

## **ProducerConsumer.java**

The producer thread generates random numbers to fill the buffer, then sleeps for a random period of time.

The consumer thread consumes numbers from the buffer, then sleeps for a random period of time.

The consumer and producer trade off until main wakes up and terminates the program.

### **How to Run:**

```
javac ProducerConsumer.java
```

```
java ProducerConsumer [main sleep time] [# producers] [# consumers]
```

EX: java ProducerConsumer 20 4 4

### **Output:**

```
● (base) maxlink@Maxs-MacBook-Air osproj % javac ProducerConsumer.java
● (base) maxlink@Maxs-MacBook-Air osproj % java ProducerConsumer 20 4 4
Producer-1 is waiting for empty buffer...
Producer-1 is producing...
Consumer-1 is waiting for full buffer...
Producer-1 produced: 3 at index 0
Producer-1 produced: 34 at index 1
Producer-1 produced: 44 at index 2
Producer-1 produced: 21 at index 3
Producer-1 produced: 27 at index 4
Consumer-1 is consuming...
Consumer-1 consumed: 3 from index 0
Consumer-1 consumed: 34 from index 1
Producer-1 sleeping for 2260 milliseconds.
Consumer-1 consumed: 44 from index 2
Consumer-1 consumed: 21 from index 3
Consumer-1 consumed: 27 from index 4
Consumer-1 sleeping for 1069 milliseconds.
Producer-1 is waiting for empty buffer...
Producer-1 is producing...
Producer-1 produced: 34 at index 0
Producer-1 produced: 19 at index 1
Consumer-1 is waiting for full buffer...
Producer-1 produced: 21 at index 2
Producer-1 produced: 58 at index 3
Producer-1 produced: 37 at index 4
Consumer-1 is consuming...
Consumer-1 consumed: 34 from index 0
Producer-1 sleeping for 1362 milliseconds.
Consumer-1 consumed: 19 from index 1
Consumer-1 consumed: 21 from index 2
Consumer-1 consumed: 58 from index 3
Producer-1 is waiting for empty buffer...
Consumer-1 consumed: 37 from index 4
Producer-1 is producing...
Producer-1 produced: 23 at index 0
Consumer-1 sleeping for 1391 milliseconds.
Producer-1 produced: 24 at index 1
Producer-1 produced: 60 at index 2
Producer-1 produced: 66 at index 3
Consumer-1 is waiting for full buffer...
Producer-1 produced: 15 at index 4
Consumer-1 is consuming...
Consumer-1 consumed: 23 from index 0
Consumer-1 consumed: 24 from index 1
Producer-1 sleeping for 1511 milliseconds.
Consumer-1 consumed: 60 from index 2
Consumer-1 consumed: 66 from index 3
Consumer-1 consumed: 15 from index 4
Producer-1 is waiting for empty buffer...
Producer-1 is producing...
Producer-1 produced: 35 at index 0
Consumer-1 sleeping for 2172 milliseconds.
Producer-1 produced: 27 at index 1
Producer-1 produced: 58 at index 2
```

```

Consumer-1 is consuming...
Consumer-1 consumed: 23 from index 0
Consumer-1 consumed: 24 from index 1
Producer-1 sleeping for 1511 milliseconds.
Consumer-1 consumed: 60 from index 2
Consumer-1 consumed: 66 from index 3
Consumer-1 consumed: 15 from index 4
Producer-1 is waiting for empty buffer...
Producer-1 is producing...
Producer-1 produced: 35 at index 0
Consumer-1 sleeping for 2172 milliseconds.
Producer-1 produced: 27 at index 1
Producer-1 produced: 58 at index 2
Producer-1 produced: 7 at index 3
Producer-1 produced: 34 at index 4
Producer-1 sleeping for 1236 milliseconds.
Consumer-1 is waiting for full buffer...
Consumer-1 is consuming...
Consumer-1 consumed: 35 from index 0
Consumer-1 consumed: 27 from index 1
Consumer-1 consumed: 58 from index 2
Producer-1 is waiting for empty buffer...
Consumer-1 consumed: 7 from index 3
Consumer-1 consumed: 34 from index 4
Producer-1 is producing...
Producer-1 produced: 93 at index 0
Consumer-1 sleeping for 1340 milliseconds.
Producer-1 produced: 18 at index 1
Producer-1 produced: 73 at index 2
Producer-1 produced: 34 at index 3
Consumer-1 is waiting for full buffer...
Producer-1 produced: 39 at index 4
Consumer-1 is consuming...
Consumer-1 consumed: 93 from index 0
Main thread has terminated the application.
(base) maxlink@Maxs-MacBook-Air osproj %

```

## SleepingTA.java

I made a producer thread to generate student threads. I synced the student threads to wait until after the producer finishes with countdown latch from this substack post <https://stackoverflow.com/questions/4691533/java-wait-for-thread-to-finish>

After the producer finishes generating student threads, then the student threads work on their assignment and seek help from the TA when needed.

The program terminates gracefully once the TA has helped all students.

## How to Run:

```
javac SleepingTA.java
```

```
java SleepingTA
```

## Output:

```
• (base) maxlink@Maxs-MacBook-Air osproj % javac SleepingTA.java
• (base) maxlink@Maxs-MacBook-Air osproj % java SleepingTA
TA is sleeping...
Producer created and started Student 1
Producer created and started Student 2
Producer created and started Student 3
Producer created and started Student 4
Producer created and started Student 5
Producer created and started Student 6
Producer created and started Student 7
Producer created and started Student 8
Producer created and started Student 9
Producer created and started Student 10
Producer has created all 10 students.
All Student threads have been created.
Student 2 is working on assignments...
Student 5 is working on assignments...
Student 3 is working on assignments...
Student 7 is working on assignments...
Student 1 is working on assignments...
Student 8 is working on assignments...
Student 9 is working on assignments...
Student 10 is working on assignments...
Student 4 is working on assignments...
Student 6 is working on assignments...
Student 4 wants to see the TA...
Student 4 is waiting in the hallway with patience 1838 ms
TA is helping Student 4...
Student 4 is being helped by the TA...
Student 1 wants to see the TA...
Student 1 is waiting in the hallway with patience 2740 ms
Student 5 wants to see the TA...
Student 5 is waiting in the hallway with patience 2632 ms
Student 9 wants to see the TA...
Student 9 is waiting in the hallway with patience 1489 ms
Student 3 wants to see the TA...
Student 3 found no available chairs and will try again later.
Student 3 is working on assignments...
Student 8 wants to see the TA...
Student 8 found no available chairs and will try again later.
Student 8 is working on assignments...
Student 10 wants to see the TA...
Student 10 found no available chairs and will try again later.
Student 10 is working on assignments...
Student 7 wants to see the TA...
Student 7 found no available chairs and will try again later.
Student 7 is working on assignments...
TA finished helping Student 4.
TA is helping Student 1...
Student 1 is being helped by the TA...
Student 2 wants to see the TA...
```

Student 2 wants to see the TA...  
Student 2 is waiting in the hallway with patience 1775 ms  
Student 9 got tired of waiting and will try again later.  
Student 9 is working on assignments...  
Student 6 wants to see the TA...  
Student 6 is waiting in the hallway with patience 1562 ms  
Student 5 got tired of waiting and will try again later.  
Student 5 is working on assignments...  
Student 3 wants to see the TA...  
Student 3 is waiting in the hallway with patience 2331 ms  
Student 6 got tired of waiting and will try again later.  
Student 6 is working on assignments...  
TA finished helping Student 1.  
TA is helping Student 2...  
Student 2 is being helped by the TA...  
Student 10 wants to see the TA...  
Student 10 is waiting in the hallway with patience 1330 ms  
Student 8 wants to see the TA...  
Student 8 is waiting in the hallway with patience 2832 ms  
Student 5 wants to see the TA...  
Student 5 found no available chairs and will try again later.  
Student 5 is working on assignments...  
Student 10 got tired of waiting and will try again later.  
Student 10 is working on assignments...  
Student 7 wants to see the TA...  
Student 7 is waiting in the hallway with patience 2354 ms  
Student 3 got tired of waiting and will try again later.  
Student 3 is working on assignments...  
TA finished helping Student 2.  
TA is helping Student 8...  
Student 8 is being helped by the TA...  
Student 9 wants to see the TA...  
Student 9 is waiting in the hallway with patience 1489 ms  
Student 9 got tired of waiting and will try again later.  
Student 9 is working on assignments...  
Student 10 wants to see the TA...  
Student 10 is waiting in the hallway with patience 1330 ms  
TA finished helping Student 8.  
TA is helping Student 7...  
Student 7 is being helped by the TA...  
Student 5 wants to see the TA...  
Student 5 is waiting in the hallway with patience 2632 ms  
Student 6 wants to see the TA...  
Student 6 is waiting in the hallway with patience 1562 ms  
Student 10 got tired of waiting and will try again later.  
Student 10 is working on assignments...  
Student 6 got tired of waiting and will try again later.  
Student 6 is working on assignments...  
TA finished helping Student 7.  
TA is helping Student 5...  
Student 5 is being helped by the TA...

```
Student 10 is waiting in the hallway with patience 1330 ms
TA finished helping Student 8.
TA is helping Student 7...
Student 7 is being helped by the TA...
Student 5 wants to see the TA...
Student 5 is waiting in the hallway with patience 2632 ms
Student 6 wants to see the TA...
Student 6 is waiting in the hallway with patience 1562 ms
Student 10 got tired of waiting and will try again later.
Student 10 is working on assignments...
Student 6 got tired of waiting and will try again later.
Student 6 is working on assignments...
TA finished helping Student 7.
TA is helping Student 5...
Student 5 is being helped by the TA...
Student 3 wants to see the TA...
Student 3 is waiting in the hallway with patience 2331 ms
Student 9 wants to see the TA...
Student 9 is waiting in the hallway with patience 1489 ms
TA finished helping Student 5.
TA is helping Student 3...
Student 3 is being helped by the TA...
Student 9 got tired of waiting and will try again later.
Student 9 is working on assignments...
Student 10 wants to see the TA...
Student 10 is waiting in the hallway with patience 1330 ms
Student 6 wants to see the TA...
Student 6 is waiting in the hallway with patience 1562 ms
TA finished helping Student 3.
TA is helping Student 10...
Student 10 is being helped by the TA...
Student 6 got tired of waiting and will try again later.
Student 6 is working on assignments...
Student 9 wants to see the TA...
Student 9 is waiting in the hallway with patience 1489 ms
TA finished helping Student 10.
TA is helping Student 9...
Student 9 is being helped by the TA...
TA finished helping Student 9.
TA is sleeping...
Student 6 wants to see the TA...
Student 6 is waiting in the hallway with patience 1562 ms
TA is helping Student 6...
Student 6 is being helped by the TA...
TA finished helping Student 6.
TA is sleeping...
Students helped: 10
Main thread interrupting all threads...
Main thread interrupting all student threads...
TA was interrupted. Exiting...
(base) maxlink@Maxs-MacBook-Air osproj %
```