W2.2 Applied

Decrypt the Answer

For today's first activity, you will decrypt the answer to the following question:

How many programmers does it take to screw in a light bulb?

using the Python interpreter.

The encrypted answer to the question asked above is:

3	5	3	12		6	0	,	9		10		4	10	11	25	-1	10	11	12		8	11	5	1	7	12	2

Translate the encrypted answer by evaluating all of the mathematical expressions provided below (i.e., each number in the list above corresponds to a letter in the table below) using the Python interpreter, and using `int()`. For the purpose of this exercise, `x=5` and `y=3`.

A	B	D	E	H
$e^{\log(10)}$	$\sin(\frac{1}{2}\pi)$	$\sqrt{x^{y+1}}$	$\frac{5!}{10}$	$x + \cos(3\pi)$
I	**L**	**M**	**N**	**O**
$\frac{3^{2^3}}{1000}$	$\lceil e^{\frac{\log(343)}{y}} \rceil$	$x\cos(20)$	$x\sin(xy)$	$\lceil \frac{8y}{x} \rceil$
P	**R**	**S**	**T**	**W**
$x + x - y + 1$	$4x - \frac{27}{y}$	$2x - 1$	$\log(\frac{x}{5})$	$\lfloor \sin(x) \rfloor$

```
from math import exp, log, sin, pi, sqrt, factorial, cos, ceil, floor # Please do not modify this l
# Please enter your code here
```

Question *Submitted Mar 8th 2022 at 11:06:13 am*

How many programmers does it take to screw in a light bulb?

NONE IT'S A HARDWARE PROBLEM

Temperature Conversion Revisited

In the previous applied session, you have written a Python code that converts 12 degrees in Fahrenheit `F` to the temperature in Celsius `C`. In this part of the applied session, you will modify the code provided in the Python file named `temp_conversion_revisited.py` such that it converts *any* given value of `F` to `C`. Specifically, please follow the instructions below to create user-friendly code:

1. Use the variable name `temp_f` to store the value of temperature in Fahrenheit that is provided by the user. When collecting the input, please prompt the user with the following message:

   "Please enter temperature in Fahrenheit: "

   Hint 1: How can you get input from the user (i.e., see the pre-class activity)?
   Hint 2: What is the data type input by the user?
2. Use the variable name `temp_c` to store the value of the temperature in Celsius, which is computed by the temperature conversion formula (i.e., the mathematical formula that equates Fahrenheit `F` to Celsius `C` is `C = (F - 32) x 5 / 9`).
3. Modify the last line using variable names `temp_f` and `temp_c` to display the correct conversion.

Predict the outcome of the following computations by hand

In this activity, please attempt to predict the outcome of the following expression *without using the Python interpreter*. Please see the pre-class activity on operator precedence if you would like a reminder and see the official Python documentation more information.

Question 1 *Submitted Mar 8th 2022 at 10:19:46 am*

```
(2 + 3) * (13 - 3)
```

- [ ] 32
- [x] 50
- [ ] 50.0
- [ ] 38.0

Question 2 *Submitted Mar 8th 2022 at 10:20:06 am*

```
2 ** 3 / 2 - 4 + 3
```

- [ ] -1.0
- [ ] 1.8284271247461903
- [x] 3.0
- [ ] 2.0

Question 3 *Submitted Mar 8th 2022 at 10:20:27 am*

```
5 // 9 + 3 % 2
```

- [ ] 0
- [x] 1
- [ ] 2.5
- [ ] 3

Question 4 *Submitted Mar 8th 2022 at 10:20:50 am*

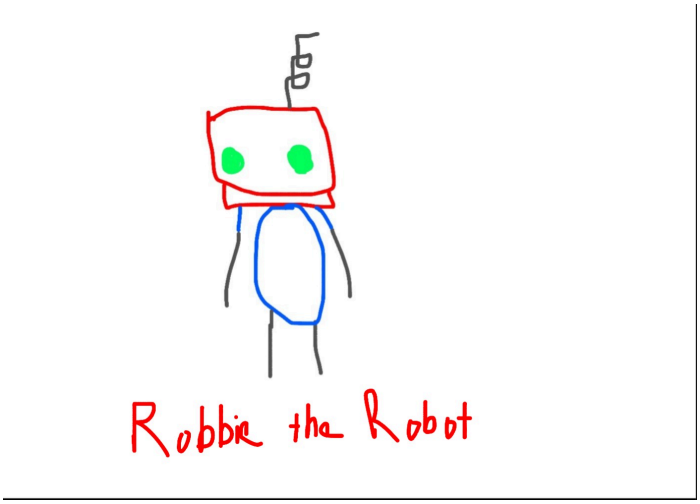
```
1 + 2 ** 3 % 5
```

- [ ] 1
- [ ] 2
- [ ] 3
- [x] 4

What is Robbie's final location?

Write a valid Python expression that computes the final location `x_final` of Robbie the Robot (i.e., visualized below), given its initial location `x_initial`, velocity `v` , acceleration `a` and movement duration `t` based on the following Physics-based formula:

$$x_{final} = x_{initial} + vt + \frac{1}{2}at^2$$



For the purposes of this activity, assume Robbie's initial position to be `x_initial=2` , velocity to be `v=15` , acceleration to be `a=2` and duration to be `t=3` . After computing Robbie's final location `x_final`, display `x_final` with the following message:

"The final location of Robbie is: `x_final` *"*

A Simple Program for Computing the Pythagorean Triple

Fill in the following program, which, given two inputs (arguments) `a` and `b` each of type `int`, prints `c` of type `int` such that `(a,b,c)` is a Pythagorean triple.

Three positive integers `a`, `b` and `c` together form a Pythagorean triple `(a,b,c)` if and only if the following holds:

$$a^2 + b^2 = c^2$$

Assume the user will enter valid values for numbers `a` and `b` that makes the triple `(a,b,c)` a Pythagorean triple.

Using Python to Compute the Greatest Common Divisor

The greatest common divisor of two integers `num_1` and `num_2` is the largest integer that divides both `num_1` and `num_2`. The goal of this question is to compute the greatest common divisor using Euclid's algorithm and Python.

Euclid's algorithm iteratively (i.e., step-by-step) computes the greatest common divisor for integers `num_1` and `num_2` such that the output of one iteration is the input to the next iteration. Specifically in each iteration, the values of `num_1` and `num_2` are updated such that:

- the new value of `num_2` is set to the remainder of dividing the previous values `num_1` to `num_2` (note that this division is an *integer division*),
- the new value of `num_1` is set to the previous value of `num_2` (i.e., before executing step 1.)

until `num_2` is equal to 0. When `num_2` is equal to 0, Euclid's algorithm terminates and outputs the final value of `num_1` to be the greatest common divisor of the original input integers `num_1` and `num_2`.

Hint 1: How can you keep track of new and old values of `num_1` and `num_2`?

Hint 2: How can you compute the remainder of an integer division in Python?

In the Python file named `gcd_manual.py`, please write a code that computes the greatest common divisor of `num_1=4320` and `num_2=3260` such that each line displays both `num_1` and `num_2` after every iteration of the Euclid's algorithm.

For example, the code should display:

```
Number 1 = 36 and number 2 = 6
Number 1 = 6 and number 2 = 0
```

for `num_1=42` and `num_2=36`; meaning the greatest common divisor of the original input integers `num_1` and `num_2` is 6.

Make Function Calls

In this activity you will need to make calls to the following functions: `add`, `subtract`, `product`, `divide` and `power`, in order to correctly compute the result of the following expression for any given values of `a`, `b`, `c` and `d`.

$$\frac{d}{4} - \frac{a^b}{2.1} \times \left(\frac{c}{d + a \times 4} \right)^{\frac{2}{c}}$$

For this activity, you are:

- only allowed to make calls to functions `add`, `subtract`, `product`, `divide` and `power`,
- not allowed to use operators directly (e.g., `+`, `-` etc.), and
- not allowed to use variables outside of `a`, `b`, `c` and `d`.

Designing a Shape Calculator

You have been tasked to create a shape calculator to compute the areas of three shapes; a circle, a rectangle, and a triangle. For each shape, the user will be providing the following input:

- For the circle, the user will enter the diameter as an integer in centimeters.
- For the rectangle, the user will enter the length and the width as real numbers in centimeters.
- For the triangle, the user will enter the base and the height as real numbers in milimeters.

Create a Python file named `calc_shapes.py` in which you will need to prompt the user for input and calculate the area of each shape. The formulae for calculating the areas are:

- For the circle,

$$\pi r^2$$

- For the rectangle,

$$length \cdot width$$

- For the triangle,

$$\frac{base \cdot height}{2}$$

When collecting the input, please prompt the user with the following messages:

"Input the diameter of the circle (cm): "

"Input the length of the rectangle (cm): "

"Input the width of the rectangle (cm): "

"Input the base of the triangle (mm): "

"Input the height of the triangle (mm): "

Once the areas are calculated, you will need to print the area of each shape in the format of `m^2`, `cm^2` and `mm^2`. For example, if the area of a particular shape is `10356.4902cm^2`, it can also be represented as `1m^2`, `356cm^2` and `49.02mm^2`. An example of the expected output is:

```
The area of the circle is 1m^2, 356cm^2 and 49.02mm^2.
The area of the rectangle is 21m^2, 86cm^2 and 46.00mm^2.
The area of the triangle is 8m^2, 3163cm^2 and 5.73mm^2.
```

Note:

Realize how the output of the calculations of m^2 and cm^2 are always integers but the output of the calculation of mm^2 is always a real number (with 2 decimal places).

It is a good idea to write some psuedocode to design a suitable algorithm before translating it to Python and also doing the calculations by hand before writing any code. Here are some things you might consider when designing your algorithm and solving this problem.

- Remember, 100cm^2 can be represented by a 10cm * 10cm square but it is not 1m^2.
- Circle provides diameter as a single integer, how will you convert it to the radius?
- When and where should you use typecasting?
- Is there any integer division you should be aware of?
- Can you access the value of pi without hard-coding a bunch of numbers? Have a look at the first question of this week's Applied session for inspiration.
- How do you extract the meters, centimeters and millimeters from a single real number? Think about integer division, modulo and type casting.
- How will you calculate the modulo of a real number while being language specific?

Feedback

Question 1 *Submitted Mar 13th 2022 at 2:58:21 pm*

Feedback

What worked best in this lesson?

Examples.

Question 2 *Submitted Mar 13th 2022 at 2:58:27 pm*

Feedback

What needs improvement most?

Nothing as of yet.