MTH 3300
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3300 Problems, Section 1: Intro, Variables, Data Types, Assignment, Printing and Input

1. *This problem has nothing to do with computers or Python (except that it involves an algorithm, which computer programs also use). It should be answered in the same way that we answered the "which number is larger" question on the first day of class: as a detailed set of directions for humans to follow. If you use the words "variable" or "print", you're not answering the question.*

   Given *any* integer n between 1 and 99, give a (practical) algorithm that determines the number of quarters, dimes, nickels, and pennies one should use to make n cents. This means: describe the steps, in order, USING ENGLISH – NOT CODE!. Every cashier uses this algorithm everyday, and most of them don't know Python; describe their thought process, but be precise about how you describe it. You may assume that we all understand basic arithmetic (plus, minus, times, divide, greater than, less than, equals). Write your answer **without** mentioning any specific price.

2. *This problem has nothing to do with computers or Python (except that it involves an algorithm, which computer programs also use). It should be answered in the same way that we answered the "which number is larger" question on the first day of class: as a detailed set of directions for humans to follow. If you use the words "variable" or "print", you're not answering the question.*

   Suppose that three people are throwing a joint party. Each person has a list of people they want to invite, and the lists overlap. They need to know how many people to expect, and so they want to know how many people they will be inviting in total, without counting names twice. Describe an algorithm, in precise detail, which will allow them to find the exact correct number of people they will be inviting in total, *without the use of a computer.* (It's ok if the process you describe would be very tedious to carry out in practice.) You may assume that humans can instantly tell whether two particular names are the same, but you may NOT!!! assume that they can instantly alphabetize long lists or spot names that are on two different lists – if you want to include these steps as parts of your algorithm, explain how they take place.

3. List the errors in each of the following programs, which attempt to multiply a length and a width to display the area of a rectangle. Don't bother *fixing* the errors; just *identify* them, describing why they are wrong. There may be one than one error per example. (Try to do it first without executing; then check by entering the code into your development environment to see if you caught everything.)

   a.

   ```
   wid = 15
   leng = 5
   Area = leng * wid
   print("The area is")
   print("Area")
   ```

   b.

   ```
   wid = 15
   leng = 5
   leng * wid = Area
   print(The area is: )
   print(Area)
   ```

   c.

   ```
   Area = leng * wid
   wid = 15
   leng = 5
   print("The area is: " area)
   ```

4. Describe what happens when the following code is executed. If there is an error, explain why; if not, explain what prints out.

   ```
   a = 32
   b = 10
   c = a - 3 * b
   b = c
   ```

```
a = a + b
-c
a = a + 2
print(a, b, c)
```

5. Describe what happens when the following code is executed. If there is an error, explain why; if not, explain what prints out.

```
a = 10
b = a+1
a + 2
b = b/3
print(a, b)
```

6. Describe what happens when the following code is executed. If there is an error, explain why; if not, explain what prints out.

```
a = 1
b = 14
a = b % 3
b = "10"
a = b * 3
b = a + 1
print(a, b)
```

7. Describe what happens when the following code is executed. If there is an error, explain why; if not, explain what prints out.

```
x = 9
y = 22
z = 0.5
out1 = y % (x ** z)
out2 = (y % x) ** z
out3 = y % x ** z
print(out1, out2, out3)
```

8. Describe what happens when the following code is executed. If there is an error, explain why; if not, explain what prints out.

```
print(50 // 9, 50 % 9, 9 // 50, 9 % 50)
```

9. What *exactly* will be displayed by the following code?

```
x = "Hiya!"
c = x[0]
print(c + x, (x[0]+x[1])*len(x))
```

10. Using the rules of precedence, what does `5 + 3 * 4 % 3 / 2` evaluate to?

11. Suppose that `x` is a variable that has been assigned a `float` value. Write code that prints out the value of $\sin(e^x)$.

12. Suppose that I have a variable named `word`, which already has a `str` value stored in it. Write the code necessary to print out the *last* letter of `word`. (So, for example, if `word` had the value `"butter"`, it would print out `r`.)

13. Write a SINGLE (one line!) statement that prints out the following:

```
Python:
It’s a good time.
```

14. Create a **single** `print` statement which displays your first name on one line, and your last name on the next line. (1 line!)

15. A program has been written, containing the following four lines. No variables have been defined in the program. Which of the following lines will cause errors? List all of `1,2,3,4` which cause errors.

```
print(Hello, "there") #1
print("Hello", "there") #2
print("Hello" + "there\n", end = "") #3
print("Hello" "there") #4
```

16. Circle each line that has an error that would have to be fixed if the program is to execute to the end. Briefly explain why for each one. *Only circle lines that would cause the Python interpreter to stop executing.*

```
fgh = 14
a = 25
x = 4a
bb = bb + 1
a = "fgh"
bb = a[0] + a[2]
ccc = a[3]
```

17. Write the code necessary to ask the user for an integer, and then print out that integer plus 1.

18. What *exactly* will be displayed by the following code? Pay attention to spaces!

```
x = 3
y = 4
print(x, end = "")
print(x,y,y)
print(x)
```

19. Write the code necessary to ask the user to enter three numbers, and then print those numbers out to the console in *reverse* order. (E.g. if the user enter the numbers `10`, `20`, and `30`, then the program should print out `30 20 10`.)

20. Write the code necessary to ask the user to enter two numbers, and then print those numbers, each with exactly three digits after the decimal place.

21. The user has entered numeric values for variables `a` and `b`. Assume that $\mathtt{a}, \mathtt{b} \neq 0$. Write a `print` statement which calculates and displays the solution to $\mathtt{a}x + \mathtt{b} = 0$ to 2 decimal places.

22. What does the following code print out, *exactly*?

```
x = 3.1234
print("The {0:7}of x is\n{1:.2f}".format("value", x))
```

23. The variables `a`, `b`, `c` contain three names (each with at most 10 letters), and the variables `ascore`, `bscore` and `cscore` contain their corresponding (two-digit integer) exam scores. Write three print statements that will print out a nicely formatted table that looks something like:

```
Alice    : 79
Bob      : 68
Carol    : 99
```

except with the specific names replaced by the values of `a`, `b` and `c`, and with the specific scores replaced by the values of `ascore`, `bscore` and `cscore`.

24. Write code that asks the user to enter two integers, with the lesser one entered first. The program should then print out a random integer that is between the two entered ones (inclusive).

25. Write code that generates two random reals between 0 and 1 – call them x and y – and then prints the value of $\sin(2\pi x)\sqrt{-2\ln y}$. (Fun fact: this program will generate a random sample from the standard Gaussian distribution with mean 0 and standard deviation 1.)