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Práctica 3: Deadlock.

Instrucciones.

- Implementar en Java las clases que se indican a continuación dentro de un proyecto Netbeans.
- Entregar dos archivos separados:
  - Archivo PDF con las capturas de ejecución que se piden.
  - Archivo ZIP que contenga la carpeta del proyecto Netbeans.

Programa.

Ejemplo: Gaston y Alphonse.

1. Implementar el ejemplo.
2. Concatenar el **identificador de alumno** a cada string que muestra el programa.
3. Capturar los dos escenarios de ejecución que se recogen en la guía.

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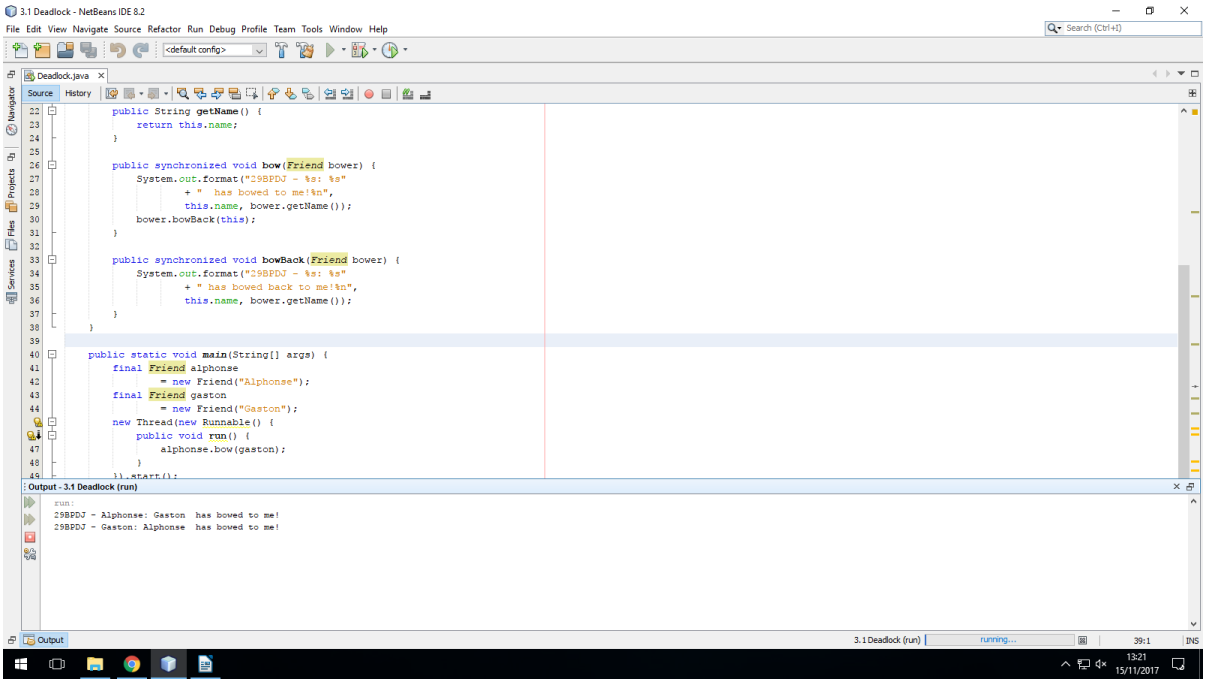

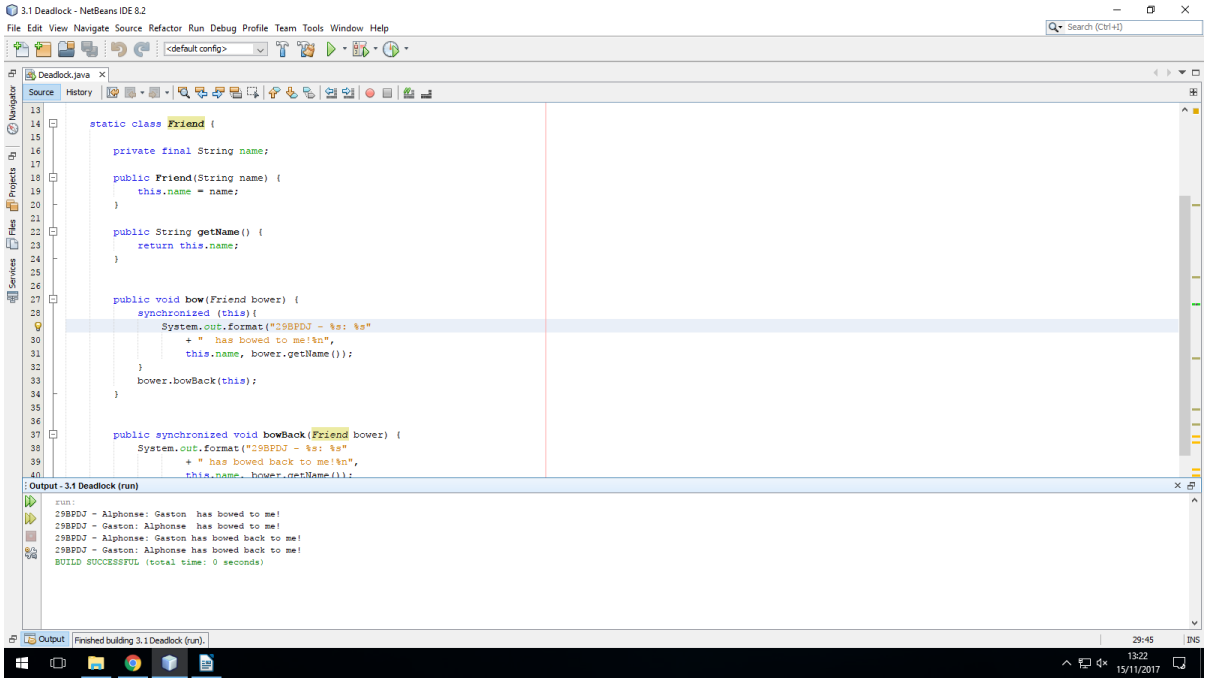

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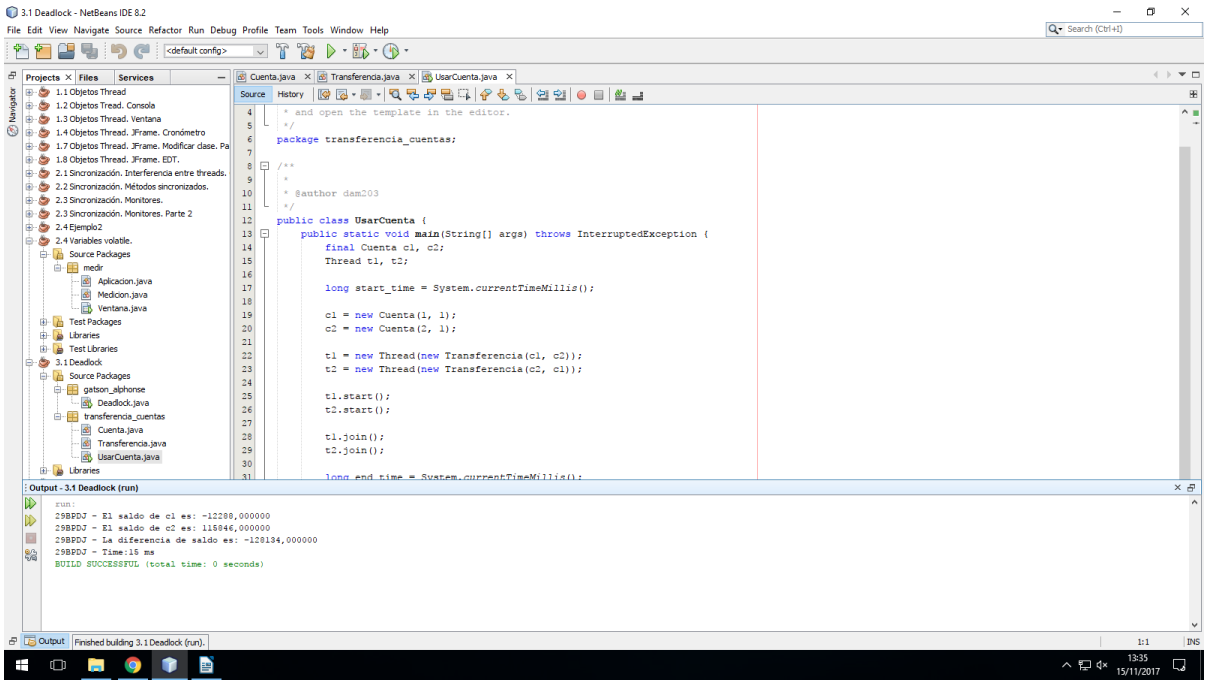
Ejemplo: Transferencias entre cuentas bancarias.

4. Implementar el ejemplo.
5. Concatenar el **identificador de alumno** a cada string que muestra el programa.
6. Indicar el tiempo de duración del programa para cada ejemplo.
7. Capturar los dos escenarios de ejecución relativos a deadlock que se recogen en la guía.



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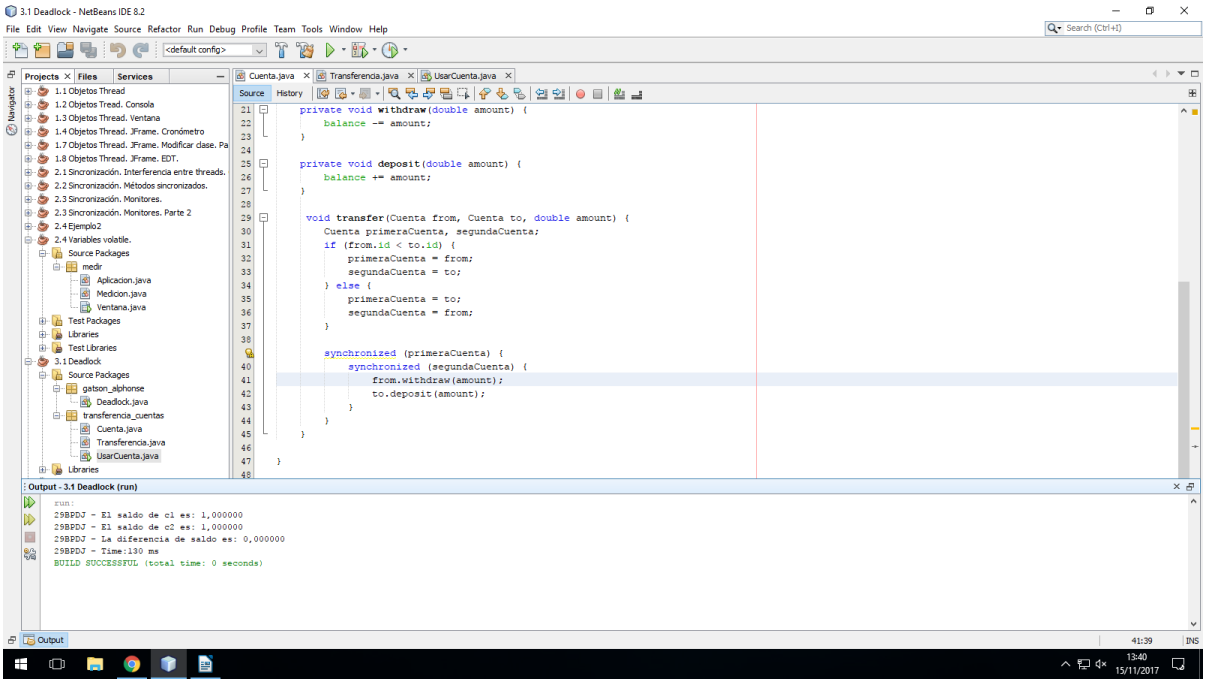

Resolver deadlock genérico.

8. Tomar como punto de partida el siguiente ejemplo genérico de deadlock.

```
public class Deadlock {
  public static void main(String[] args) {
    // These are the two resource objects we'll try to get locks for
    final Object resource1 = "resource1";
    final Object resource2 = "resource2";
    // Here's the first thread.  It tries to lock resource1 then resource2
    Thread t1 = new Thread() {
      public void run() {
        // Lock resource 1
        synchronized(resource1) {
          System.out.println("Thread 1: locked resource 1");

          // Pause for a bit, simulating some file I/O or something.
          // Basically, we just want to give the other thread a chance to
          // run.  Threads and deadlock are asynchronous things, but we're
          // trying to force deadlock to happen here...
          try { Thread.sleep(50); } catch (InterruptedException e) {}

          // Now wait 'till we can get a lock on resource 2
          synchronized(resource2) {
            System.out.println("Thread 1: locked resource 2");
          }
        }
```

```
      }
    };

    // Here's the second thread.  It tries to lock resource2 then resource1
    Thread t2 = new Thread() {
      public void run() {
        // This thread locks resource 2 right away
        synchronized(resource2) {
          System.out.println("Thread 2: locked resource 2");

          // Then it pauses, for the same reason as the first thread does
          try { Thread.sleep(50); } catch (InterruptedException e) {}

          // Then it tries to lock resource1.  But wait!  Thread 1 locked
          // resource1, and won't release it 'till it gets a lock on
          // resource2.  This thread holds the lock on resource2, and won't
          // release it 'till it gets resource1.  We're at an impasse. Neither
          // thread can run, and the program freezes up.
          synchronized(resource1) {
            System.out.println("Thread 2: locked resource 1");
          }
        }
      }
    };

    // Start the two threads. If all goes as planned, deadlock will occur,
    // and the program will never exit.
    t1.start();
    t2.start();
  }
}
```

9. Los strings deberán de mostrar el **identificador de alumno**.
10. Capturar el resultado de ejecutar la clase.

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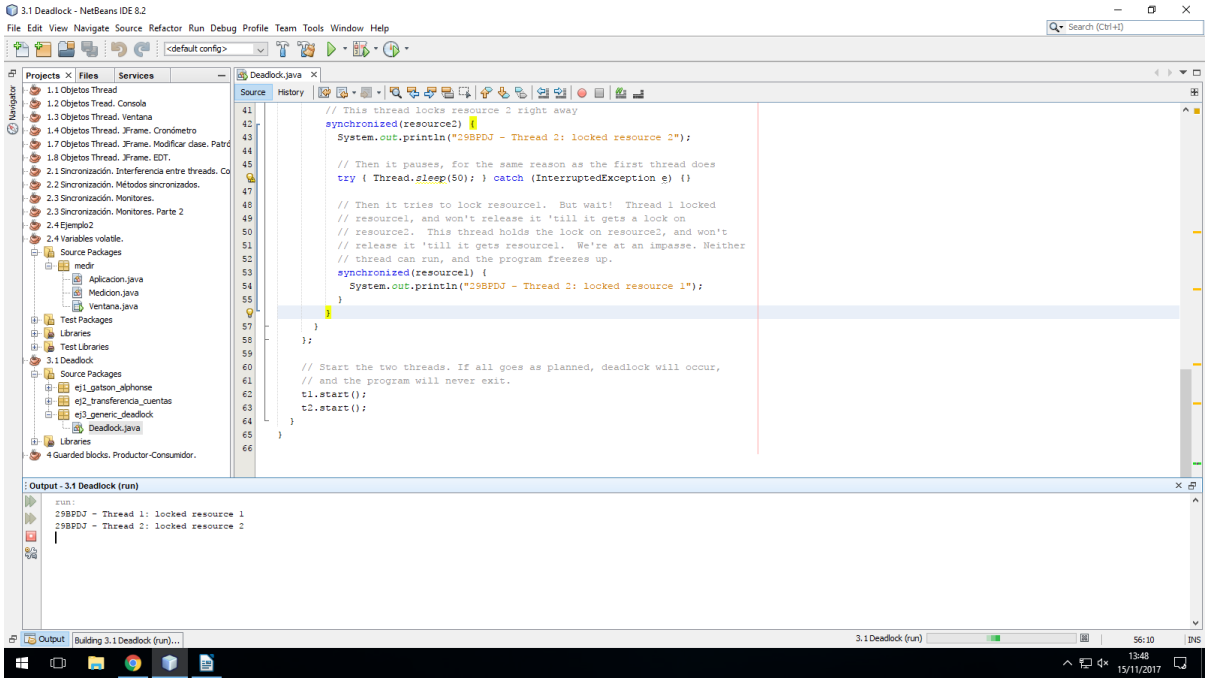

11. Resolver el deadlock.
    a. Sólo deberá modificarse uno de los threads.
    b. No se podrá modificar el orden en el que acceden a los recursos.
12. Copiar y pegar el código de la clase.

```
  public class Deadlock {
 public static void main(String[] args) {
  // These are the two resource objects we'll try to get locks for
  final Object resource1 = "resource1";
  final Object resource2 = "resource2";
  // Here's the first thread.  It tries to lock resource1 then resource2
  Thread t1 = new Thread() {
    public void run() {
      // Lock resource 1
      synchronized(resource1) {
        System.out.println("29BPDJ - Thread 1: locked resource 1");

        // Pause for a bit, simulating some file I/O or something.
        // Basically, we just want to give the other thread a chance to
        // run.  Threads and deadlock are asynchronous things, but we're
        // trying to force deadlock to happen here...
```

```
        try { Thread.sleep(50); } catch (InterruptedException e) {}
      }
        // Now wait 'till we can get a lock on resource 2
        synchronized(resource2) {
          System.out.println("29BPDJ - Thread 1: locked resource 2");
        }
    }
  };

  // Here's the second thread.  It tries to lock resource2 then resource1
  Thread t2 = new Thread() {
    public void run() {
      // This thread locks resource 2 right away
      synchronized(resource2) {
        System.out.println("29BPDJ - Thread 2: locked resource 2");

        // Then it pauses, for the same reason as the first thread does
        try { Thread.sleep(50); } catch (InterruptedException e) {}

        // Then it tries to lock resource1.  But wait!  Thread 1 locked
        // resource1, and won't release it 'till it gets a lock on
        // resource2.  This thread holds the lock on resource2, and won't
        // release it 'till it gets resource1.  We're at an impasse. Neither
        // thread can run, and the program freezes up.
        synchronized(resource1) {
          System.out.println("29BPDJ - Thread 2: locked resource 1");
        }
      }
    }
  };

  // Start the two threads. If all goes as planned, deadlock will occur,
  // and the program will never exit.
  t1.start();
  t2.start();
```

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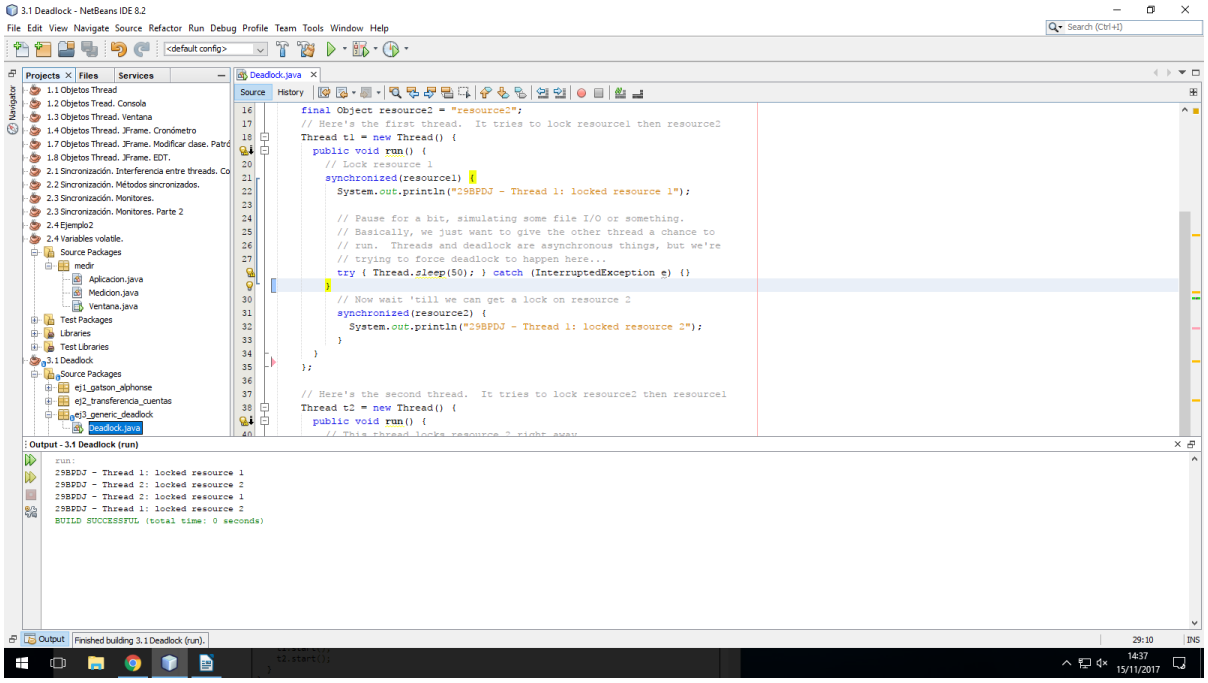
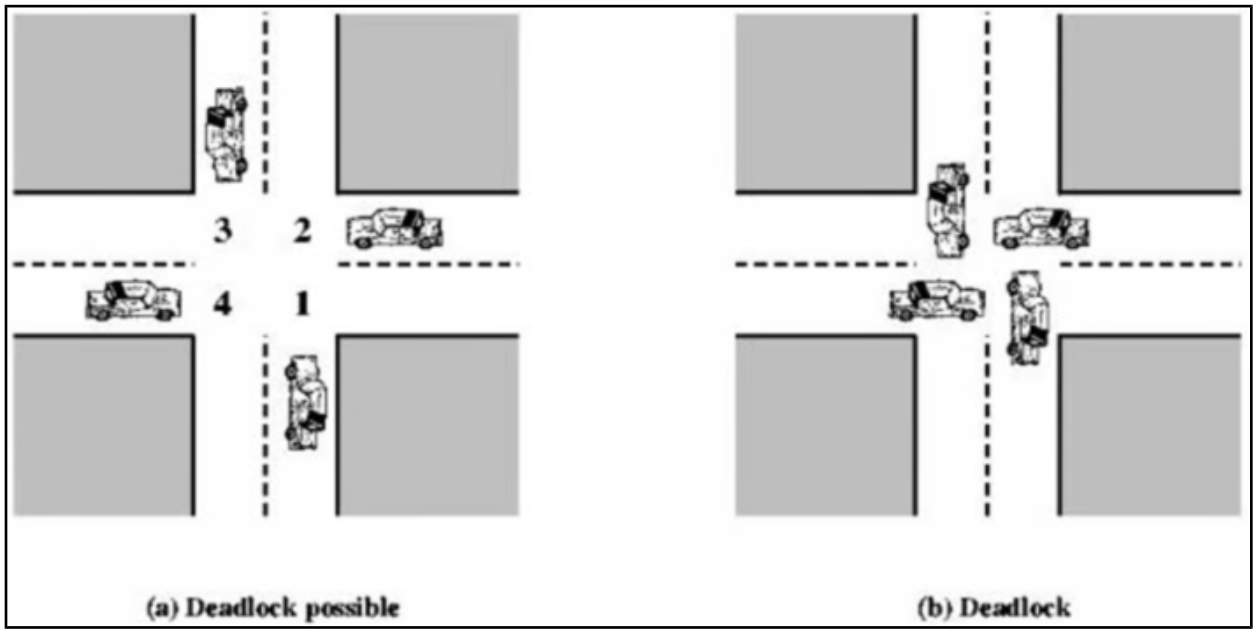
```
    }
  }
```

13. Capturar el resultado de ejecutar la clase.



Resolver deadlock en un cruce de coches.



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14. Partir del siguiente ejemplo de deadlock.

    a. Clase *Demo0*

```
public class Demo0 {
        public static void main(String[] args) {
        Cars demo1 = new Cars(1);
        Cars demo2 = new Cars(2);
        Cars demo3 = new Cars(3);
        Cars demo4 = new Cars(4);

        new Thread(new Runnable() {
                @Override
                public void run() {
                demo1.waiting(demo2);
                }
        }).start();

        new Thread(new Runnable() {
                @Override
                public void run() {
                demo2.waiting(demo3);
                }
        }).start();

        new Thread(new Runnable() {
                @Override
                public void run() {
                demo3.waiting(demo4);
                }
        }).start();

        new Thread(new Runnable() {
                @Override
                public void run() {
                demo4.waiting(demo1);
                }
        }).start();
        }
}
```

    b. Clase *Cars*

```
public class Cars {
        private int number;

        public Cars(int t) {
        number = t;
        }

        public int getNumber() {
        return number;
        }

        public synchronized void waiting(Cars t) {
        System.out.format("Car " + number + " is waiting for Car " + t.getNumber() + "\n");
```

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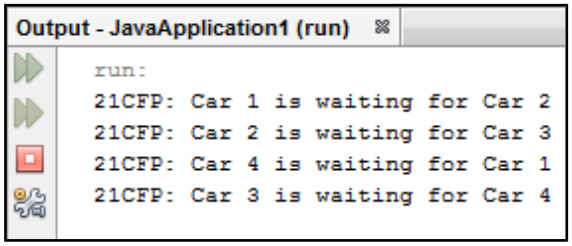
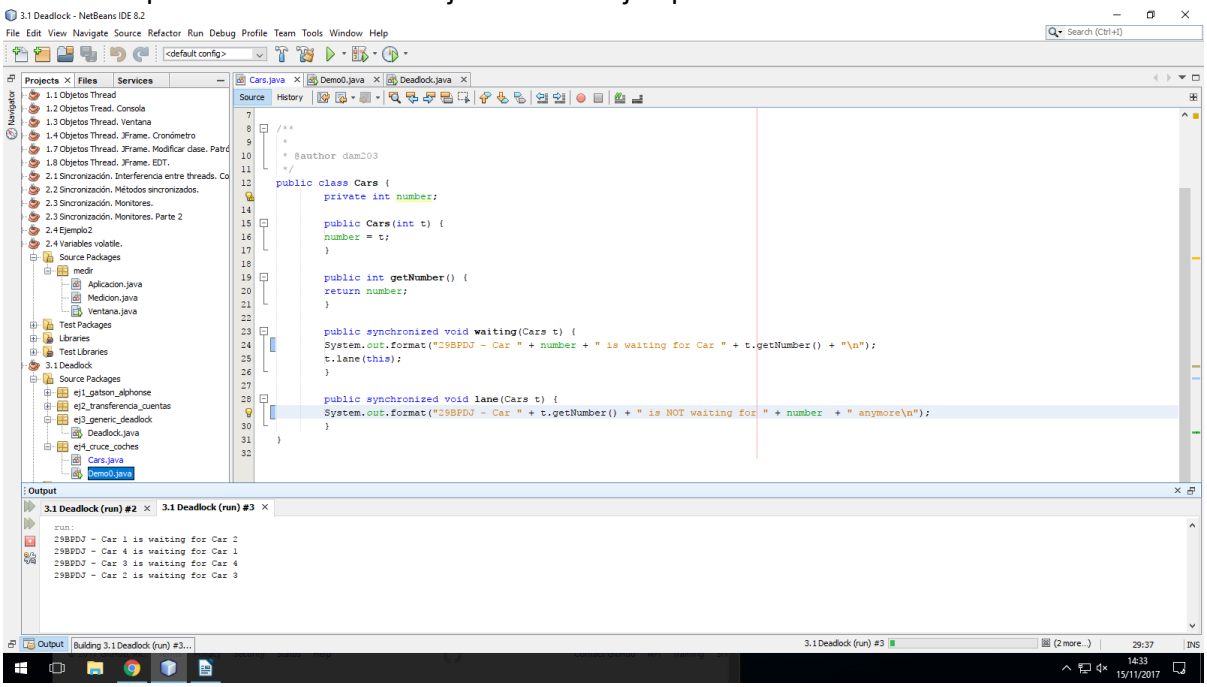
```
        t.lane(this);
        }

        public synchronized void lane(Cars t) {
        System.out.format("Car " + t.getNumber() + " is NOT waiting for " + number  + "
anymore\n");
        }
}
```

c. Al ejecutar el programa se produce un deadlock.



15. Implementar ambas clases.
    a. Los nombres de clase deberán comenzar por mayúscula.
    b. Los strings que muestra deberán de incorporar el **identificador de alumno**.
16. Capturar el resultado de ejecutar este ejemplo.



17. Resolver el deadlock. Será necesario inspirarse en la solución de los filósofos cenando para evitar que los coches choquen.
18. Copiar y pegar el código de la clase que se ha modificado.

public void waiting(Cars t) {

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```
        if (this.number == 1) {
            synchronized (this) {
                System.out.format("Car " + number + " is waiting for Car " + t.getNumber() + "\n");
            }
            t.lane(this);
        } else{
            synchronized (this) {
                System.out.format("Car " + number + " is waiting for Car " + t.getNumber() + "\n");
                t.lane(this);
            }
        }
}
```

19. Capturar el resultado de ejecutar este ejemplo.