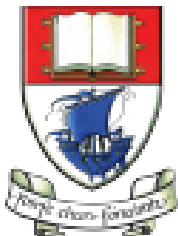


Unit Test Examples

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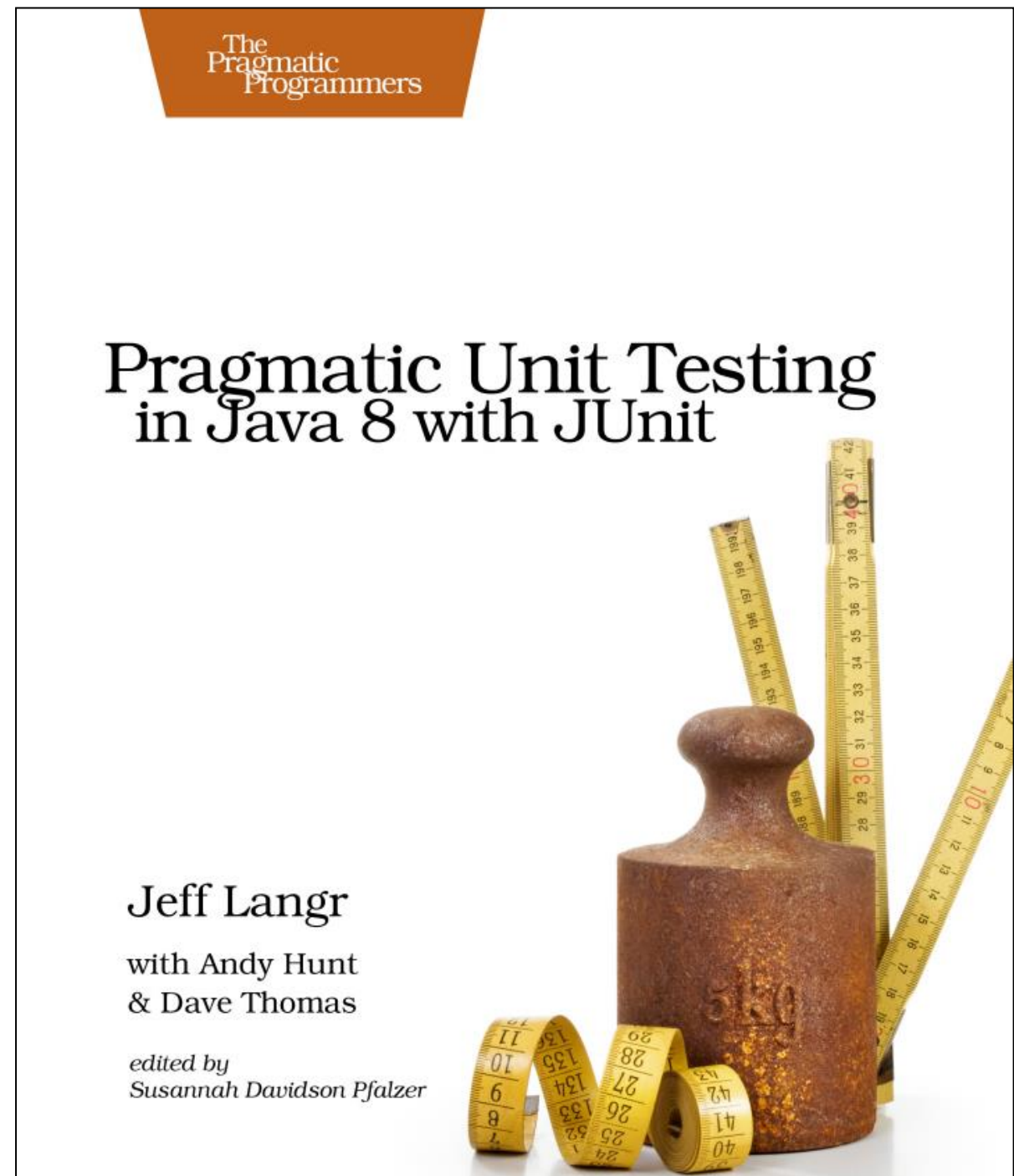


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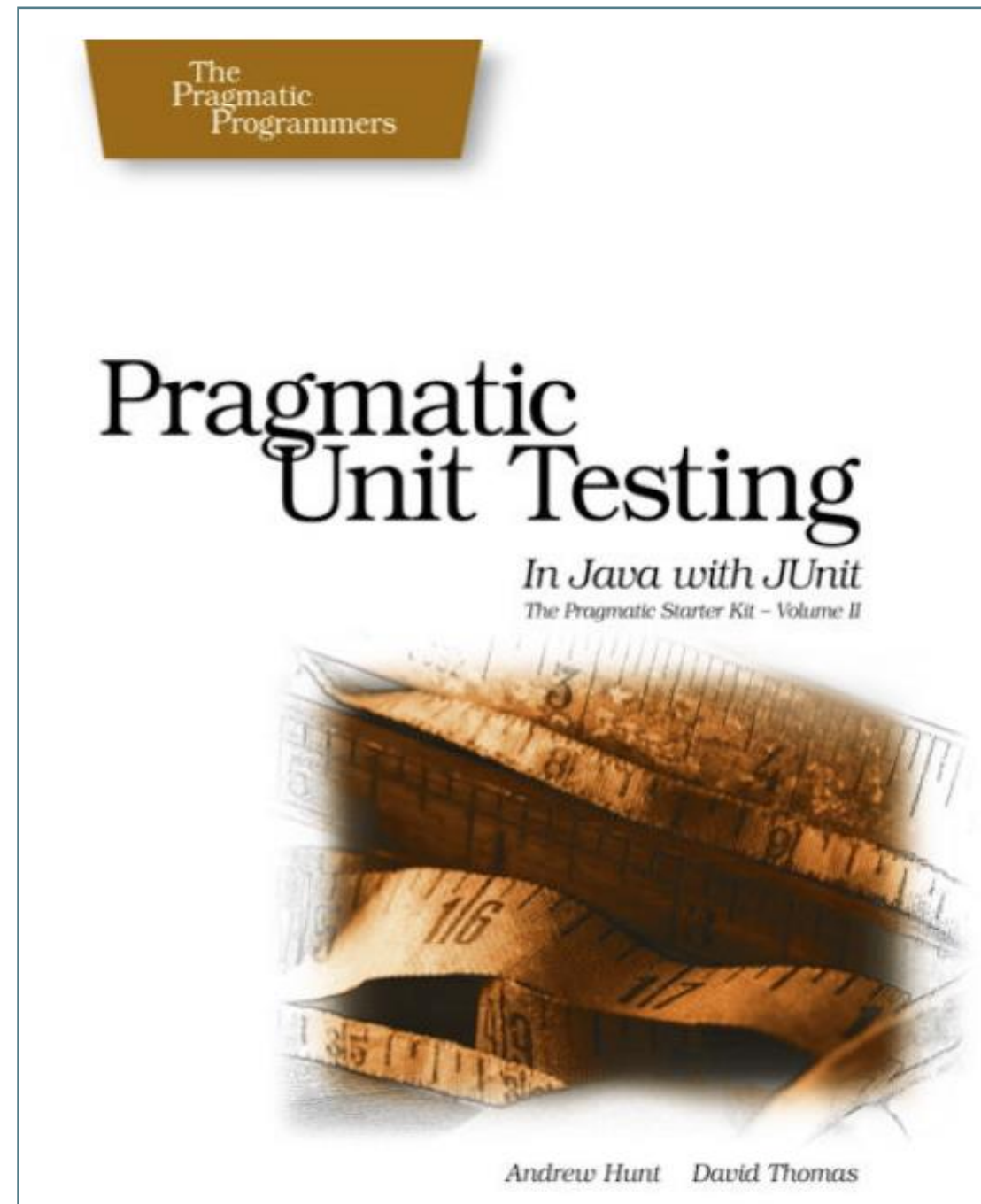
Excellent Unit Testing Resource

- New in 2015.
- Some excellent “New School” testing approaches.
- Source code used in the book is available at:
https://pragprog.com/titles/utj2/source_code



Simple Unit Test Examples from 2003 book!

- Stack
- VideoPlayer



Stack Interface

```
public interface Stack
{
    public String pop ();

    public void push (String item);

    public String top ();

    public boolean isEmpty ();
}
```

```
public class ArrayStack implements Stack
```

```
{  
    private int    next_index;  
    private String[] stack;
```

```
    public ArrayStack()
```

```
{  
        stack = new String[100];  
        next_index = 0;  
    }
```

```
    public String pop ()
```

```
{  
        if (next_index == 0)  
        {  
            throw new RuntimeException("empty stack");  
        }  
        return stack[--next_index];  
    }
```

```
    public void delete (int n)
```

```
{  
        next_index -= n;  
    }
```

ArrayStack

```
    public void push (String aString)
```

```
{  
        stack[next_index++] = aString;  
    }
```

```
    public String top ()
```

```
{  
        if (next_index == 0)  
        {  
            throw new  
                RuntimeException ("empty stack");  
        }  
        return stack[next_index - 1];  
    }
```

```
    public boolean isEmpty ()
```

```
{  
        return next_index == 0;  
    }
```

```
}
```

StackTest

- Test Fixture

```
public class StackTest
{
    private Stack testStack;

    @Before
    public void setUp()
    {
        testStack = new ArrayStack();
    }

    @After
    public void tearDown()
    {
        testStack = null;
    }
}
```

Test Specifications

1. Starting with an empty stack, call `push()` to push a test string onto the stack. Verify that `top()` returns that string several times in a row, and that `isEmpty()` returns false.
2. For a brand-new stack, `isEmpty()` should be true, `top()` and `pop()` should throw exceptions.
3. Call `pop()` to remove the test string, and verify that it is the same string. `isEmpty()` should now be true. Call `pop()` again verify an exception is thrown.
4. Now do the same test again, but this time add multiple items to the stack - each of them strings which have the same value (say all "test"). Make sure you get the right ones back, in the right order (the most recent item added should be the one returned). In this case, `assertEquals()` isn't good enough; you need `assertSame()` to ensure it's the same object.
5. Push a null onto the stack and pop it; confirm you get a null back.
6. Ensure you can use the stack after it has thrown exceptions.

1.

Starting with an empty stack, call push() to push a test string onto the stack.

Verify that top() returns that string several times in a row.

Verify isEmpty() returns false.

```
@Test
public void top()
{
    testStack.push("Item 1");
    assertEquals("Item 1", testStack.top());
    assertEquals("Item 1", testStack.top());
    assertEquals("Item 1", testStack.top());
    assertFalse(testStack.isEmpty());
}
```


2.

For a brand-new stack:
isEmpty() should be true
top() and pop() should throw exceptions.

JUnit 3

```
public void testEmptyStack ()
{
    assertTrue(testStack.isEmpty());
    try
    {
        testStack.top();
        fail("should throw empty stack exception");
    }
    catch (Exception e)
    {
        assertTrue(true);
    }
    try
    {
        testStack.pop();
        fail("should throw empty stack exception");
    }
    catch (Exception e)
    {
        assertTrue(true);
    }
}
```

JUnit 4

// Case 2

@Test

```
public void emptyStack()
{
    assertTrue(testStack.isEmpty());
}
```

// Case 2

@Test(expected = Exception.class)

```
public void testTopException()
{
    testStack.top();
}
```

// Case 2

@Test(expected = Exception.class)

```
public void testPopException()
{
    testStack.pop();
}
```

3.

- Call pop() to remove a test string, and verify that it is the same string.
- isEmpty() should now be true.
- Call pop() again verify an exception is thrown.

```
@Test
public void testPop() throws Exception
{
    String testStr = new String ("test");
    testStack.push(testStr);
    assertEquals(testStr, testStack.pop());
    //assertTrue(testStack.isEmpty());
    try
    {
        testStack.pop();
        fail("Pop should throw exception");
    }
    catch (Exception e)
    {
        assertTrue(true);
    }
}
```

4.

- Now do the same test again, but this time add multiple items to the stack - each of them strings which have the same value (say all "test").
- Make sure you get the right ones back, in the right order (the most recent item added should be the one returned).
- In this case, assertEquals() isn't good enough; you need assertEquals() to ensure it's the same object

```
@Test
public void testPopDuplicate()
{
    String test1 = new String ("test");
    String test2 = new String ("test");
    String test3 = new String ("test");

    testStack.push(test1);
    testStack.push(test2);
    testStack.push(test3);

    assertEquals(test3, testStack.pop());
    assertEquals(test2, testStack.pop());
    assertEquals(test1, testStack.pop());
}
```

5.

- Push a null onto the stack and pop it; confirm you get a null back.

```
@Test
public void testNull()
{
    testStack.push(null);
    assertEquals (null, testStack.pop());
}
```

6.

- Ensure you can use the stack after it has thrown exceptions

```
@Test
public void testException()
{
    try
    {
        testStack.pop();
        fail("Pop should throw exception");
    }
    catch (Exception e)
    {
        assertTrue(true);
    }
    testStack.push("test");
    assertEquals ("test", testStack.top());
    assertFalse (testStack.isEmpty());
}
```

CollectionStack

JUnit 4

```
public class StackTest
{
    private Stack testStack;

    @Before
    public void setUp()
    {
        //testStack = new ArrayStack();
        testStack = new CollectionStack();
    }

    //as before...
```

```
public class CollectionStack implements Stack
{
    private java.util.Stack<String> stack;

    public CollectionStack()
    {
        stack = new java.util.Stack<String>();
    }

    public boolean isEmpty ()
    {
        return stack.isEmpty();
    }

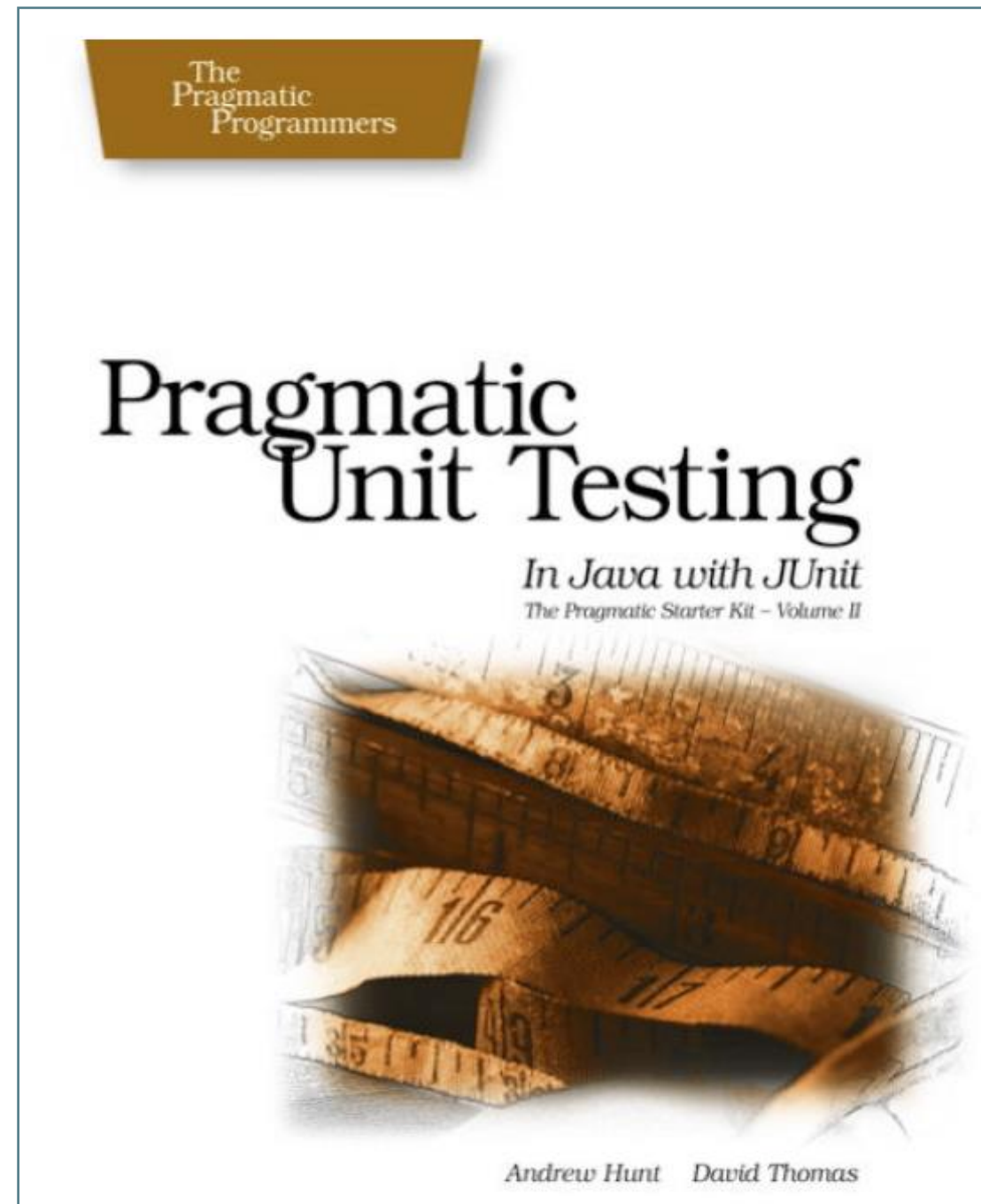
    public String pop ()
    {
        return stack.pop();
    }

    public void push (String item)
    {
        stack.push(item);
    }

    public String top ()
    {
        return stack.peek();
    }
}
```

Some Unit Test Examples

- Stack
- **VideoPlayer**



VideoPlayer Specification

- Implementations will provide methods to control a VCR or tape deck.
- There's the notion of a current position that lies somewhere between the beginning of tape (considered to be zero) and the end of tape - considered to be the tape duration in seconds.

```
public interface VideoPlayer
{
    public void fastForward (int seconds);

    public void rewind (int seconds);

    public int currentTimePosition ();

    public void markTimePosition (String name);

    public void gotoMark (String name);
}
```

- You can ask for the current position and move from there to another given position. Fast-forward moves from current position toward end by some amount. Rewind moves from current position toward the beginning by some amount. When tapes are first loaded, they are positioned at beginning automatically.
- A "Mark" can be established at any location - and this is remembered by the player. Going to a mark should make the location of the mark the current position.

VideoPlayer

- Initial implementation....

```
public class VideoPlayerImpl implements VideoPlayer
{
    private int duration;
    private int currentPosition;
    private Map<String, Integer> marks;

    public VideoPlayerImpl(int length)
    {
        this.duration = length;
        marks = new HashMap<String, Integer>();
    }

    public int currentPosition ()
    {
        return currentPosition;
    }

    public void gotoMark (String name)
    {
    }

    public void markTimePosition (String name)
    {
    }

    public void rewind (int seconds)
    {
    }

    public void fastForward (int seconds)
    {
    }
}
```

Test Case Specifications

1. Verify that the initial position is 0.
2. Fast forward by some allowed amount (not past end of tape), then rewind by same amount. Should be at initial location.
3. Rewind by some allowed amount amount (not past beginning of tape), then fast forward by same amount. Should be at initial location.
4. Fast forward past end of tape, then rewind by same amount. Should be before the initial location by an appropriate amount to reflect the fact that you can't advance the location past the end of tape.
5. Try the same thing in the other direction (rewind past beginning of tape).
6. Mark various positions and return to them after moving the current position around.
7. Mark a position and return to it without moving in between

Test Fixture

```
public class VideoPlayerTest
{
    private VideoPlayer editor;

    @Before
    public void setUp() throws Exception
    {
        editor = new VideoPlayerImpl(100);
    }

    @After
    public void tearDown() throws Exception
    {
        editor = null;
    }
}
```

1.

- Verify that the initial position is 0

```
@Test
public void testBOT()
{
    assertEquals(0, editor.currentTimePosition());
}
```

```
public class VideoPlayerImpl implements VideoPlayer
{
    private int duration;
    private int currentPosition;
    private Map<String, Integer> marks;

    public VideoPlayerImpl(int length)
    {
        this.duration = length;
        marks = new HashMap<String, Integer>();
    }

    public int currentTimePosition ()
    {
        return currentPosition;
    }
}
```

2.

- Fast forward by some allowed amount (not past end of tape), then rewind by same amount. Should be at initial location.

@Before

```
public void setUp() throws Exception
{
    editor = new VideoPlayerImpl(100);
}
```

@Test

```
public void testFF()
{
    editor.fastForward(30);
    editor.rewind(30);
    assertEquals(0, editor.currentTimePosition());
}
```

```
public void rewind (int seconds)
{
    currentPosition -= seconds;
}
```

```
public void fastForward (int seconds)
{
    currentPosition += seconds;
}
```

3.

- Rewind by some allowed amount (not past beginning of tape), then fast forward by same amount. Should be at initial location.

@Before

```
public void setUp() throws Exception
{
    editor = new VideoPlayerImpl(100);
}
```

@Test

```
public void testRewind()
{
    editor.fastForward(30);

    editor.rewind(20);
    editor.fastForward(20);
    assertEquals(30, editor.currentTimePosition());
}
```

```
public void rewind (int seconds)
{
    currentPosition -= seconds;
}
```

```
public void fastForward (int seconds)
{
    currentPosition += seconds;
}
```

4.

- Fast forward past end of tape, then rewind by same amount.
- Should be before the initial location by an appropriate amount to reflect the fact that you can't advance the location past the end of tape.

@Before

```
public void setUp() throws Exception
{
    editor = new VideoPlayerImpl(100);
}
```

@Test

```
public void testFFBeyondEnd()
{
    editor.fastForward(50);

    editor.fastForward(60);
    editor.rewind(60);
    assertEquals(40, editor.currentTimePosition());
}
```

```
public void fastForward (int seconds)
{
    if ((currentPosition + seconds) < duration)
    {
        currentPosition += seconds;
    }
    else
    {
        currentPosition = 100;
    }
}
```

5

- Try the same thing in the other direction (rewind past beginning of tape).

```
public void rewind (int seconds)
{
    if ((currentPosition - seconds) >= 0)
    {
        currentPosition -= seconds;
    }
    else
    {
        currentPosition = 0;
    }
}
```

```
@Before
public void setUp() throws Exception
{
    editor = new VideoPlayerImpl(100);
}

@Test
public void testRewindBeyondStart()
{
    editor.fastForward(50);

    editor.rewind(60);
    editor.fastForward(60);
    assertEquals(60, editor.currentTimePosition());
}
```


6,7

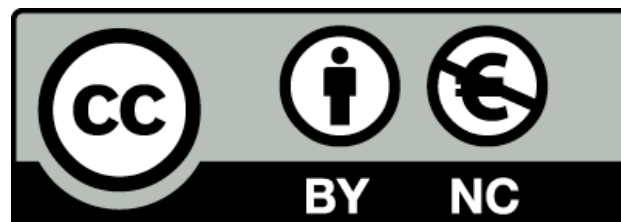
- Mark various positions and return to them after moving the current position around.
- Mark a position and return to it without moving in between.

```
@Test
public void testMark()
{
    editor.fastForward(30);
    editor.markTimePosition("one");
    editor.fastForward(30);
    editor.markTimePosition("two");

    editor.gotoMark("one");
    assertEquals(30, editor.currentTimePosition());
    editor.gotoMark("two");
    assertEquals(60, editor.currentTimePosition());
}
```

```
public void gotoMark (String name)
{
    if (marks.containsKey(name))
    {
        currentPosition = marks.get(name);
    }
}

public void markTimePosition (String name)
{
    marks.put(name, currentPosition);
}
```



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