SAMPLE PLTL SESSION

Exercise 1: Drawing Pictures

A Java program involves creating and manipulating *objects*, each of which provides some *operations*. An operation can either perform a task (like printing something on the computer screen), or it can do a computation and tell you the answer. Some operations require that you provide values to be used in their task/computation.

For this exercise, we'll assume that we have an *Artist* object named *picasso* that provides the following operations (they all require that you provide an *integer* value, and they all perform tasks):

`drawLineDown( int length )`
: Draw a vertical line of the given length (in inches), starting from the current position and going straight down. The current position is changed to be at the bottom end of the line.

`drawLineUp( int length )`
: Draw a vertical line of the given length, starting from the current position and going straight up. The current position is changed to be at the top end of the line.

`drawLineRight( int length )`
: Draw a horizontal line of the given length, starting from the current position and going straight to the right. The current position is changed to be at the right end of the line.

`drawLineLeft( int length )`
: Draw a horizontal line of the given length, starting from the current position and going straight to the left. The current position is changed to be at the left end of the line.

`moveRight( int d )`
: Move the current position d inches to the right.

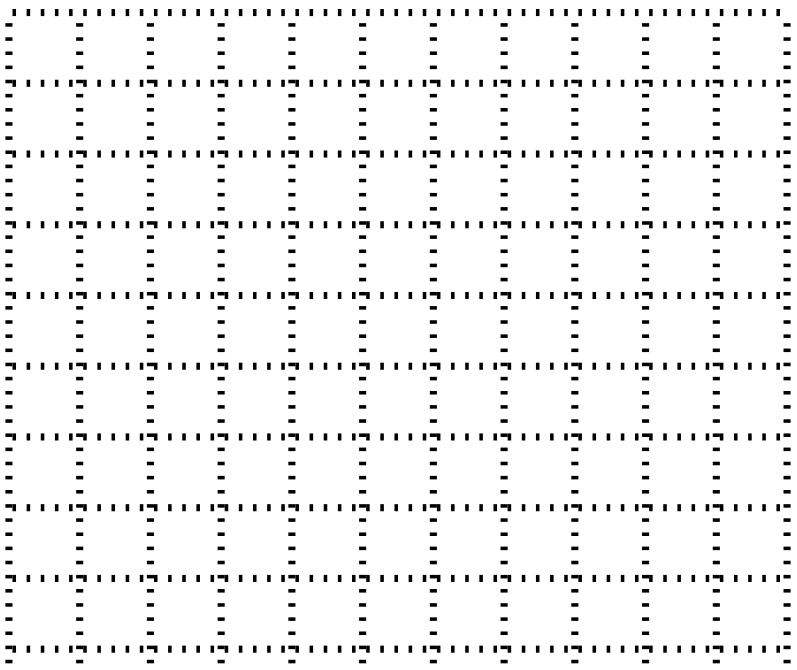
`moveLeft( int d )`
: Move the current position d inches to the left.

`moveUp( int d )`
: Move the current position d inches up.

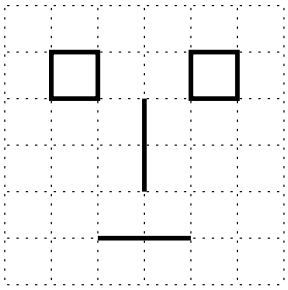
`moveDown( int d )`
: Move the current position d inches down.

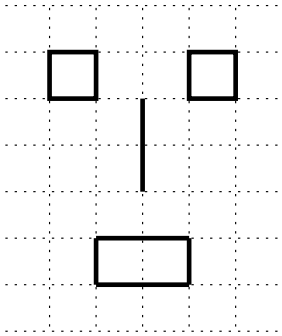
Part (a). What is drawn when the following code executes? (Use the grid below to do the drawing; assume that the current position starts in the top left corner and that the squares in the grid are 1 inch high and 1 inch wide.)

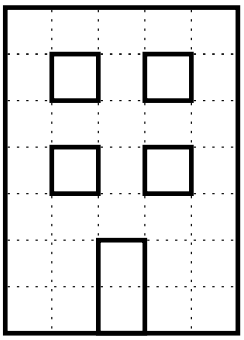
```
picasso.drawLineDown( 7 );
picasso.moveUp( 4 );
picasso.drawLineRight( 2 );
picasso.moveUp( 3 );
picasso.drawLineDown( 7 );
picasso.moveRight( 2 );
picasso.drawLineRight( 2 );
picasso.moveLeft( 1 );
picasso.drawLineUp( 7 );
picasso.moveLeft( 1 );
picasso.drawLineRight( 2 );
```



Part (b). Divide into groups of two. Each group choose one of the pictures shown below and write Java code that would make *picasso* draw the picture. (The dotted lines are not part of the pictures; they're there to show you how many inches you need to move or draw. Each dotted box is one inch on each side. Assume that the current position starts in the top left corner of the grid.)







Part (c). What other *Artist* methods would have made it easier to draw the pictures?

Exercise 2: Evaluating Logical Formulas

Most computer programs do different things depending on what conditions hold (for example, what the user types, or what data is read from a file). Programmers use *logical formulas* to control what their programs do. To help you understand how to evaluate logical formulas, we'll play a game using the decks of yellow and blue cards. Each blue card has an English sentence that is either true or false. Each yellow card has one of three symbols: ! (which means *not*), && (which means *and*), or || (which means *or*).

You can make logical formulas by putting either an "and" (a &&) or an "or" (a ||) between two English sentences, and if you want you can also put a "not" (an !) in front of either or both sentences.

If you use an "and", the whole formula is true only if both parts are true. For example, the formula (*We are in Madison* && *A mouse is smaller than an elephant*) is true, because both parts are true. However, (*We are in Madison* && *The moon is made of green cheese*) is false because only one part is true, and (*Today is Sunday* && *The moon is made of green cheese*) is also false because neither part is true.

If you use an "or", the whole formula is true if at least *one* part is true. For example, the formula (*We are in Madison* || *The moon is made of green cheese*) is true because one part is true, but (*Today is Sunday* || *The moon is made of green cheese*) is false because neither part is true.

When you use a "not" in front of a sentence, you change it from true to false or vice versa. For example, (! *We are in Madison*) is false, and (! *The moon is made of green cheese*) is true.

You can use more than two sentences in your logical formula, but then you should use parentheses to make it clear how to evaluate the formula. For example, the following two formulas have different values (can you figure out which is true and which is false?):

(*We are in Madison* && *Today is Sunday*) || *The moon is made of green cheese*

We are in Madison && (*Today is Sunday* || *The moon is made of green cheese*)

Divide into groups of four to play the game (with two people per team). Each team starts with 6 cards, 3 yellow and 3 blue. The two teams take turns as follows:

- When it's your team's turn, if you can make a logical formula that evaluates to true using at least 3 of your cards (plus as many parentheses as you want to use), put down the formula and draw new cards. Otherwise, trade in one of your cards for a card of the same color.
- The first team to put down at least 8 cards wins.

Exercise 3: Logical Thinking

One of the benefits many students find they get from taking Computer Science courses is that it helps develop their logical-thinking skills. Here are two logic puzzles for you to try.

1. What are the ages?

   Two mathematicians are sitting together in a building. They don't have anything to do at the moment, so one says to the other, "Try guessing the ages of my three children. I'll give you a hint: the product of their ages is 72." The other mathematician says, "That's not enough information. Tell me more." The first mathematician says, "Their ages add to be the number of this building." The other mathematician goes outside, looks at the building number, comes back, and says, "That still isn't enough information. Tell me more." The mathematician says, "My youngest child's name is Anne."

   What are the ages of the children?

2. Find the bad coin

   Assume that you have 8 coins, and you know that 7 are OK but one is bad. You know that the bad coin has a different weight than the good coins, but you don't know whether it's heavier or lighter.

   Figure out how, using only a balance scale, you can find out which is the bad coin using just 3 weighings. Hint: Find a way to determine that half of the coins are OK with just 1 weighing.

   Now figure out which is the bad coin assuming that you have *nine* coins, one of which is bad. (Still use just 3 weighings to find the bad coin.)

   And now for a real challenge, do the same thing assuming that you have 13 coins.

The Earth is flat

Madison is the capital of Wisconsin

17 is a prime number

Red and blue make purple

A chestnut tree makes acorns

Ducks can’t fly

The Earth moves around the sun

The UW-Madison was founded in 1492

Miss Muffet is afraid of spiders

The time now is 3:33pm

The sun sets in the west

Disco music was popular in the 1930’s

Oak trees grow on the moon

Bascom Hall is exactly ten miles from the state capitol building.

Maine is the only state whose name is just one syllable.

It is snowing outside.

The mascot of the University of Wisconsin is Bucky the Bobcat.

Frank Lloyd Wright went to school at the UW-Madison

Georgia O’Keefe was born near Sun Prairie, Wisconsin

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