

Lab 12: Concurrency

Exercise 1: Create a Project

1. Create a project called “lab12”
 - a) If you are using Eclipse create a project in Eclipse as we did in previous weeks.
 - b) If you are using text editor, create a “lab12” directory in “java” directory which is in your home directory.
2. Download the Queue.java from Piazza and put it in the project source folder..

Exercise 2: Write a Producer Thread which generates random numbers and put them into Queue.

1. Write a class named Producer which extends from Thread class.
2. Declare an instance variable queue having Queue type. And initialize the instance variable with the parameter of the constructor.
3. In the run method, generate a random integer and put it into the queue. Do this in a for loop of 20 iteration.
4. In the main method of Queue,
 - a) create an instance of Queue,
 - b) create two instances of Producer threads which use the queue instance
 - c) and start the threads.
 - d) In the main thread print the size of the queue after producer threads complete.
5. Run the Queue application
6. Make the Queue class thread safe.
7. Rerun the application.

Exercise 3: Write a Consumer Thread which removes numbers from the Queue and prints them.

1. Write a class named Consumer which extends from Thread class.
2. Declare an instance variable queue having Queue type. And initialize the instance variable with the parameter of the constructor.
3. In the run method, remove an element from the queue and print it.
4. If the consumer receives an interrupt, end the consumer thread.
5. In the main method of Queue,
 - a) Create an instance of Consumer thread which uses the queue instance

- b) and start the thread.
 - c) In the main thread after producer threads completes, wait for the consumer to empty the queue and interrupt the consumer.
6. Run the application.
 7. Observe that when queue is empty, the consumer gets a `java.util.NoSuchElementException`
 8. Modify the Consumer so that it removes an element from the queue only when the queue is not empty

Exercise 4: Modify the Consumer Thread so that when Queue is empty it pauses and when Queue has an element it starts.

In the consumer class, instead of checking the queue whether it is empty or not, modify the Queue class so that if the Queue is empty it will block the consumer in the remove method.

1. Modify the remove method of Queue,
 - a) Check whether the Queue is empty
 - b) If so, call the wait method
2. Modify the add method to notify the other threads
3. Remove the control in the Consumer which checks whether the queue empty or not.