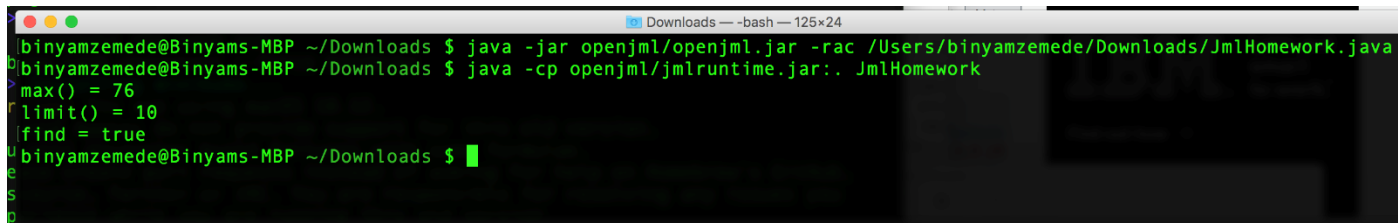
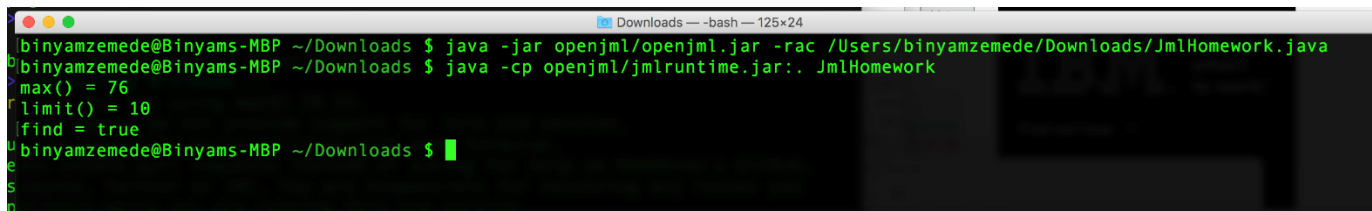


### Step1: initial setup and execution



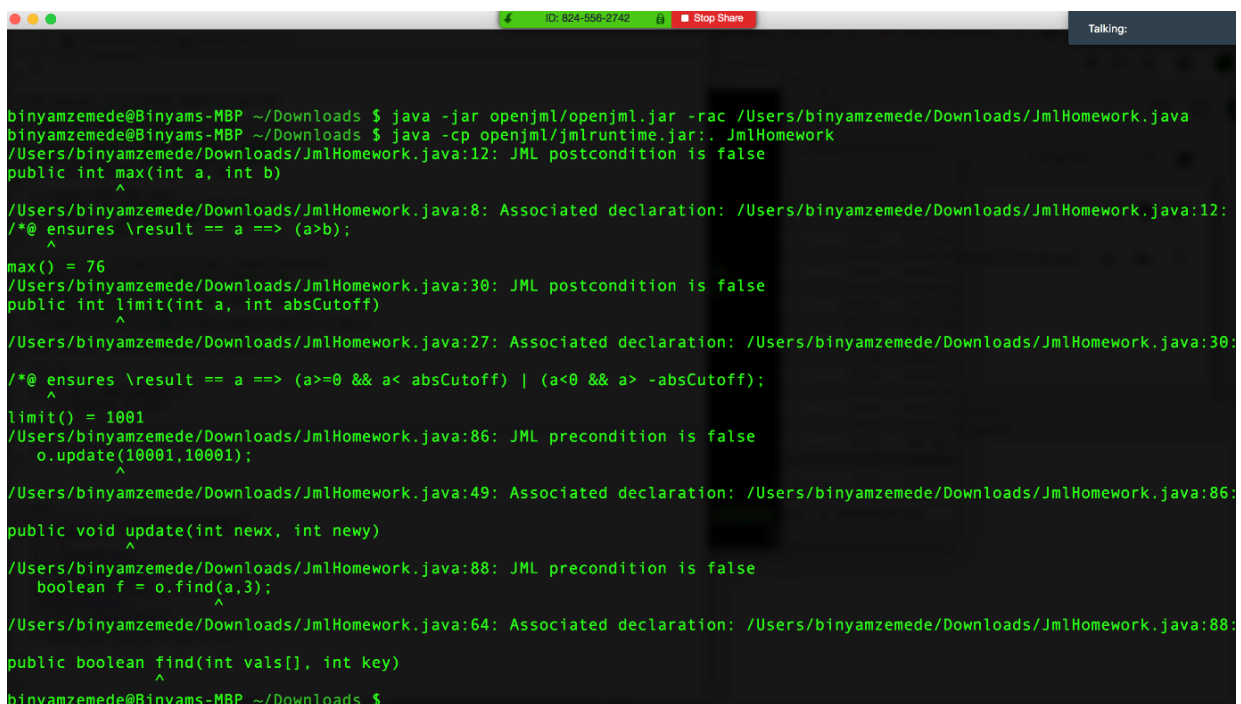
```
binyamzemed@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -rac /Users/binyamzemed/Downloads/JmlHomework.java
binyamzemed@Binyams-MBP ~/Downloads $ java -cp openjml/jmlruntime.jar:. JmlHomework
max() = 76
limit() = 10
find = true
binyamzemed@Binyams-MBP ~/Downloads $
```

### Step2: command line showing that the program still compiles and runs as it has



```
binyamzemed@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -rac /Users/binyamzemed/Downloads/JmlHomework.java
binyamzemed@Binyams-MBP ~/Downloads $ java -cp openjml/jmlruntime.jar:. JmlHomework
max() = 76
limit() = 10
find = true
binyamzemed@Binyams-MBP ~/Downloads $
```

command line showing the program, now recompiled, runs and causes the assertions to fail.



```
binyamzemed@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -rac /Users/binyamzemed/Downloads/JmlHomework.java
binyamzemed@Binyams-MBP ~/Downloads $ java -cp openjml/jmlruntime.jar:. JmlHomework
/Users/binyamzemed/Downloads/JmlHomework.java:12: JML postcondition is false
public int max(int a, int b)
      ^
/Users/binyamzemed/Downloads/JmlHomework.java:8: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:12:
/*@ ensures \result == a ==> (a>b);
      ^
max() = 76
/Users/binyamzemed/Downloads/JmlHomework.java:30: JML postcondition is false
public int limit(int a, int absCutoff)
      ^
/Users/binyamzemed/Downloads/JmlHomework.java:27: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:30:
/*@ ensures \result == a ==> (a>=0 && a< absCutoff) | (a<0 && a> -absCutoff);
      ^
limit() = 1001
/Users/binyamzemed/Downloads/JmlHomework.java:86: JML precondition is false
    o.update(10001,10001);
      ^
/Users/binyamzemed/Downloads/JmlHomework.java:49: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:86:
public void update(int newx, int newy)
      ^
/Users/binyamzemed/Downloads/JmlHomework.java:88: JML precondition is false
    boolean f = o.find(a,3);
      ^
/Users/binyamzemed/Downloads/JmlHomework.java:64: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:88:
public boolean find(int vals[], int key)
      ^
binyamzemed@Binyams-MBP ~/Downloads $
```

### Step3:

```

binyamzemed@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -esc /Users/binyamzemed/Downloads/JmlHomework.java
/Users/binyamzemed/Downloads/JmlHomework.java:69: warning: The prover cannot establish an assertion (PossiblyNegativeIndex) in method find
    if (vals[i] == key)
        ^
/Users/binyamzemed/Downloads/JmlHomework.java:73: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:61: ) in method find
    return false;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:61: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:73:
    ensures \result == false==>
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:70: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:59: ) in method find
    return true;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:59: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:70:
    *@ ensures \result == true ==>
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:35: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:27: ) in method limit
    return absCutoff;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:27: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:35:
    *@ ensures \result == a ==> (a>=0 && a< absCutoff) | (a<0 && a> -absCutoff);
    ^
error: An error while executing a proof script for main: (error "line 4906 column 60: invalid function application, missing arguments
java_lang_Boolean_toString_4007")
>>>(define-fun BL_0_afterIf_509__A26 () Bool (= [_JML__tmp782| java_lang_Boolean_toString_4007])
/Users/binyamzemed/Downloads/JmlHomework.java:19: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:8: ) in method max
    return b-1;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:8: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:19:
    *@ ensures \result == a ==> (a>b);
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:49: warning: The prover cannot establish an assertion (InvariantExit: /Users/binyamzemed/Downloads/JmlHomework.java:7: ) in method update
public void update(int newx, int newy)
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:7: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:49:
    //@ public invariant x+y >= 0;
    ^
1 error
11 warnings
binyamzemed@Binyams-MBP ~/Downloads $

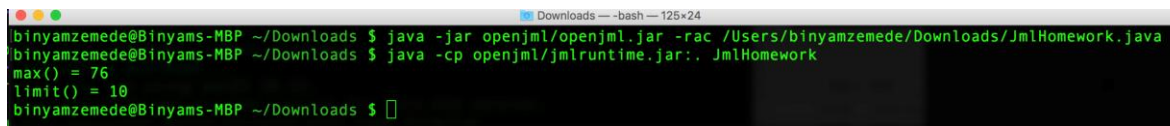
```

After fixing the error. It only has warning.

```

binyamzemed@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -esc /Users/binyamzemed/Downloads/JmlHomework.java
/Users/binyamzemed/Downloads/JmlHomework.java:69: warning: The prover cannot establish an assertion (PossiblyNegativeIndex) in method find
    if (vals[i] == key)
        ^
/Users/binyamzemed/Downloads/JmlHomework.java:73: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:61: ) in method find
    return false;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:61: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:73:
    ensures \result == false==>
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:70: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:59: ) in method find
    return true;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:59: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:70:
    *@ ensures \result == true ==>
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:35: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:27: ) in method limit
    return absCutoff;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:27: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:35:
    *@ ensures \result == a ==> (a>=0 && a< absCutoff) | (a<0 && a> -absCutoff);
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:16: warning: The prover cannot establish an assertion (Postcondition: /Users/binyamzemed/Downloads/JmlHomework.java:8: ) in method max
    return a;
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:8: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:16:
    *@ ensures \result == a ==> (a>b);
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:49: warning: The prover cannot establish an assertion (InvariantExit: /Users/binyamzemed/Downloads/JmlHomework.java:7: ) in method update
public void update(int newx, int newy)
    ^
/Users/binyamzemed/Downloads/JmlHomework.java:7: warning: Associated declaration: /Users/binyamzemed/Downloads/JmlHomework.java:49:
    //@ public invariant x+y >= 0;
    ^
11 warnings
binyamzemed@Binyams-MBP ~/Downloads $

```

A terminal window titled "Downloads — -bash — 125x24" with a standard macOS window header (red, yellow, green buttons). The terminal shows a user named "binyamzemedie" at a machine named "Binyams-MBP" in the directory "~/Downloads". The user runs two Java commands. The first command is "java -jar openjml/openjml.jar -rac /Users/binyamzemedie/Downloads/JmlHomework.java", which produces the output "max() = 76". The second command is "java -cp openjml/jmlruntime.jar:. JmlHomework", which produces the output "limit() = 10". The prompt returns to the user after each command.

```
binyamzemedie@Binyams-MBP ~/Downloads $ java -jar openjml/openjml.jar -rac /Users/binyamzemedie/Downloads/JmlHomework.java
binyamzemedie@Binyams-MBP ~/Downloads $ java -cp openjml/jmlruntime.jar:. JmlHomework
max() = 76
limit() = 10
binyamzemedie@Binyams-MBP ~/Downloads $
```