

Task5:

Presentation of the task:

The goal of this task is to simulate the functionalism of a barber shop in which there are three types of barber. Barbers only for women, barbers only for men and versatile barbers for both women and men. In this barber shop there is a number of place in the waiting room. If there is no places to sit for an arriving client, then the client left. When all the client of the simulation has their hair done or left because there were no places in the waiting room, all the barber are done for the day.

Program explanation:

In this part I will explain how my solution is working.

First, just after all the includes we can see that the variables **N1**, **N2**, **N3**, **M** and **C** are defined with “`#define`”. **N1** represent the number of barbers for women, **N2** represent the number of barbers for men and **N3** represent the number of versatile barbers for both women and men. **M** is the number of chairs in the waiting room for the clients, and **C** is the number of clients for the simulation.

After theses declarations we initialize all the functions that we will call later. The function **randomTimeIni()** is made to initialize the random value function. All the other functions declared do not need more explanations than their names.

Then, there is four arrays in which we will store all the ids related to each type of barber and for the clients. It allows us to differentiate all the barber of each type and all clients.

Next, we declared all the semaphores, we will initialize them in the main by adding the number of chairs (**M**) in **wating_room**, the number of barbers for each type for the barbers chairs semaphores, zero for all the barber bed because at the beginning, barbers are not sleeping. And **waitbarber** is set at zero too because this semaphore is made to establish a link between clients and barbers.

Before that, in the **main**, we can found four for loops. They are all made to set ids in arrays. In fact, theses loops are made to put the value of the line equal to the line number. With this, the first client will have the id 0, the second, the id 1...

Then we initialize threads for each type of barber and for clients.

Next, we joined all the client threads, which mean that client are on their way to the barber shop.

Let's understand what's going on in the functions.

So, as said previously, the **pthread_join** means that the client is on its way to the barber shop. In the function **createClient()** we are getting the client id, then we get a random gender for the client with the function **returnRandomGender()**.

After that, the function **waitRandomTimeBetween0and()** is called with "30" in parameter. It will do a sleep of a specific number of seconds between 0 and 29.

After this random time the **sem_getvalue()** is used to simulate the client looking if there is some place in the waiting room. If there is no more place the client left.

Let's assume that there is some place in the waiting room and our client is a woman. Our client will check continuously if a barber is available by checking first if there is a barber only for women. It means that for a woman or for a man a specific barber is preferred than a versatile one.

When a barber is selected by the client, one place in the **waiting_room** is released and one barber chair is occupied (by the client).

Let's stay here with the client function and let's see what is going on in the **createBarber()** function (we will come back to the client just after).

Lets analyses the function **createBarberW()**. As for the **clientCreation()** function we can see that the id is defined at the barber creation according to the array made for. The barber just after its creation will sleep and wait that one client came to wake it up. When it happened the barber will do its job during a random amount of time between 0 and 14 seconds. Then the barber goes back to sleep until all the clients are done. When it happened the flag **clientAreAllDone** allows barbers to be done for the day.

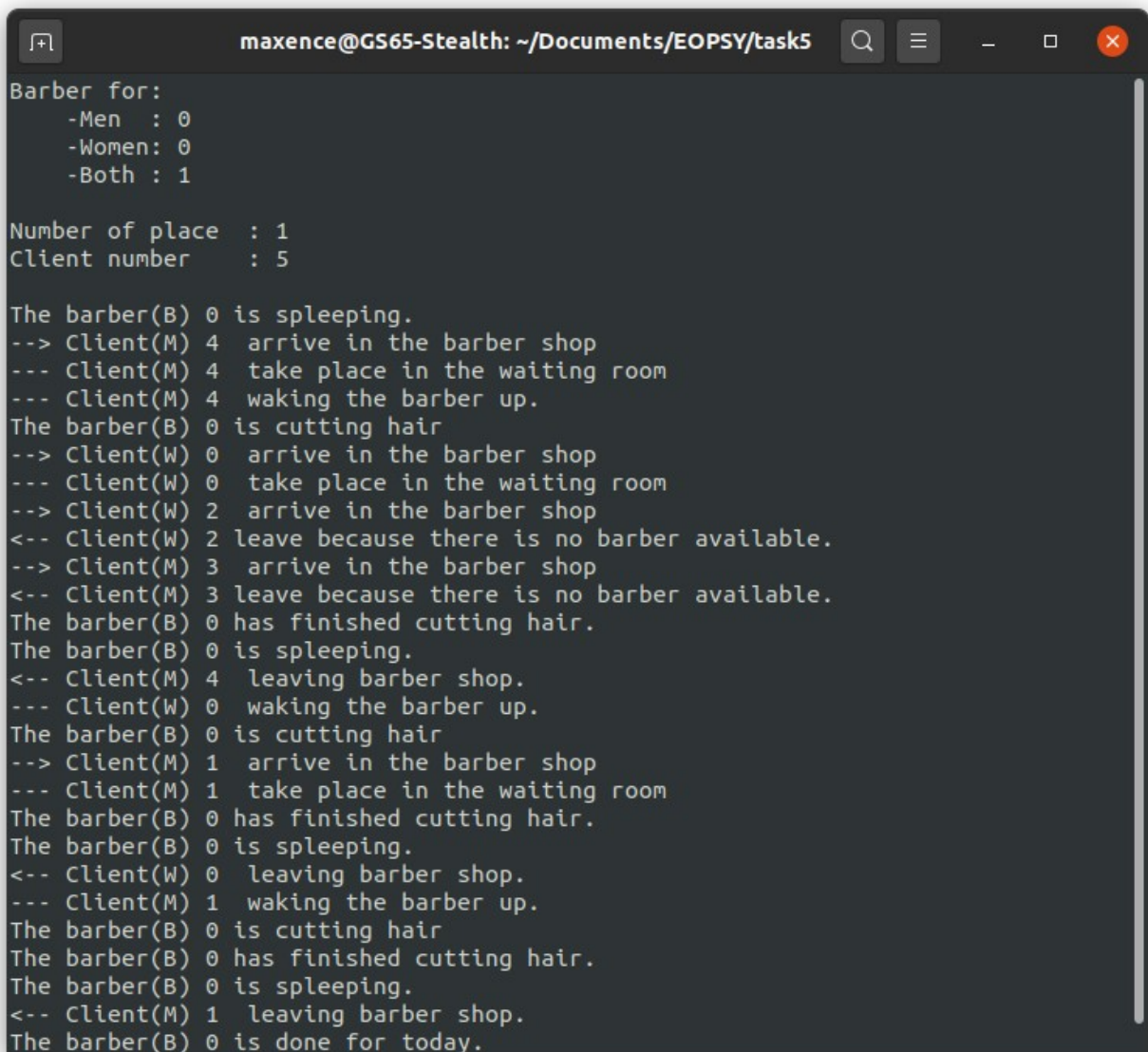
Lets go back to the client function. After it's cut, the client will released one barber chair and leave.

When all the clients are done, as said previously, barbers will stop working. The last three for loop in the main are here to call a last time all the barbers so that they understand that it is the end of the day.

Examples:

In this part we are going to see some example when the program is running to see the differences.

Case 1 ($N_1=N_2=0$, $N_3=1$, $M=1$, $C=5$):

A terminal window titled 'maxence@GS65-Stealth: ~/Documents/EOPSY/task5' displays the output of a simulation. The output shows the barber's initial state (sleeeeping), the number of places (1) and client numbers (5). It then tracks the arrival and service of clients 0, 1, 2, 3, and 4. Client 4 is the first to arrive and is served. Client 0 arrives while the barber is cutting and waits. Client 2 arrives but leaves because the waiting room is full. Client 3 also arrives but leaves for the same reason. After client 4 leaves, the barber serves client 0, then client 1, and finally client 0 again. The simulation ends with the barber stating they are done for today.

```
Barber for:
  -Men : 0
  -Women: 0
  -Both : 1

Number of place : 1
Client number : 5

The barber(B) 0 is spleeping.
--> Client(M) 4 arrive in the barber shop
--- Client(M) 4 take place in the waiting room
--- Client(M) 4 waking the barber up.
The barber(B) 0 is cutting hair
--> Client(W) 0 arrive in the barber shop
--- Client(W) 0 take place in the waiting room
--> Client(W) 2 arrive in the barber shop
<-- Client(W) 2 leave because there is no barber available.
--> Client(M) 3 arrive in the barber shop
<-- Client(M) 3 leave because there is no barber available.
The barber(B) 0 has finished cutting hair.
The barber(B) 0 is spleeping.
<-- Client(M) 4 leaving barber shop.
--- Client(W) 0 waking the barber up.
The barber(B) 0 is cutting hair
--> Client(M) 1 arrive in the barber shop
--- Client(M) 1 take place in the waiting room
The barber(B) 0 has finished cutting hair.
The barber(B) 0 is spleeping.
<-- Client(W) 0 leaving barber shop.
--- Client(M) 1 waking the barber up.
The barber(B) 0 is cutting hair
The barber(B) 0 has finished cutting hair.
The barber(B) 0 is spleeping.
<-- Client(M) 1 leaving barber shop.
The barber(B) 0 is done for today.
```

In this case we can see that the client 4 is the first to arrive. Then during its cutting, the client 0 arrived and takes place in the waiting room. Just after clients 2 and 3 arrived but there is no more place in the waiting room so they left. We can also see that the barber for both women and men can do haircut for men and women.

Case 2 ($N_1=N_2=N_3=1$, $M=1$, $C=5$):

```
maxence@GS65-Stealth: ~/Documents/EOPSY/task5

Barber for:
  -Men : 1
  -Women: 1
  -Both : 1

Number of place : 1
Client number : 5

The barber(W) 0 is sleeping.
The barber(M) 0 is sleeping.
The barber(B) 0 is sleeping.
--> Client(W) 3 arrive in the barber shop
--- Client(W) 3 take place in the waiting room
--- Client(W) 3 waking the barber up.
The barber(W) 0 is cutting hair
--> Client(M) 0 arrive in the barber shop
--- Client(M) 0 take place in the waiting room
--- Client(M) 0 waking the barber up.
The barber(M) 0 is cutting hair
The barber(M) 0 has finished cutting hair.
The barber(M) 0 is sleeping.
<-- Client(W) 3 leaving barber shop.
--> Client(M) 1 arrive in the barber shop
--- Client(M) 1 take place in the waiting room
--- Client(M) 1 waking the barber up.
The barber(B) 0 is cutting hair
The barber(W) 0 has finished cutting hair.
The barber(W) 0 is sleeping.
<-- Client(M) 0 leaving barber shop.
--> Client(W) 2 arrive in the barber shop
--- Client(W) 2 take place in the waiting room
--- Client(W) 2 waking the barber up.
The barber(W) 0 is cutting hair
The barber(B) 0 has finished cutting hair.
The barber(B) 0 is sleeping.
<-- Client(M) 1 leaving barber shop.
--> Client(M) 4 arrive in the barber shop
--- Client(M) 4 take place in the waiting room
--- Client(M) 4 waking the barber up.
The barber(M) 0 is cutting hair
The barber(W) 0 has finished cutting hair.
The barber(W) 0 is sleeping.
<-- Client(W) 2 leaving barber shop.
The barber(M) 0 has finished cutting hair.
The barber(M) 0 is sleeping.
<-- Client(M) 4 leaving barber shop.
The barber(W) 0 is done for today.
The barber(M) 0 is done for today.
The barber(B) 0 is done for today.
```

In this case we can see that the first client to come is the client 3 who is a woman. And then the barber for women is taking care of her. We can see the same fact with the client 0 who is a man is taken care of by the barber for men. Then the client 1 come, a man.

Because of the fact that the barber for men is already working for another man, the client is waking the versatile barber up.