

CS 110

Math in Python

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Announcements

- PA 2
- Group seating
- Videos for online
- Log in to Gradescope


The Mathematical Operators

+	Addition
-	Subtraction
*	Multiplication
/	Division
//	Integer Division
**	Exponent
%	Modulus

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Note: using these on 2 integers functions differently than it does when strings are involved!



Strings vs Ints (Addition)

What will the value of each of these variables be? No Computers!

a = '4' + 5

b = 20 + 15

c = 2 + 'Hi there'

d = 'Hi there' + 'Hi there'

Strings vs Ints (Multiplication)

What will the value of each of these variables be? No Computers!

a = '4' * 5

b = 20 * 15

c = 2 * 'Hi there'

d = 'Hi there' * 'Hi there'

What will the value of the variables be?

No Computers!

```
a = 3 + 3 - 2 * 4
```

```
b = 5 * 5 / 10
```

```
d = a - b * 2
```

```
print(d)
```

What will the value of the variables be?

No Computers!

$$a = 3 + 3 - 2 * 4 \quad -2$$

$$b = 5 * 5 / 10$$

$$d = a - b * 2$$

What will the value of the variables be?

No Computers!

$$a = 3 + 3 - 2 * 4 \quad -2$$

$$b = 5 * 5 / 10 \quad 2.5$$

$$d = a - b * 2$$

What will the value of the variables be?

No Computers!

a	=	3	+	3	-	2	*	4	-2
b	=	5	*	5	/	10			2.5
d	=	a	-	b	*	2			-7.0

Mathematical Expressions

- The math on the left-hand side of the equals-sign in the previous example are referred to as **mathematical expressions**
- A **mathematical expression** is a combination of one or more **operands** and zero or more **operators** that produce a **value**

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- A **mathematical expression** is a combination of one or more **operands** and zero or more **operators** that produce a **value**
 - **Operand:** A value or variable in a math expression
 - **Operator:** A symbol that represents a mathematical operation (such as `+` `-` `*` `/` `//` `**` `%`)

PEMDAS

- What does PEMDAS stand for?

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- The operator precedence:
 1. First **P**arentheses,
 2. Then **E**xponentiation
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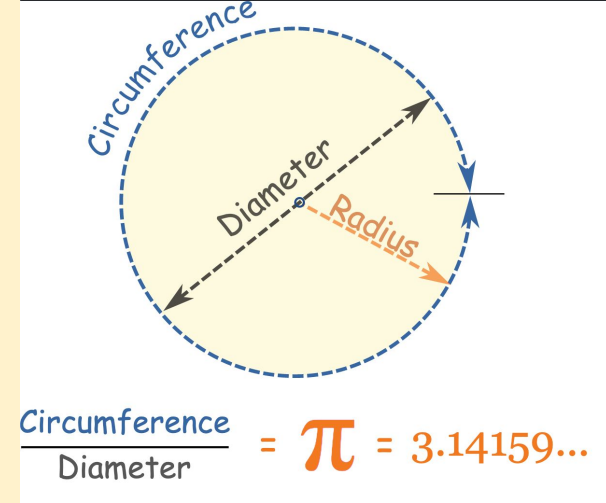


If there is a tie, then python will evaluate the math left-to-right

Area of Circle

- Write a program that takes a diameter, and calculates the area of the corresponding circle

$$\text{Area} = 3.14 \times r^2$$



Enter circle diameter: 5

Area of circle with diameter 5.0 is 19.625

Area of Circle

```
### Author: Benjamin Dicken
```

```
### Course: CSc 110
```

```
### Description: This program accepts a circle diameter as input.
```

```
###           it then calculates and prints the area for that circle.
```

```
diameter = float(input('Enter circle diameter: '))
```

```
area = 3.14 * (diameter / 2)**2
```

```
print('Area of circle with diameter', diameter, 'is', area)
```

Parentheses

- Parentheses can be used in mathematical expressions
- Specifically, they can be used to force a particular order of operations
- Similar to regular math!

PEMDAS

- What value will each of these variables take on? No computers!

$$a1 = 5 / 5 * 10 * 5$$

$$a2 = 5 / (5 * 10) * 5$$

$$b1 = 5 * 10 - 2$$

$$b2 = 5 * (10 - 2)$$

PEMDAS

- What value will each of these variables take on? No computers!

$$a1 = 5 / 5 * 10 * 5 \quad 50.0$$

$$a2 = 5 / (5 * 10) * 5 \quad 0.5$$

$$b1 = 5 * 10 - 2 \quad 48$$

$$b2 = 5 * (10 - 2) \quad 40$$

Integer Division

- What value will this variable take on? No computers!

```
b = (3 // (4 // 5)) + 1
```

An Example from Basketball

- Who here likes basketball?

An Example from Basketball

- Who here likes basketball?
- Who here is familiar with the rules of basketball?

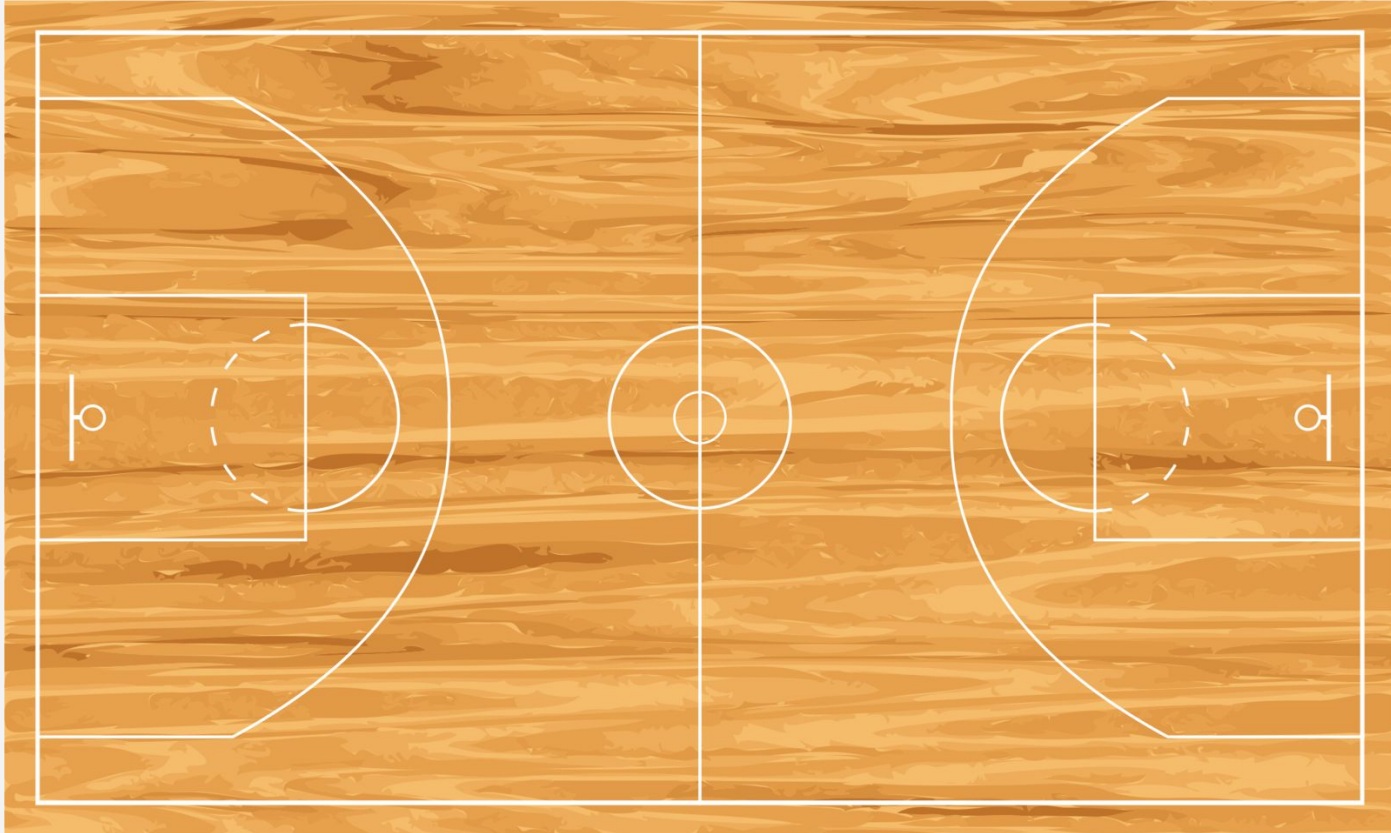
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- Who here likes basketball?
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- Who knows what **shooting percentage** means?

An Example from Basketball

- Who here likes basketball?
- Who here is familiar with the rules of basketball?
- Who knows what **shooting percentage** means?
- Who knows what **true shooting percentage** (TS%) means?

3's vs 2's vs FT's (free throws)



Shooting Percentage

- The percentage of the shots that a player makes out of all of the shots attempted
- Generally, the higher the better
- However

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Player A: Takes only 3's, makes 7/15

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Which is better?

Shooting Percentage

- The percentage of the shots that a player makes out of all of the shots attempted
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Player A: Takes only 3's, makes 7/15

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Which is better?

**Regular shooting
percentage doesn't
tell the whole story!**

True Shooting Percentage

- A shooting percentage that takes into account the various types of shots a player can take

True Shooting Percentage

- A shooting percentage that takes into account the various types of shots a player can take
- The formula (from Wikipedia):

$$TS\% = \frac{PTS}{2(FGA + (0.44 \times FTA))} \times 100$$

Implement tsp.py

- Write a program that takes three values as input
- Calculates and prints out the TS%, for example:

Enter points scored:

25

Enter FG attempts:

20

Enter FT attempts:

5

True Shooting Percentage: 56.31%

$$TS\% = \frac{PTS}{2(FGA + (0.44 \times FTA))} \times 100$$

tsp.py

```
points = int(input('Enter points scored:\n'))  
fga = int(input('Enter FG attempts:\n'))  
fta = int(input('Enter FT attempts:\n'))
```

tsp.py

```
points = int(input('Enter points scored:\n'))
fga = int(input('Enter FG attempts:\n'))
fta = int(input('Enter FT attempts:\n'))

tsp = (points / (2 * (fga + (0.44 * fta)))) * 100
```

tsp.py

```
points = int(input('Enter points scored:\n'))
fga = int(input('Enter FG attempts:\n'))
fta = int(input('Enter FT attempts:\n'))

tsp = (points / (2 * (fga + (0.44 * fta)))) * 100

print('True Shooting Percentage: ' + str(round(tsp, 2)) + '%')
```

Implement sp.py

- Write a program that takes two
- Calculates and prints out the (regular) shooting percentage
- For example:

Enter shots taken:

17

Enter shots made:

10

Shooting Percentage: 58.82%

sp.py

```
shots = int(input('Enter shots taken:\n'))
```

```
made = int(input('Enter shots made:\n'))
```

```
sp = made / shots * 100
```

```
print('Shooting Percentage: ' + str(round(sp, 2)) + '%')
```