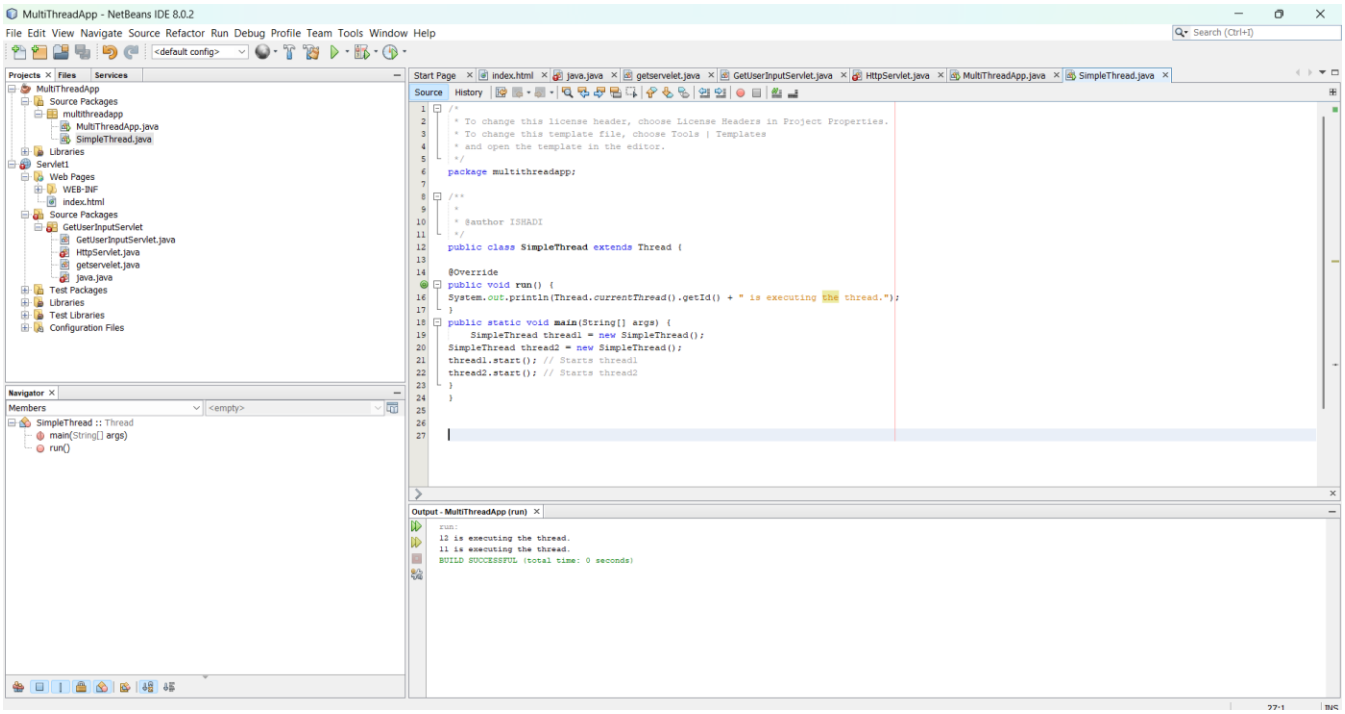
Lab Sheet 1 : Multi-threaded Java Application

1. Create a Simple Thread Class
   SimpleThread.java

```
public class SimpleThread extends Thread {
@Override
public void run() {
System.out.println(Thread.currentThread().getId() + " is executing
the thread.");
}
public static void main(String[] args) {
SimpleThread thread1 = new SimpleThread();
SimpleThread thread2 = new SimpleThread();
thread1.start(); // Starts thread1
thread2.start(); // Starts thread2
}
}
```



Output

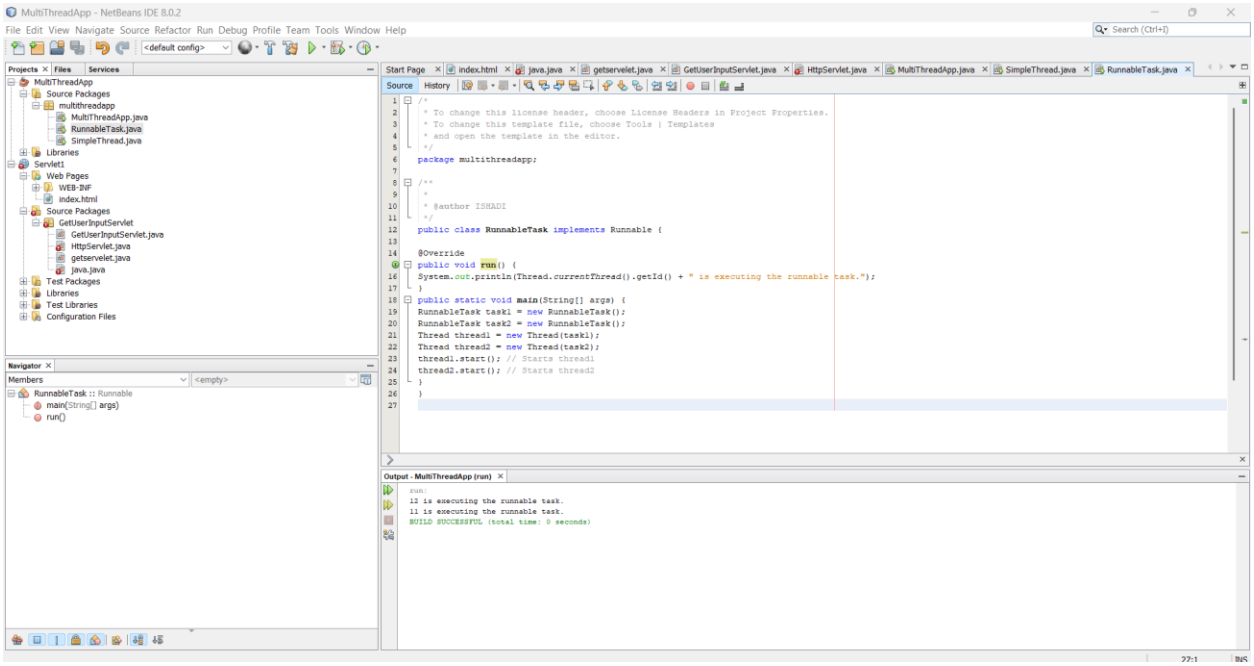
11 is executing the thread.

12 is executing the thread.

Part 2: Using Runnable Interface

RunnableTask.java

```
public class RunnableTask implements Runnable {
@Override
public void run() {
System.out.println(Thread.currentThread().getId() + " is executing
the runnable task.");
}
public static void main(String[] args) {
RunnableTask task1 = new RunnableTask();
RunnableTask task2 = new RunnableTask();
Thread thread1 = new Thread(task1);
Thread thread2 = new Thread(task2);
thread1.start(); // Starts thread1
thread2.start(); // Starts thread2
}
}
```



Output

13 is executing the runnable task.

14 is executing the runnable task.

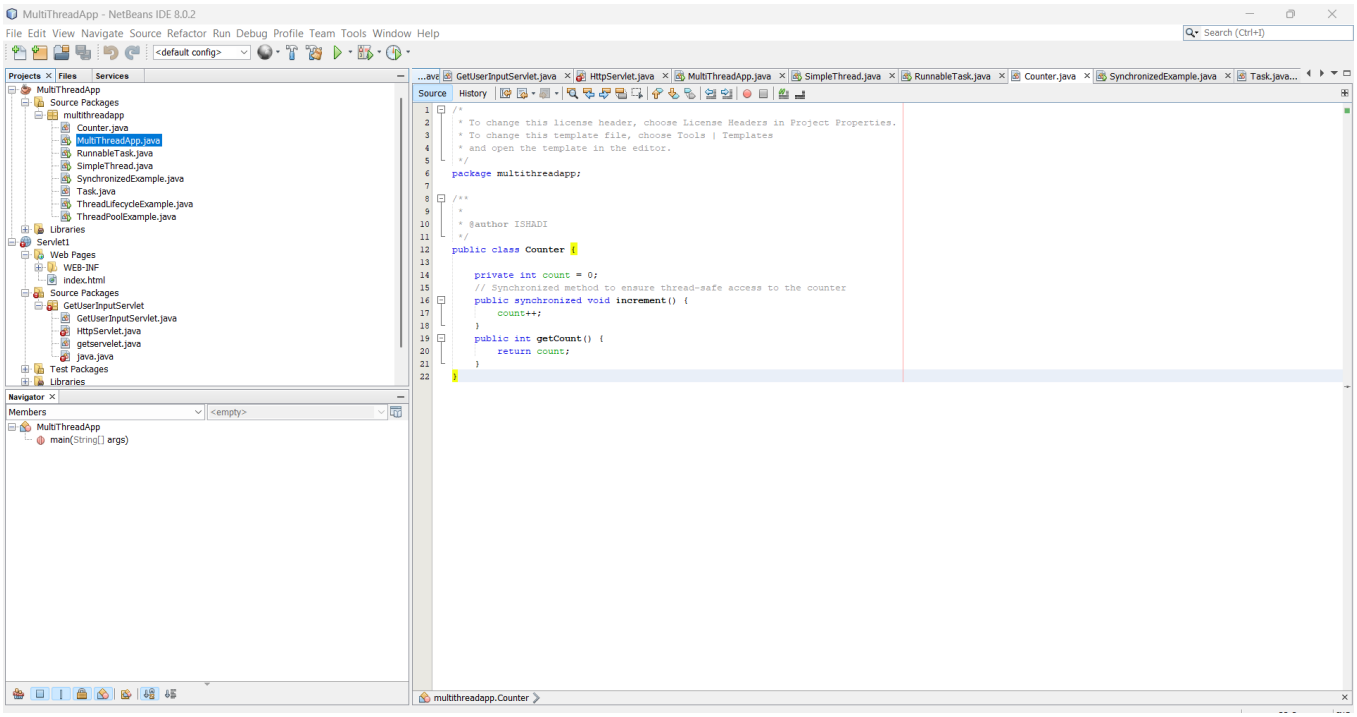
Part 3: Synchronizing Threads

- Counter.java AND SynchronizedExample.java

  Counter.java

```
class Counter {
private int count = 0;
// Synchronized method to ensure thread-safe access to the counter
public synchronized void increment() {
count++;
}
public int getCount() {
return count;
}
}
```

```
public class SynchronizedExample extends Thread {
private Counter counter;
public SynchronizedExample(Counter counter) {
this.counter = counter;
}
@Override
public void run() {
for (int i = 0; i < 1000; i++) {
counter.increment();
}
}
public static void main(String[] args) throws InterruptedException {
Counter counter = new Counter();
// Create and start multiple threads
Thread thread1 = new SynchronizedExample(counter);
Thread thread2 = new SynchronizedExample(counter);
thread1.start();
thread2.start();
// Wait for threads to finish
thread1.join();
thread2.join();
System.out.println("Final counter value: " + counter.getCount());
}
}
```



- SynchronizedExample.java

```
public class SynchronizedExample extends Thread {

    private Counter counter;


    public SynchronizedExample(Counter counter) {
        this.counter = counter;
    }


    @Override
    public void run() {
        for (int i = 0; i < 1000; i++) {
            counter.increment();
        }
```

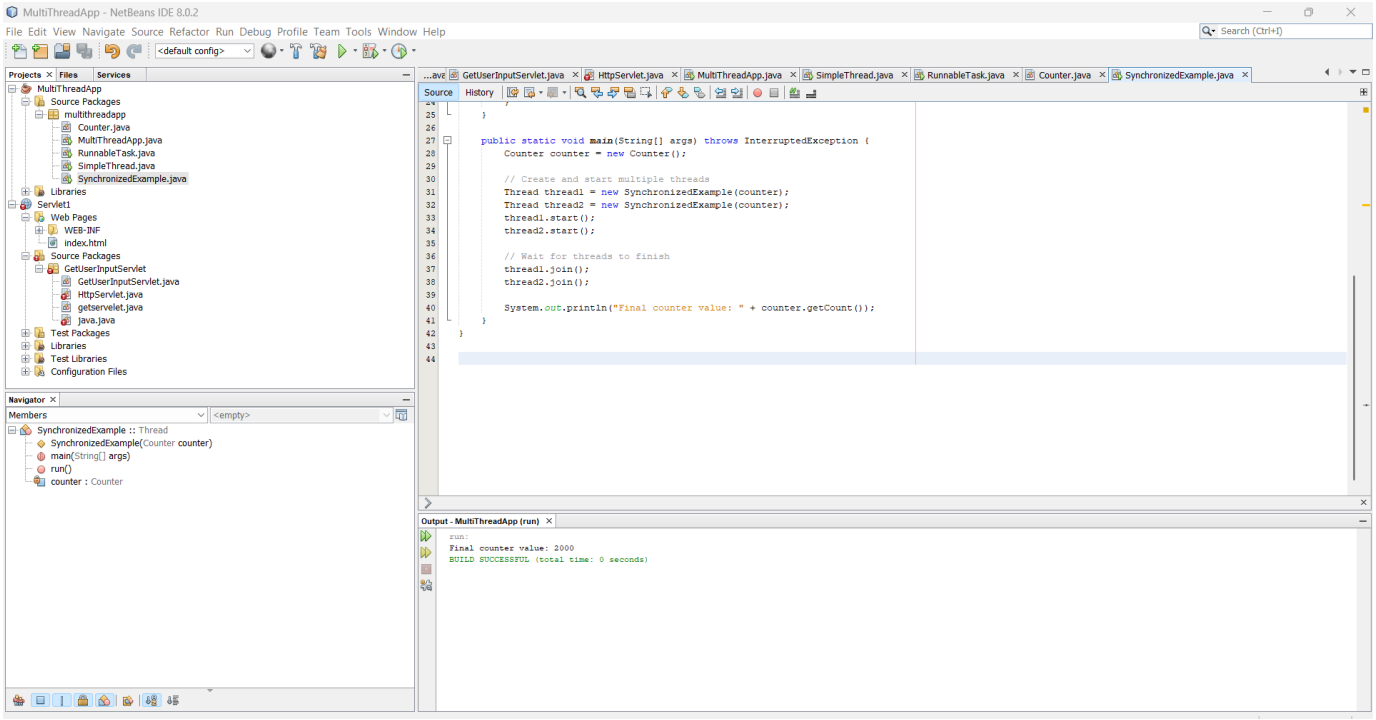
```
    }

    public static void main(String[] args) throws InterruptedException {
        Counter counter = new Counter();

        // Create and start multiple threads
        Thread thread1 = new SynchronizedExample(counter);
        Thread thread2 = new SynchronizedExample(counter);
        thread1.start();
        thread2.start();

        // Wait for threads to finish
        thread1.join();
        thread2.join();

        System.out.println("Final counter value: " + counter.getCount());
    }
}
```



Output

Final counter value: 2000

Part 4: Thread Pooling

- Task.java AND ThreadPoolExample.java

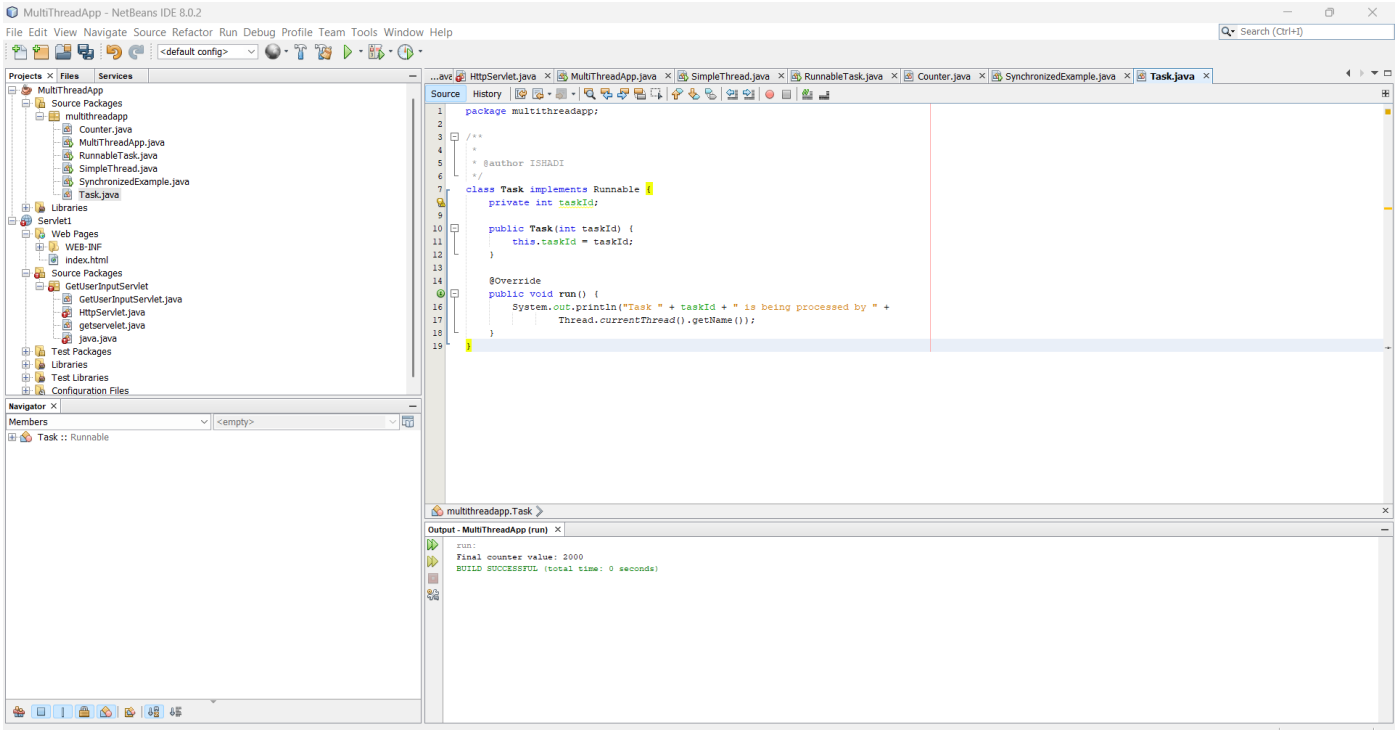
Task.java

```
package multithreadapp;


/**
 *
 * @author ISHADI
 */
class Task implements Runnable {
    private int taskId;

    public Task(int taskId) {
        this.taskId = taskId;
    }

    @Override
    public void run() {
        System.out.println("Task " + taskId + " is being processed by " +
                Thread.currentThread().getName());
    }
}
```


MultiThreadApp - NetBeans IDE 8.0.2
File Edit View Navigate Source Refactor Run Debug Profile Team Tools Window Help
Search (Ctrl+I)
Projects
Files
Services
MultiThreadApp
Source Packages
multithreadapp
Counter.java
MultiThreadApp.java
RunnableTask.java
SimpleThread.java
SynchronizedExample.java
Task.java
Libraries
Servlet1
Web Pages
WEB-INF
index.html
Source Packages
GetUserInputServlet
GetUserInputServlet.java
HttpServlet.java
getservelet.java
java.java
Test Packages
Libraries
Test Libraries
Configuration Files
Navigator
Members
Task :: Runnable
HttpServlet.java
MultiThreadApp.java
SimpleThread.java
RunnableTask.java
Counter.java
SynchronizedExample.java
Task.java
Source
History
package multithreadapp;
/**
*
* @author ISHADI
*/
class Task implements Runnable {
private int taskId;
public Task(int taskId) {
this.taskId = taskId;
}
@Override
public void run() {
System.out.println("Task " + taskId + " is being processed by " +
Thread.currentThread().getName());
}
}
multithreadapp.Task
Output - MultiThreadApp (run)
run:
Final counter value: 2000
BUILD SUCCESSFUL (total time: 0 seconds)

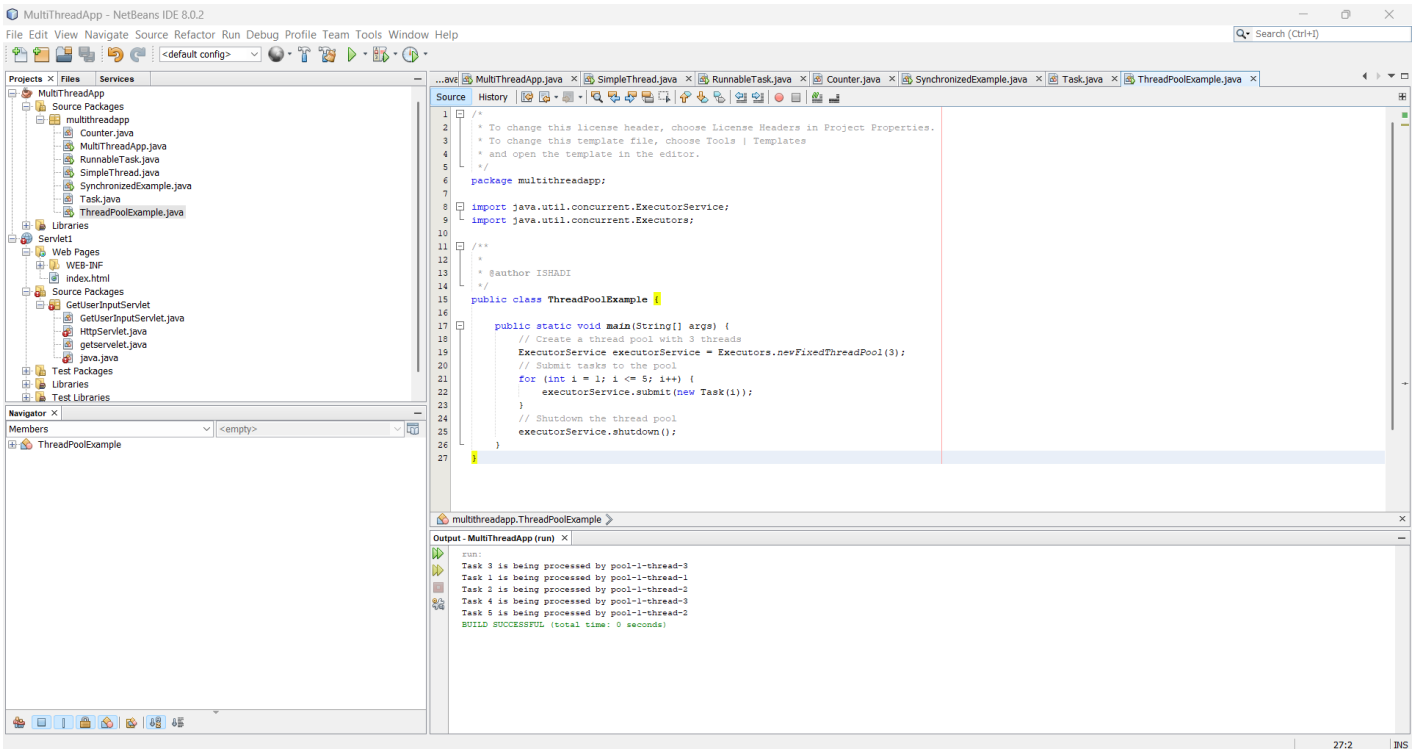
- ThreadPoolExample.java

```
import java.util.concurrent.ExecutorService;
import java.util.concurrent.Executors;
class Task implements Runnable {
private int taskId;
public Task(int taskId) {
this.taskId = taskId;
}
@Override
public void run() {
System.out.println("Task " + taskId + " is being processed by " +
Thread.currentThread().getName());
}
}
public class ThreadPoolExample {
public static void main(String[] args) {
// Create a thread pool with 3 threads
ExecutorService executorService = Executors.newFixedThreadPool(3);
// Submit tasks to the pool
for (int i = 1; i <= 5; i++) {
executorService.submit(new Task(i));
}
// Shutdown the thread pool
```

```
        executorService.shutdown();

    }

}
```



Output

Task 1 is being processed by pool-1-thread-1

Task 2 is being processed by pool-1-thread-2

Task 3 is being processed by pool-1-thread-3

Task 4 is being processed by pool-1-thread-1

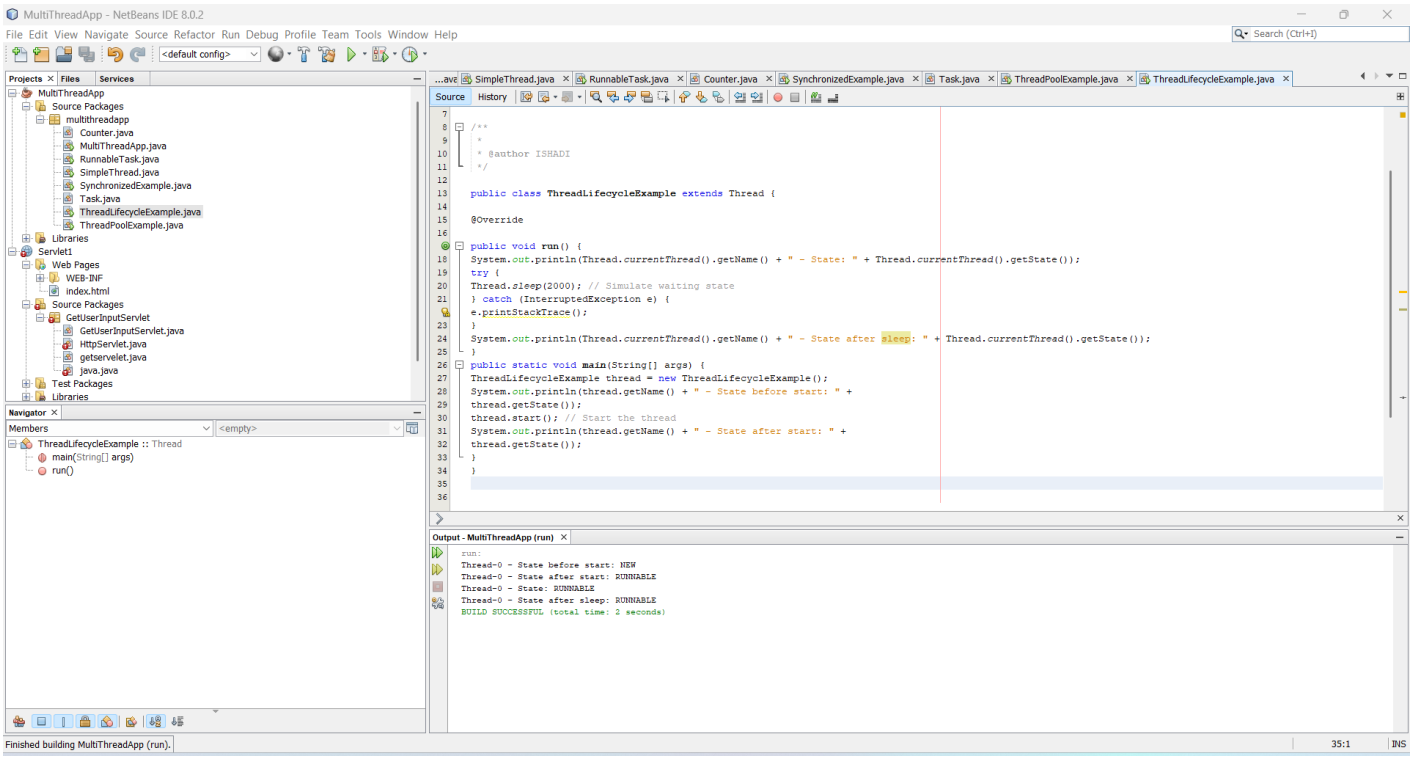
Task 5 is being processed by pool-1-thread-2

Part 5: Thread Lifecycle and States

- ThreadLifecycleExample.java.

```
public class ThreadLifecycleExample extends Thread {
@Override
public void run() {
System.out.println(Thread.currentThread().getName() + " - State: " +
Thread.currentThread().getState());
try {
Thread.sleep(2000); // Simulate waiting state
} catch (InterruptedException e) {
e.printStackTrace();
}
System.out.println(Thread.currentThread().getName() + " - State after
sleep: " + Thread.currentThread().getState());
}
public static void main(String[] args) {
ThreadLifecycleExample thread = new ThreadLifecycleExample();
System.out.println(thread.getName() + " - State before start: " +
thread.getState());
thread.start(); // Start the thread
System.out.println(thread.getName() + " - State after start: " +
thread.getState());
}
```

}



Output

Thread-0 - State before start: NEW

Thread-0 - State after start: RUNNABLE

Thread-0 - State: RUNNABLE

Thread-0 - State during sleep: TIMED_WAITING

Thread-0 - State after sleep: RUNNABLE

Thread-0 - State after finish: TERMINATED