

Section Handout 3

Based on a handout by Eric Roberts, Mehran Sahami, and Patrick Young

Problem One: True or False?

For each of the following statements below, indicate whether it is true or false in Java:

1. The value of a *local variable* named `i` has no direct relationship with that of a variable named `i` in its caller.
2. The value of a *parameter* named `x` has no direct relationship with that of a variable named `x` in its caller.

Problem Two: Method Trace

For the program below, trace through its execution by hand to show what output is produced when it runs. We strongly recommend approaching this by using the approach outlined by the textbook – each time a method is called, draw a box containing all the local variables and parameters of that method so that you have an easier time keeping the variables straight.

For convenience, we've numbered the lines of the program for you.

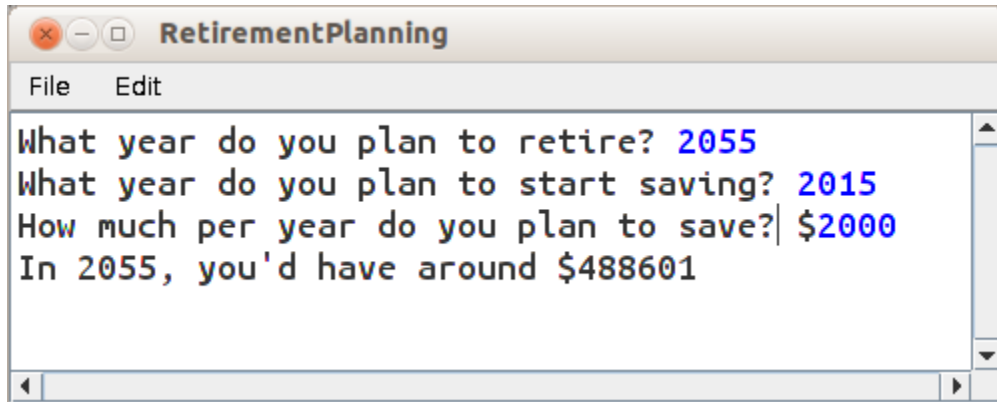
```
import acm.program.*;

public class QuestionableJava extends ConsoleProgram {
1:   public void run() {
2:       int marten = 137;
3:       int faye = 42;
4:
5:       println("marten = " + marten);
6:       hannelore(faye);
7:       println("marten = " + marten);
8:       println("faye = " + faye);
9:
10:      marten = angus(faye, marten + faye);
11:      println("marten = " + marten);
12:
13:      marten = angus(marten, faye);
14:      println("marten = " + marten);
15:  }
16:
17:  private void hannelore(int marten) {
18:      println("marten = " + marten);
19:      marten = 160;
20:  }
21:
22:  private int angus(int martin, int faye) {
23:      int dora = faye - martin;
24:      println("dora = " + dora);
25:      return dora % 10;
26:  }
}
```

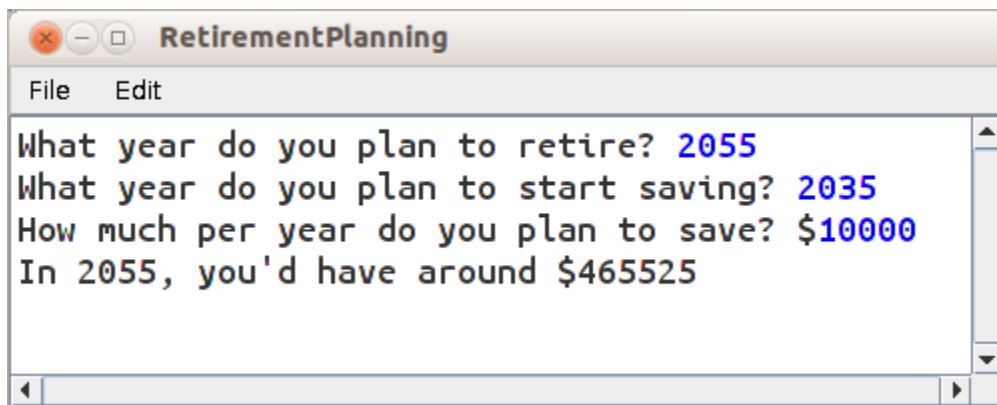
Problem Three: Retirement Strategies

We'd like you to write a program that prompts the user for three pieces of information: when they plan to retire, when they plan to start contributing to their retirement account, and how much per year they plan to put into their retirement account. You should then print out the total amount of money they'll have available for retirement, in dollars, when they hit their retirement year. For simplicity, let's assume that the saved money accrues interest at an annual rate of 7.5%, which matches the average performance of the S&P 500 index over the long run. You'd be amazed how big the impact of saving early can be!

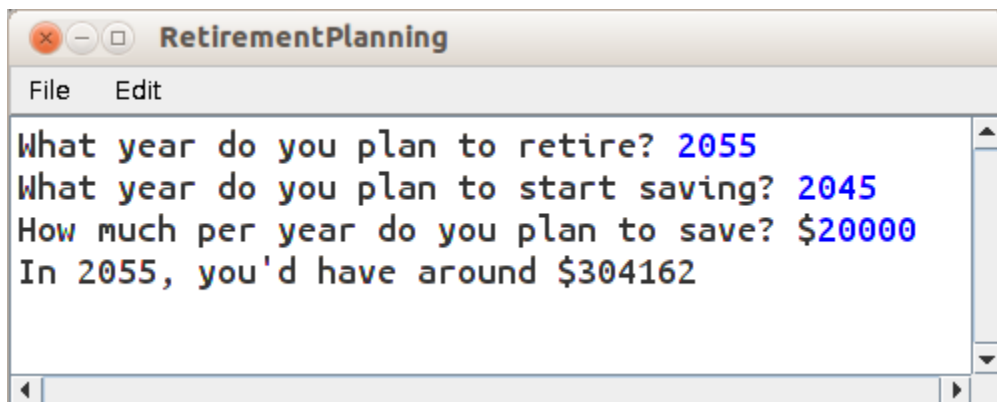
Here are some sample runs of the program:



```
RetirementPlanning
File Edit
What year do you plan to retire? 2055
What year do you plan to start saving? 2015
How much per year do you plan to save? $2000
In 2055, you'd have around $488601
```



```
RetirementPlanning
File Edit
What year do you plan to retire? 2055
What year do you plan to start saving? 2035
How much per year do you plan to save? $10000
In 2055, you'd have around $465525
```



```
RetirementPlanning
File Edit
What year do you plan to retire? 2055
What year do you plan to start saving? 2045
How much per year do you plan to save? $20000
In 2055, you'd have around $304162
```

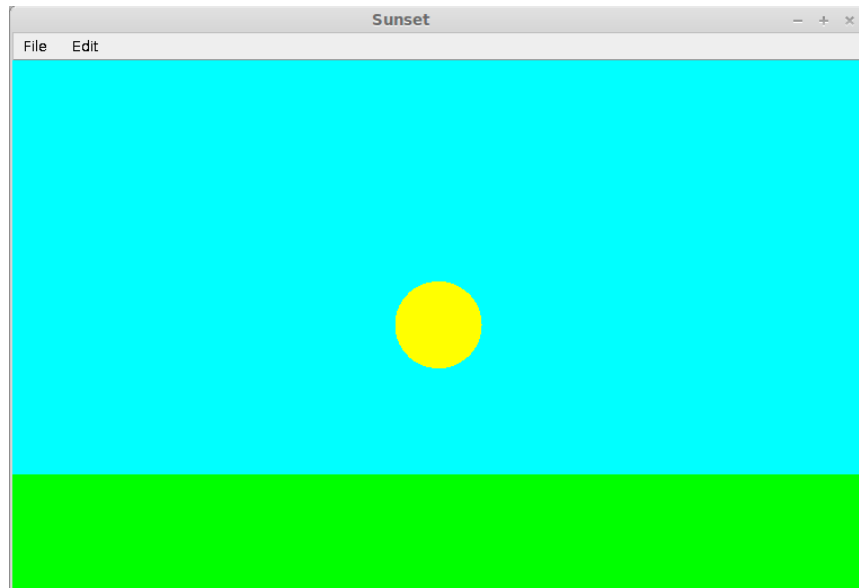
Problem Four: A Coin-Flipping Game

There's a classic gambling game for two players that works as follows. Each player shows up with a bag of coins of a size of their choosing. The players then alternate taking one of their coins and flipping it – if it comes up heads, they keep it; if it comes up tails, they hand it to the other player. (A slightly modified version of this game appears in the first scene of Tom Stoppard's *Rosencrantz and Guildenstern are Dead*). Eventually, one of the players runs out of coins and loses.

Write a program that prompts the user for the initial number of coins in each player's bag, then simulates this game until one of the players wins. At the start of the game and before each flip, you should print out the number of coins each player has. At the end of the game, you should print out which player ultimately ended up winning.

Problem Five: Sunset

Write a `GraphicsProgram` that simulates a sunset. Your program should start off by drawing the sun centered in the window over a green horizon, as shown here:



Your program should then animate the sun sinking beneath the horizon. If you'd like, you might want to consider changing the color of the sun, the sky, or the horizon as the sun gets lower and lower.