

```
#include <iostream>
#include <random>
#include <vector>
#include <string>
#include <deque>
#include <exception>
#include "helper.h"
```

```
typedef pair<int, int> queue_element;
```

```
void *producer (void *parameter);
void *consumer (void *parameter);
int initSemaphores(int queue_size);
int getJobId(deque <queue_element> buffer);
int generateRandomNumber(int min, int max);
```

```
struct ProducerParameters {
    int sem_id;
    int jobs_per_producer;
    deque <pair<int, int>>* buffer;
    int* id;
};
```

```
struct ConsumerParameters {
    int sem_id;
    deque <queue_element>* buffer;
    int* id;
};
```

```
int main (int argc, char **argv) {
```

```
    // check for command line variables
    if (argc != 5) {
```

```
        cerr << "ERROR! Please provide 4 command line variables:\n\n" <<
            "1. Size of the queue\n" <<
            "2. Number of jobs each producer generates\n" <<
            "3. Number of producers\n" <<
            "4. Number of consumers\n" << endl;
```

```
        return (-1);
    }
```

```
    // assign command line variables
    int queue_size = check_arg(argv[1]);
    int jobs_per_producer = check_arg(argv[2]);
    int number_of_producers = check_arg(argv[3]);
    int number_of_consumers = check_arg(argv[4]);
```

```
-UU-:---F1 main.cc
```

```
Top L17
```

```
(C++/1 Abbrev)
```

```
Compilation finished
```

```
-*- mode: compilation; default-directory: "~/Coursework/OS_1/" -*-
Compilation started at Wed Dec 5 15:38:04
```

```
make -k
g++ -Wall -c helper.cc main.cc
g++ -Wall -pthread -o main helper.o main.o
```

```
Compilation finished at Wed Dec 5 15:38:05
```

```
-UUU:~*--F1 compilation
```

```
All L1
```

```
(Compilation:exit [0])
```

tui.doc.ic.ac.uk - PuTTY

```
aa5118@tui:~/Coursework/OS_1$ ./main 3 4 3 3
Producer(1): Job id 1 duration 3
Producer(3): Job id 2 duration 4
Producer(2): Job id 3 duration 5
Consumer(1): Job id 1 executing sleep duration 3
Consumer(2): Job id 2 executing sleep duration 4
Consumer(3): Job id 3 executing sleep duration 5
Producer(2): Job id 1 duration 9
Producer(3): Job id 2 duration 8
Consumer(1): Job id 1 completed
Consumer(1): Job id 1 executing sleep duration 9
Consumer(2): Job id 2 completed
Consumer(2): Job id 2 executing sleep duration 8
Producer(2): Job id 1 duration 7
Producer(1): Job id 2 duration 5
Consumer(3): Job id 3 completed
Consumer(3): Job id 1 executing sleep duration 7
Producer(3): Job id 1 duration 7
Producer(3): Job id 2 duration 5
Producer(3): No more jobs to produce.
Consumer(3): Job id 1 completed
Consumer(3): Job id 2 executing sleep duration 5
Consumer(1): Job id 1 completed
Consumer(2): Job id 2 completed
Consumer(1): Job id 1 executing sleep duration 7
Consumer(2): Job id 2 executing sleep duration 5
Producer(2): Job id 1 duration 9
Producer(1): Job id 2 duration 1
Producer(2): No more jobs to produce.
Producer(1): Job id 3 duration 8
Consumer(3): Job id 2 completed
Consumer(3): Job id 1 executing sleep duration 9
Consumer(2): Job id 2 completed
Consumer(2): Job id 2 executing sleep duration 1
Consumer(2): Job id 2 completed
Consumer(2): Job id 3 executing sleep duration 8
Consumer(1): Job id 1 completed
Producer(1): No more jobs to produce.
Consumer(3): Job id 1 completed
Consumer(2): Job id 3 completed
Consumer(1): No more jobs left.
Consumer(2): No more jobs left.
Consumer(3): No more jobs left.
aa5118@tui:~/Coursework/OS_1$
```