OS HW2 Programming exercises

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Environment

- OS: Ubuntu 22.04
- Kernel: Linux 5.15.153.1-microsoft-standard-WSL2
- Compiler: gcc 11.4.0

4.24

Commands

```
cd 4.24
gcc main.c -pthread -o main
./main
3000000
```

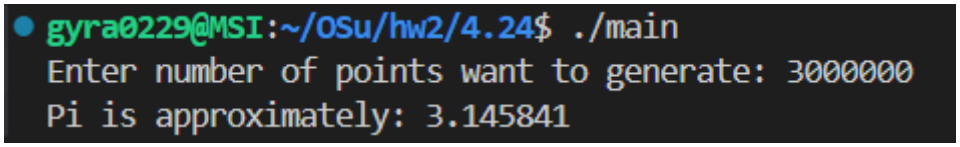

Figure 1: The result for `./main` in `4.24`

4.27

Commands

```
cd 4.27
gcc main.c -pthread -o main
./main
20
```

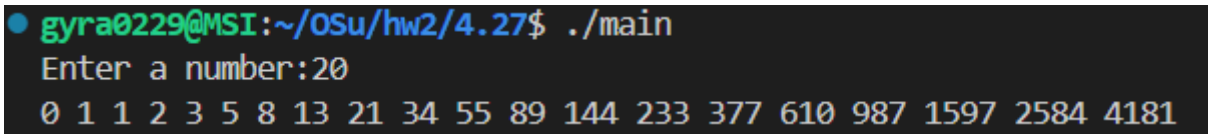

Figure 2: The result for `./main` in `4.27`

6.33

```c
#define MAX_RESOURCES 5
int available_resources = MAX_RESOURCES;
int decrease_count(int count) {
  if (available_resources < count) {
    return -1;
  } else {
    available_resources -= count;
    return 0;
  }
}
int increase_count(int count) {
  available_resources += count;
  return 0;
```

```
14 }
15
```

(a) The data involved race condition is `available_resources`.
(b) The race condition occurs at line 4, 7, 12.
(c) The revised version using mutex is as follows:

```
#include <pthread.h>
#define MAX_RESOURCES 5
int available_resources = MAX_RESOURCES;
pthread_mutex_t mutex;
int decrease_count(int count) {
  pthread_mutex_lock(&mutex);
  if (available_resources < count) {
    pthread_mutex_unlock(&mutex);
    return -1;
  } else {
    available_resources -= count;
    pthread_mutex_unlock(&mutex);
    return 0;
  }
}
int increase_count(int count) {
  pthread_mutex_lock(&mutex);
  available_resources += count;
  pthread_mutex_unlock(&mutex);
  return 0;
}
```