Python Practice Problems

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1 Numeric types and operators

What is `2`?

What is `2.0`?

What is `type(2)`?

What is `type(2.0)`?

How are `2` and `2.0` different?

What is `type(2 + 2.0)`?

What is `2 + 5`?

What is `2 - 5`?

What is `-5`?

What is `2 * 5`?

What is `2**5`?

What is `2**0.5`?

What is `2 / 5`?

What is `2 // 5`?

What is `type(2 / 5)`?

What is `type(2 // 5)`?

What is `5 / 2`?

What is `5 // 2`?

What is `5.0 / 2.0`?

What is `5.0 // 2.0`?

What does the `//` operator do?

What is `5 % 2`?

What is `6 % 2`?

What is `7 % 2`?

What is `2 % 5`?

What does the `%` operator do?

aWhat is `1 + 2 / 4`?

What is `(1 + 2) / 4`?

Why are the values of the two proceeding expressions different?

2 Booleans

What is `True`?

What is `False`?

What is `not False`?

What is `True and True`?

What is `True and False`?

What is `False or True`?

What is `True or (not False))`?

What is `2 < 5`?

What is `2 > 5`?

What is `(2 < 5) and (5 < 10)`?

3 Strings

What is `"Hello, World"`?

What is `type("Hello, World")`?

What is `type('Hello, World')`?

What is `print("Hello, World")`?

What is `print("Hello,\nWorld ")`?

What is `"Hello," + 'World'`?

4 Lists

What is `[]`?

What is `[1, 2, 3]`?

What is `['a', 'b', 'c']`?

What is `type([])`?

What is `type([1, 2, 3])`?

What is `type(['a', 'b', 'c'])`?

What is `list([1,2,3])`?

What is `type(list())`?

What is `[1, 2, 3] + ['a', 'b', 'c']`?

What is `[1, 2, 3] + [4, 5, 6]`?

How would you generate the list `[0,2,3,...,99]`?

How would you generate the list `[1,2,3,...,100]`?

How would you generate the list `[5,10,15,20,...,100]`?

If `x = [2,4,6,8,10]`, how would you get the fourth element of `x`?

if `x = [10,20,30,40,...,1000]`, how would you get the last 10 elements of `x`?

5 Numpy arrays

What does `import numpy as np` do?

What is `np.array([1,2,3])`?

If `x = np.array([1,2,3])`, what is `x + 2`?

What is `x * 2`?

What is `2 * x`?

What is `x / 2`?

What is `x**2`?

If `x = np.array([1,2,3])` and `y = np.array([4,5,6])`, what is `x + y`?

What is `x / y`?

What is `x + 2 * y`?

What is `(x + 2) * y`?

How would you generate the array `array([0, 1, 2, 3, ..., 99])`?

How would you generate the array `array([ 0., 0.2, 0.4, 0.6, ..., 2.0])`?

How would you generate an array of 101 equally spaced values between 0 and 11 (including both 0 and 11)?

Let `x = np.arange(20, 1, -2)`. How would you get all the elements of `x` *except* the last five?

Let `x = np.arange(20, 1, -2)`. How would you get the last five elements of `x` in reverse order?

Let `x = np.array([3,1,4,1,5,9,6,5])`. What is `x[x >= 4]`?

Let `x = np.array([3,1,4,1,5,9,6,5])` and `y = np.array([3,6,9,7,5,3,1,5])`.
What is `x[y**2 < 4*y]`? What is `x[x < y]`?

6 Control structures

Let `x = "Silly string!"`. Write a for-loop to print each character of `x` on its own line.

Let `x = "Silly string!"`. Write a for-loop to create a list containing each of the characters of `x`.

What is the value of `i` after executing this snippet?

```
for i in range(3):
    x = i**2 + 1
```

What is the value of `x` after executing this snippet?

```
for i in range(3):
    x = i**2 + 1
```

What is the value of `different_variable` after executing this snippet?

```
for different_variable in range(3):
    x = different_variable**2 + 1
```

What is the value of `x` after executing this snippet?

```
for different_variable in range(3):
    x = different_variable**2 + 1
```

What is the value of `x` after executing this snippet?

```
x = []
for i in range(3):
    x.append(i**2 + 1)
```

What is `[(i**2 + 1) for i in range(3)]`?

Let `x = [(i**2 + 1) for i in range(3)]`. What is the value of `i`?

Let `x = [(foo**2 + 1) for foo in range(3)]`. What is the value of `foo`?

Let `x = [(i**2 + 1) for i in range(3)]`. What is the first value of `x`?

Let `x = [(foo**2 + 1) for foo in range(3)]`. What is the last value of `x`?

Let `x = [(i**2 + 1) for i in range(3)]`. What is `x[0]`?

Let `x = [(foo**2 + 1) for foo in range(3)]`. What is `x[2]`?

What is `[(i**2 + 1) for i in range(10) if (i % 2) != 0]`?

Let `x = "Silly string!"`. Write a list comprehension to create a list containing each of the characters of `x`.

What is the value of `x` after executing this snippet?

```
a = 10
if (a < 20) and (a > 101**0.5):
    x = 3.14159
elif a > (a + 2**3) / 2:
    x = 2.7182
else:
     x = 1.414
```

Write a for-loop that iterates over over the numbers 0 to 24. If the current number is divisible by three, print "Multiple of three!". If the number is 10, print "It's a ten!". Otherwise, do nothing.

7 Built-in functions

Let `x = range(10)`.

What is `len(x)`?

What is `max(x)`?

What is `min(x)`?

What is `sum(x)`?

What is `[i for i in reversed(x)]`?

What is `abs(-1)`?

8 Numpy functions

Let `x = np.arange(1,10,0.5)`

What is `np.mean(x)`?

What is `np.median(x)`?

What is `np.var(x)`?

What is `np.var(x, ddof=1)`?

What is `np.percentile(x,50)`?

What is `np.percentile(x, 25)`?

What is `np.percentile(x, 75)`?

What is `np.percentile(x, 75, interpolation="midpoint")`?

What is `x[::-1]`?

What is `np.concatenate([[1,2,3], [4,5,6]])`?

Let `y = np.concatenate([x, x[::-1]])`

What is `np.mean(y)`?

What is `np.std(y)`?

What is `np.std(y, ddof=1)`?

How do the preceding calls to `np.std` differ?

Let `m = np.arange(12)`. What does `m` look like?

Let `m.shape = 3,4`. What does `m` look like now?

What is `np.mean(m, axis=0)`?

What is `np.mean(m, axis=1)`?

9 Simulation

How would you generate a sample of size 10 from a standard normal distribution (i.e. $N(\mu = 0, \sigma = 1)$?

How would you find the mean of that sample? How would you find the median of that sample?

How would you generate 5 samples, each of size 10 from a standard normal distribution? How would

you calculate the means of each of those samples?

How would you generate 500 samples, each of size 10, from a standard normal distribution? How would you calculate the means of each of those samples?

If you generate 500 samples of size 10, and calculate the mean of each sample, how would you then calculate the "grand mean" (the mean of all the means)? How would you calculate the standard deviation of those means? [Note that this is a simulated sampling distribution!]