Graded Exercise 0

CSC140 Foundations of Computer Science

14 February 2020

1. If we were studying physics, chemistry, economics, or mathematics, then we might use the word variable to mean "the unknown," "the quantity that we are measuring," or the "the quantity that changes."

   By contrast, in the study of computer science we use the word variable to mean what?

   Complete the sentence: "A variable is a. . . "

   _____

   A variable is a named location in the computer's memory.

2. For which two audiences do programmers write?

   _____

   Programmers write for the machine and for other people.

   These other people may include teammates, clients, and successors who will take responsibility for the software after the original others have moved on to other work.

3. What is the value of the following Python expression?

   $$10 - 3 - 2$$

   - Is it $(10 - 3) - 2 = 7 - 2 = 5$?
   - Or is it $10 - (3 - 2) = 10 - 1 = 9$?

$$10 - 3 - 2 = 5$$

4. What are the values of these four Python expressions?

```
12 / 8
12 // 8
12 % 8
8 * (12 // 8) + (12 % 8)
```

$$12/8 = 1.5$$
$$12//8 = \lfloor 1.5 \rfloor = 1$$
$$12\%8 = 12 \bmod 8 = 4$$
$$8 * (12//8) + (12\%8) = 8 \cdot 1 + 4 = 12$$

5. What is the value of this Python expression?

```
2 ** 3 * 2 ** 3
```

$$2**3 \ * \ 2**3 = 2^3 \cdot 2^3 = 8 \cdot 8 = 64$$

6. This statement **does not mean** "y is equal to 3 times x plus 2."

```
y = 3 * x + 2
```

What does it mean?

"y gets the value 3 times x plus 2"

Here is a more verbose explanation of what the statement means:

- get the value stored in the computer's memory at the location named x
- multiply that value times 3
- add 2 to that product
- store the resulting sum in the computer's memory at the location named y

7. Suppose that...

- the value of a variable x is a number whose square root we want to find
- the value of a variable *guess* is an estimate of the square root of x

Since...

$$guess \cdot \frac{x}{guess} = x$$

...if one of the multipliers on the left is larger than the square root of x, the other must be smaller.

That is...

- If $guess < \sqrt{x}$, then it must be the case that $\frac{x}{guess} > \sqrt{x}$.
- Similarly, if $guess > \sqrt{x}$, then it must be the case that $\frac{x}{guess} < \sqrt{x}$.

A better guess at the square root lies between the number that is too low and the number that is too high. Given a *guess* for the square root of x, a better guess is the arithmetic mean of $\frac{x}{guess}$ and *guess*.

Write Python code that begins by guessing that the square root of 2 is 1.0 and then computes two better estimates.

```
x = 2.0
guess = 1.0
guess = (guess + x/guess)/2
guess = (guess + x/guess)/2
```

8. The evaluation of this expression in the Python interpreter yields a value
   of *True*.

   $$\textbf{float}('inf') + \textbf{float}('inf') == \textbf{float}('inf')$$

   Explain.

   _____

   float('inf') is a representation of positive infinity.

   Infinity plus infinity equals infinity.

9. What will this code print?

```
LETTERS_IN_ALPHABET = 26
OFFSET = 3

plain_text = 'M'
print( 'plain_text =', plain_text )

pos = ord( plain_text ) - ord( 'A' )

print( 'pos of ', plain_text , ' = ', pos )

pos = (pos + OFFSET) % LETTERS_IN_ALPHABET
cipher_text = chr( pos + ord( 'A' ))

print( 'cipher_text =', cipher_text )
```

   _____

```
plain_text  =   M
pos of  M   =   12
cipher_text  =   P
```

10. Python's Turtle module allows a programmer to define a color by speci-
fying the amount of red, green, and blue in the color. The programmer
specifies these three components with integers in the interval $[0, 255]$.

A programmer can blend two colors. The components of the blended color
are weighted averages. For example, the red component of the blend is a
weighted average of the red components of the two colors.

Let $r0$ and $r1$ be the red components of the two colors that are to be
blended. Let t $(0.0 \leq t \leq 1.0)$ be the weight.

Then this is the formula for a weighted average of the red components of
the two colors:

$$blended\_red = r0 \cdot (1 - t) + r1 \cdot t$$

If we were studying mathematics, this would be enough, because in a
study of algebra or calculus we do not often make a distinction between
integers and floating point numbers.

The Turtle function requires integer parameters.

Translate the mathematical statement shown above into Python, taking
care to make sure that the value assigned to $blended\_red$ is an integer.

```
blended_red  =  int(r0  *  (1  −  t)  +  r1  *  t)
```

11. Jasmine Finer offers advice in How to Write Beautiful Python Code With
PEP 8.

Which single letter names for variables does she tell us never to use?

She advises us to never use lower case "l," upper case "O'," or upper case "I" as names for our variables. These letters, she tells, resemble the digits 0 and 1 and could be confused for those numbers.

12. *The Economist* published "Python is becoming the worlds most popular coding language" on July 26, 2018.

    In the third paragraph, the article tells readers that "Python might seem destined to become the lingua franca of coding, rendering all other competitors obsolete."

    What prediction from Grady Booch, IBM's chief software scientist, follows?

    _____

    Grady Booch tells us that some programming languages are better for solving some kinds of problems. He predicts that software engineers will continue to use other languages in those domains for which they are especially well-suited.

    Grady Booch also observes that nothing lasts forever. Other programming languages enjoyed great popularity in the past. In time, another programming language will appear and programmers will prefer it over Python.

    _____

13. (4 points, due Monday, February 17, 2020 at 9 a.m.) Write 256 to 512 words about one of the programmers, engineers or mathematicians who contributed to NASA's early efforts to put people in space.

    Look for the information that you need on our course's Moodle site. You will find links to articles and videos there. You might want to search further for other articles and videos on the Web (but this is not required). You need not read and view all that you find on Moodle—make choices.

    Share details of that life that you believe are most important, most surprising, and most telling.

Draw some lessons from the story of this life. What aspects of your person's character, attitudes, or work habits inspired you most? What parts of this person's example would you most like to imitate?

14. (4 points, due Friday, February 14, 2020) Show your instructor a program that draws a geometric figure. This will be the program that you have adapted from the example given to you. (That example is the program that draws a cardioid curve.)