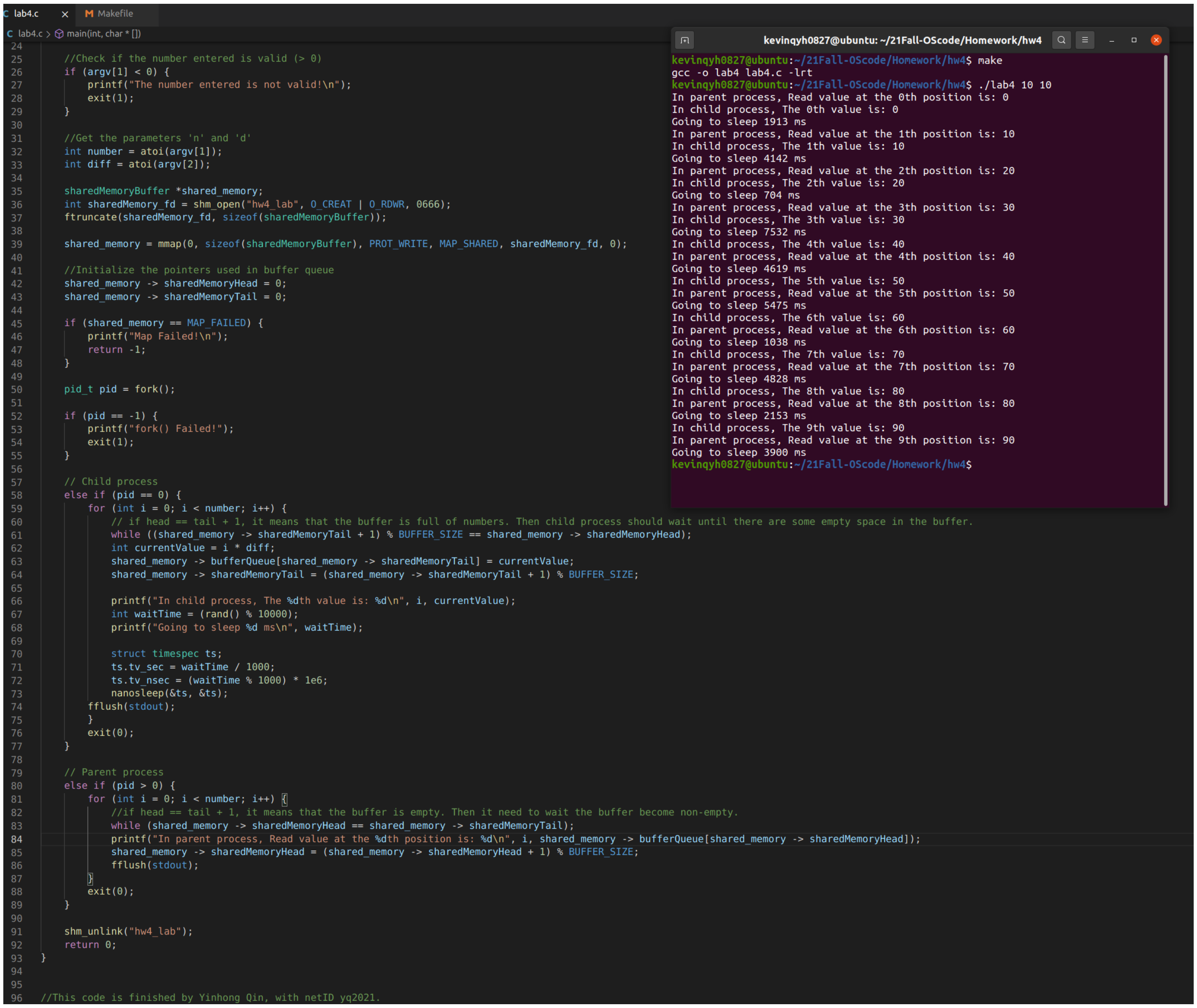
Yinhong Qin
yq2021@nyu.edu

Homework 4

CS 6233
October 20, 2021

Problem 1

Below is the screenshot of the program and the command-line of my solution for Homework4 Problem.


lab4.c
Makefile
lab4.c > main(int, char * [])
kevinqyh0827@ubuntu: ~/21Fall-OScode/Homework/hw4

```c

    //Check if the number entered is valid (> 0)
    if (argv[1] < 0) {
        printf("The number entered is not valid!\n");
        exit(1);
    }

    //Get the parameters 'n' and 'd'
    int number = atoi(argv[1]);
    int diff = atoi(argv[2]);

    sharedMemoryBuffer *shared_memory;
    int sharedMemory_fd = shm_open("hw4_lab", O_CREAT | O_RDWR, 0666);
    ftruncate(sharedMemory_fd, sizeof(sharedMemoryBuffer));

    shared_memory = mmap(0, sizeof(sharedMemoryBuffer), PROT_WRITE, MAP_SHARED, sharedMemory_fd, 0);

    //Initialize the pointers used in buffer queue
    shared_memory -> sharedMemoryHead = 0;
    shared_memory -> sharedMemoryTail = 0;

    if (shared_memory == MAP_FAILED) {
        printf("Map Failed!\n");
        return -1;
    }

    pid_t pid = fork();

    if (pid == -1) {
        printf("fork() Failed!");
        exit(1);
    }

    // Child process
    else if (pid == 0) {
        for (int i = 0; i < number; i++) {
            // if head == tail + 1, it means that the buffer is full of numbers. Then child process should wait until there are some empty space in the buffer.
            while ((shared_memory -> sharedMemoryTail + 1) % BUFFER_SIZE == shared_memory -> sharedMemoryHead);
            int currentValue = i * diff;
            shared_memory -> bufferQueue[shared_memory -> sharedMemoryTail] = currentValue;
            shared_memory -> sharedMemoryTail = (shared_memory -> sharedMemoryTail + 1) % BUFFER_SIZE;

            printf("In child process, The %dth value is: %d\n", i, currentValue);
            int waitTime = (rand() % 10000);
            printf("Going to sleep %d ms\n", waitTime);

            struct timespec ts;
            ts.tv_sec = waitTime / 1000;
            ts.tv_nsec = (waitTime % 1000) * 1e6;
            nanosleep(&ts, &ts);
        fflush(stdout);
        }
        exit(0);
    }

    // Parent process
    else if (pid > 0) {
        for (int i = 0; i < number; i++) {
            //if head == tail + 1, it means that the buffer is empty. Then it need to wait the buffer become non-empty.
            while (shared_memory -> sharedMemoryHead == shared_memory -> sharedMemoryTail);
            printf("In parent process, Read value at the %dth position is: %d\n", i, shared_memory -> bufferQueue[shared_memory -> sharedMemoryHead]);
            shared_memory -> sharedMemoryHead = (shared_memory -> sharedMemoryHead + 1) % BUFFER_SIZE;
            fflush(stdout);
        }
        exit(0);
    }

    shm_unlink("hw4_lab");
    return 0;
}


//This code is finished by Yinhong Qin, with netID yq2021.
```

```
kevinqyh0827@ubuntu:~/21Fall-OScode/Homework/hw4$ make
gcc -o lab4 lab4.c -lrt
kevinqyh0827@ubuntu:~/21Fall-OScode/Homework/hw4$ ./lab4 10 10
In parent process, Read value at the 0th position is: 0
In child process, The 0th value is: 0
Going to sleep 1913 ms
In parent process, Read value at the 1th position is: 10
In child process, The 1th value is: 10
Going to sleep 4142 ms
In parent process, Read value at the 2th position is: 20
In child process, The 2th value is: 20
Going to sleep 704 ms
In parent process, Read value at the 3th position is: 30
In child process, The 3th value is: 30
Going to sleep 7532 ms
In child process, The 4th value is: 40
In parent process, Read value at the 4th position is: 40
Going to sleep 4619 ms
In child process, The 5th value is: 50
In parent process, Read value at the 5th position is: 50
Going to sleep 5475 ms
In child process, The 6th value is: 60
In parent process, Read value at the 6th position is: 60
Going to sleep 1038 ms
In child process, The 7th value is: 70
In parent process, Read value at the 7th position is: 70
Going to sleep 4828 ms
In child process, The 8th value is: 80
In parent process, Read value at the 8th position is: 80
Going to sleep 2153 ms
In child process, The 9th value is: 90
In parent process, Read value at the 9th position is: 90
Going to sleep 3900 ms
kevinqyh0827@ubuntu:~/21Fall-OScode/Homework/hw4$
```

Figure 1: Screenshot of program and command-line