

Activity 7 - Process Synchronization

Members

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```
// callcenter.c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <semaphore.h>

int main(int argc, char **argv)
{
    int num_agents = 2;
    if (argc > 1)
        num_agents = atoi(argv[1]);
    printf("Starting a call center with %d agents.\n", num_agents);

    //
    // OS -- CRAETE NAMED SEMAPHORE HERE
    //
    sem_t *sem = sem_open("callcenter", O_CREAT, 0644, num_agents);

    int semval;
    while (1)
    {
        //
        // OS -- PLACE CURRENT VALUE OF SEMAPHORE IN 'semval' HERE
        //
        sem_getvalue(sem, &semval);

        printf("There are %d agents available now.\n", semval);
        sleep(3);
    }
}

// customer.c
#include <stdio.h>
#include <stdlib.h>
#include <unistd.h>
#include <fcntl.h>
#include <time.h>
#include <semaphore.h>

int rand_int(int n)
{
    // Generate random integer number between [1, n]
    int r = rand();
    return (r % n) + 1;
}
```

```

int main(int argc, char **argv)
{
    printf("Starting customer\n");

    //
    // OS -- OPEN NAMED SEMAPHORE HERE
    //
    sem_t *sem = sem_open("callcenter", 0);

    while (1)
    {
        // Customer will wait between 1-3 seconds before placing the next phone call
        int wait_time = rand_int(3);
        printf("Wait for %d minutes\n", wait_time);
        sleep(wait_time);
        printf("Next customer calls the call center, press 10 buttons, and listens to silly music.\n");
        time_t t0 = time(NULL);
        // Wait for an agent

        //
        // OS -- LOCK SEMAPHORE HERE
        //
        sem_wait(sem);

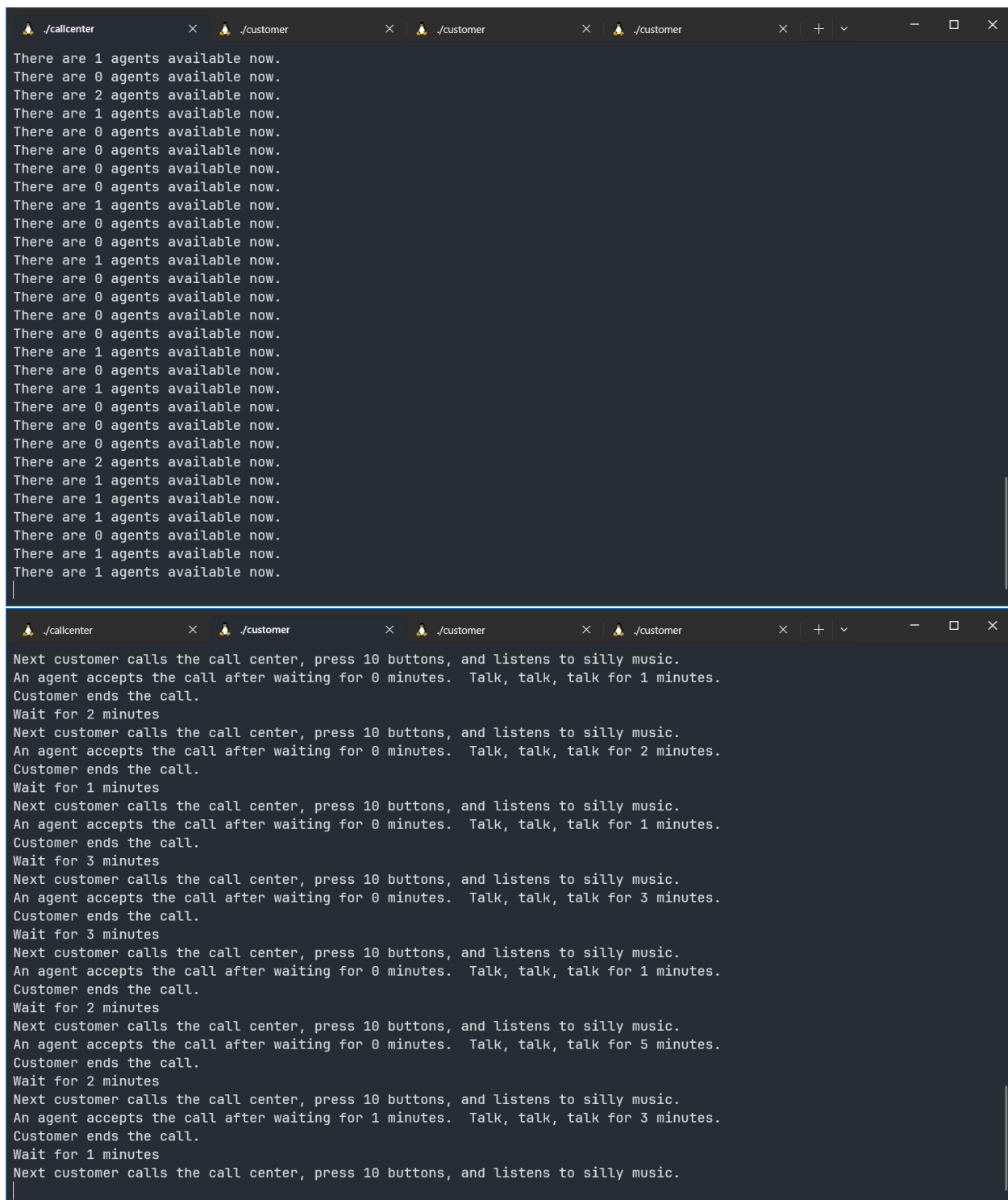
        time_t t = time(NULL) - t0;
        // An agent accepts the call, using it for 1-5 seconds.
        int call_time = rand_int(5);
        printf("An agent accepts the call after waiting for %ld minutes. Talk, talk, talk for %d minutes.\n", t, call_time);
        sleep(call_time);
        // Customer hangs up the phone

        //
        // OS -- UNLOCK SEMAPHORE HERE
        //
        sem_post(sem);

        printf("Customer ends the call.\n");
    }
}

```

Screenshots



```
./callcenter x ./customer x ./customer x ./customer x + - □ x
There are 1 agents available now.
There are 0 agents available now.
There are 2 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 0 agents available now.
There are 2 agents available now.
There are 1 agents available now.
There are 1 agents available now.
There are 1 agents available now.
There are 0 agents available now.
There are 1 agents available now.
There are 1 agents available now.

./callcenter x ./customer x ./customer x ./customer x + - □ x
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 1 minutes.
Customer ends the call.
Wait for 2 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 2 minutes.
Customer ends the call.
Wait for 1 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 1 minutes.
Customer ends the call.
Wait for 3 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 3 minutes.
Customer ends the call.
Wait for 3 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 1 minutes.
Customer ends the call.
Wait for 2 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 0 minutes. Talk, talk, talk for 5 minutes.
Customer ends the call.
Wait for 2 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
An agent accepts the call after waiting for 1 minutes. Talk, talk, talk for 3 minutes.
Customer ends the call.
Wait for 1 minutes
Next customer calls the call center, press 10 buttons, and listens to silly music.
```