true chef takes given ingredients and prepare güllaç.The wholesaler waits for dessert to be ready.After,wholesaler takes dessert for sale and the chefs must wait again for next visit. While these are being,chefs and wholesaler print their activities on screen. Our objective is to implement the chefs and the wholesaler as 6+1 threads that print on screen their activities.

# 2 METHOD

## 2.1 Problem Solution

For solving this problem,I use 2 unnamed semaphores and 6+1 threads.6 threads are for chefs and 1 of them is main thread that is wholesaler.One of two semaphores is using for sycronization for chefs,and other one is using for waiting for wholesaler while dessert is preparing by chef. For keeping ingredients,I use global array.In my main function,I allocate place in memory for global array. I initialize semaphores.Then I open input file that is given in commandline argument.Then,I control file whether that is includes invalid characters or not.After,I create 6 thread for chefs.And I write chefs function that all 6 threads use that function.In that function,according to chef number,I select print messages on screen.Then I make a loop that is until wholesaler is bringing ingredients.Accoring to ingredients in global array,which chef's lack of ingredients is compliying that ingredients,that chef prepares güllaç and prints selected activities on screen a.I print  messages on screen for true chef by if-else conditions.I print messages in critical section.So I write messages between wait and post semaphore named sem.That semaphore is using for providing syncronization between chefs.After preparing dessert,a semaphore named sem_wholesaler is posted so,wholesaler cannot wait more and he/she can go for sale of dessert.While these are done for chefs,in main function,I write  wholesaler's activities.For wholesaler,I create a loop that is until end of file.I read each line that includes 2 distinct letters for ingredients. Then I select printing messages according to read letters.I write messages and I put 2 ingredients in global array in critical section between semaphores.So I protect wholesaler.These all operations for wholesaler and chefs becomes concurrently.At the end of main thread that is wholesaler,I wait for all chefs by using pthread_join function.I free allocated area and I destroy semaphores that I used.

According to my code; Chef 1 is waiting for walnuts and sugar, chef 2 is waiting for flour and walnuts, chef 3 is waiting for sugar and flour, chef 4 is waiting for walnuts and milk, chef 5 is waiting for milk and flour,chef 6 is waiting for milk and sugar.

# 3 RESULTS

**RUNNING RESULT 1:**

➕ **input.txt file:**

```
home > nevra > Desktop > hw4 >   ≡ in
    1      FW
    2      SF
    3      WS
    4      WF
    5      WM
    6      MF
    7      MS
    8      FS
    9      SW
   10      SM
   11
```

➕ **result:**

```
nevra@ubuntu:~/Desktop/hw4$ ./program -i input.txt
chef 6 is waiting for milk and sugar
chef 5 is waiting for milk and flour
chef 4 is waiting for walnuts and milk
chef 3 is waiting for sugar and flour
chef 2 is waiting for flour and walnuts
chef 1 is waiting for walnuts and sugar
the wholesaler delivers flour and walnuts
the wholesaler is waiting for the dessert
Chef 2 has taken the flour
chef 2  has taken the walnuts
chef 2  is preparing the dessert
chef 2 has delivered the dessert to the wholesaler
chef 2  is waiting for flour and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and flour
the wholesaler is waiting for the dessert
Chef 3 has taken the sugar
chef 3  has taken the flour
chef 3  is preparing the dessert
chef 3 has delivered the dessert to the wholesaler
chef 3  is waiting for sugar and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and sugar
the wholesaler is waiting for the dessert
Chef 1 has taken the walnuts
chef 1  has taken the sugar
chef 1  is preparing the dessert
chef 1 has delivered the dessert to the wholesaler
chef 1  is waiting for sugar and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and flour
the wholesaler is waiting for the dessert
Chef 2 has taken the flour
chef 2  has taken the walnuts
chef 2  is preparing the dessert
chef 2 has delivered the dessert to the wholesaler
chef 2  is waiting for flour and walnuts
```

```
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and milk
the wholesaler is waiting for the dessert
Chef 4 has taken the walnuts
chef 4  has taken the milk
chef 4  is preparing the dessert
chef 4 has delivered the dessert to the wholesaler
chef 4  is waiting for milk and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers milk and flour
the wholesaler is waiting for the dessert
Chef 5 has taken the milk
chef 5  has taken the flour
chef 5  is preparing the dessert
chef 5 has delivered the dessert to the wholesaler
chef 5  is waiting for milk and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers milk and sugar
the wholesaler is waiting for the dessert
Chef 6 has taken the milk
chef 6  has taken the sugar
chef 6  is preparing the dessert
chef 6 has delivered the dessert to the wholesaler
chef 6  is waiting for milk and sugar
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers flour and sugar
the wholesaler is waiting for the dessert
Chef 3 has taken the sugar
chef 3  has taken the flour
chef 3  is preparing the dessert
chef 3 has delivered the dessert to the wholesaler
chef 3  is waiting for sugar and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and walnuts
the wholesaler is waiting for the dessert
Chef 1 has taken the walnuts
chef 1  has taken the sugar
chef 1  is preparing the dessert
chef 1 has delivered the dessert to the wholesaler
chef 1  is waiting for sugar and walnuts
```

```
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and milk
the wholesaler is waiting for the dessert
Chef 6 has taken the milk
chef 6  has taken the sugar
chef 6  is preparing the dessert
chef 6 has delivered the dessert to the wholesaler
chef 6  is waiting for milk and sugar
the wholesaler has obtained the dessert and left to sell it
nevra@ubuntu:~/Desktop/hw4$
```

**RUNNING RESULT 2:**

➕ **input.txt file:**

```
 1    MS
 2    FS
 3    SW
 4    SM
 5    FW
 6    SF
 7    WS
 8    WF
 9    WM
10    MF
11    FW
12    SF
```

➕ **Result:**

```
nevra@ubuntu:~/Desktop/hw4$ ./program -i input.txt
chef 6 is waiting for milk and sugar
chef 5 is waiting for milk and flour
chef 4 is waiting for walnuts and milk
chef 3 is waiting for sugar and flour
chef 2 is waiting for flour and walnuts
chef 1 is waiting for walnuts and sugar
the wholesaler delivers milk and sugar
the wholesaler is waiting for the dessert
Chef 6 has taken the milk
chef 6  has taken the sugar
chef 6  is preparing the dessert
chef 6 has delivered the dessert to the wholesaler
chef 6  is waiting for milk and sugar
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers flour and sugar
the wholesaler is waiting for the dessert
Chef 3 has taken the sugar
chef 3  has taken the flour
chef 3  is preparing the dessert
chef 3 has delivered the dessert to the wholesaler
chef 3  is waiting for sugar and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and walnuts
the wholesaler is waiting for the dessert
Chef 1 has taken the walnuts
chef 1  has taken the sugar
chef 1  is preparing the dessert
chef 1 has delivered the dessert to the wholesaler
chef 1  is waiting for sugar and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and milk
the wholesaler is waiting for the dessert
Chef 6 has taken the milk
chef 6  has taken the sugar
chef 6  is preparing the dessert
chef 6 has delivered the dessert to the wholesaler
chef 6  is waiting for milk and sugar
```

```
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers flour and walnuts
the wholesaler is waiting for the dessert
Chef 2 has taken the flour
chef 2  has taken the walnuts
chef 2  is preparing the dessert
chef 2 has delivered the dessert to the wholesaler
chef 2  is waiting for flour and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and flour
the wholesaler is waiting for the dessert
Chef 3 has taken the sugar
chef 3  has taken the flour
chef 3  is preparing the dessert
chef 3 has delivered the dessert to the wholesaler
chef 3  is waiting for sugar and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and sugar
the wholesaler is waiting for the dessert
Chef 1 has taken the walnuts
chef 1  has taken the sugar
chef 1  is preparing the dessert
chef 1 has delivered the dessert to the wholesaler
chef 1  is waiting for sugar and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and flour
the wholesaler is waiting for the dessert
Chef 2 has taken the flour
chef 2  has taken the walnuts
chef 2  is preparing the dessert
chef 2 has delivered the dessert to the wholesaler
chef 2  is waiting for flour and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers walnuts and milk
the wholesaler is waiting for the dessert
Chef 4 has taken the walnuts
chef 4  has taken the milk
chef 4  is preparing the dessert
chef 4 has delivered the dessert to the wholesaler
chef 4  is waiting for milk and walnuts
```

```
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers milk and flour
the wholesaler is waiting for the dessert
Chef 5 has taken the milk
chef 5  has taken the flour
chef 5  is preparing the dessert
chef 5 has delivered the dessert to the wholesaler
chef 5  is waiting for milk and flour
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers flour and walnuts
the wholesaler is waiting for the dessert
Chef 2 has taken the flour
chef 2  has taken the walnuts
chef 2  is preparing the dessert
chef 2 has delivered the dessert to the wholesaler
chef 2  is waiting for flour and walnuts
the wholesaler has obtained the dessert and left to sell it
the wholesaler delivers sugar and flour
the wholesaler is waiting for the dessert
Chef 3 has taken the sugar
chef 3  has taken the flour
chef 3  is preparing the dessert
chef 3 has delivered the dessert to the wholesaler
chef 3  is waiting for sugar and flour
the wholesaler has obtained the dessert and left to sell it
nevra@ubuntu:~/Desktop/hw4$
```

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**My program is working with 0 warning,0 memory leak and 0 error.To Show this:**

```
nevra@ubuntu:~/Desktop/sp$ make
gcc -c program.c -Wall -Wextra -pedantic -g  -I .
gcc -o program program.o -pthread
nevra@ubuntu:~/Desktop/sp$
```

```
==4382==
==4382== HEAP SUMMARY:
==4382==     in use at exit: 0 bytes in 0 blocks
==4382==   total heap usage: 8 allocs, 8 frees, 2,659 bytes allocated
==4382==
==4382== All heap blocks were freed -- no leaks are possible
==4382==
==4382== For counts of detected and suppressed errors, rerun with: -v
==4382== ERROR SUMMARY: 0 errors from 0 contexts (suppressed: 0 from 0)
nevra@ubuntu:~/Desktop/sp$
```