CS 110
Math in Python

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Announcements

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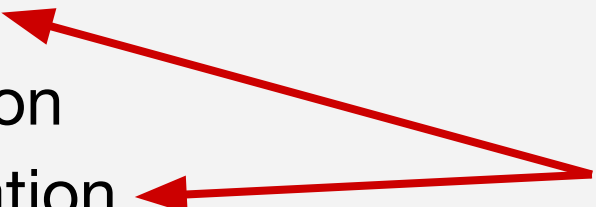
The Mathematical Operators

+   Addition

-       Subtraction

*   Multiplication

/   Division

//   Integer Division

**   Exponent

%   Modulus

The Mathematical Operators

+   Addition

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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!

```python
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          -2
b = 5 * 5 / 10
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
```

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**

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**
  - **Operand:** A value or variable in a math expression
  - **Operator:** A symbol that represents a mathematical operation (such as + - * / // ** %)
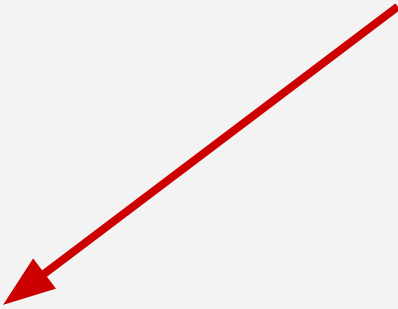
PEMDAS

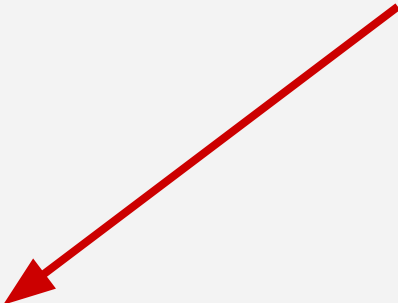- What does PEMDAS stand for?

PEMDAS

- What does PEMDAS stand for?
- The operator precedence:

1. First **P**arentheses,

2. Then **E**xponentiation

3. **M**ultiplication and **D**ivision have equal precedence

4. Lastly, **A**ddition and **S**ubtraction have equal precedence

PEMDAS

- What does PEMDAS stand for?
- The operator precedence:

This is also where integer division and modulus rank

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PEMDAS

- What does PEMDAS stand for?
- The operator precedence:

1. First Parentheses,

2. Then Exponentiation

3. Multiplication and Division have equal precedence

4. Lastly, Addition and Subtraction have equal precedence

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

This is also where integer division and modulus rank

Area of Circle

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

$$\textbf{Area = 3.14 x r}^{\textbf{2}}$$

Circumference

Diameter

Radius

$$\frac{Circumference}{Diameter} = \pi = 3.14159...$$
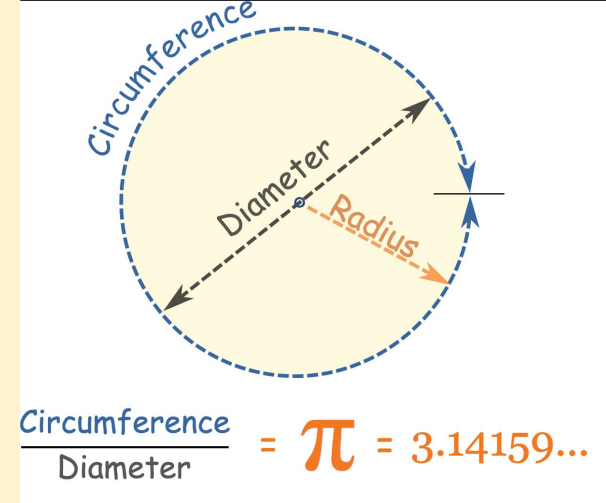
```
Enter circle diameter: 5
Area of circle with diameter 5.0 is 19.625
```

Area of Circle

```python
### 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       50.0
a2 = 5 / (5 * 10) * 5       0.5


b1 = 5 *  10 - 2            48
b2 = 5 * (10 - 2)           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?

An Example from Basketball

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- Who here is familiar with the rules of basketball?
- Who knows what **shooting percentage** means?
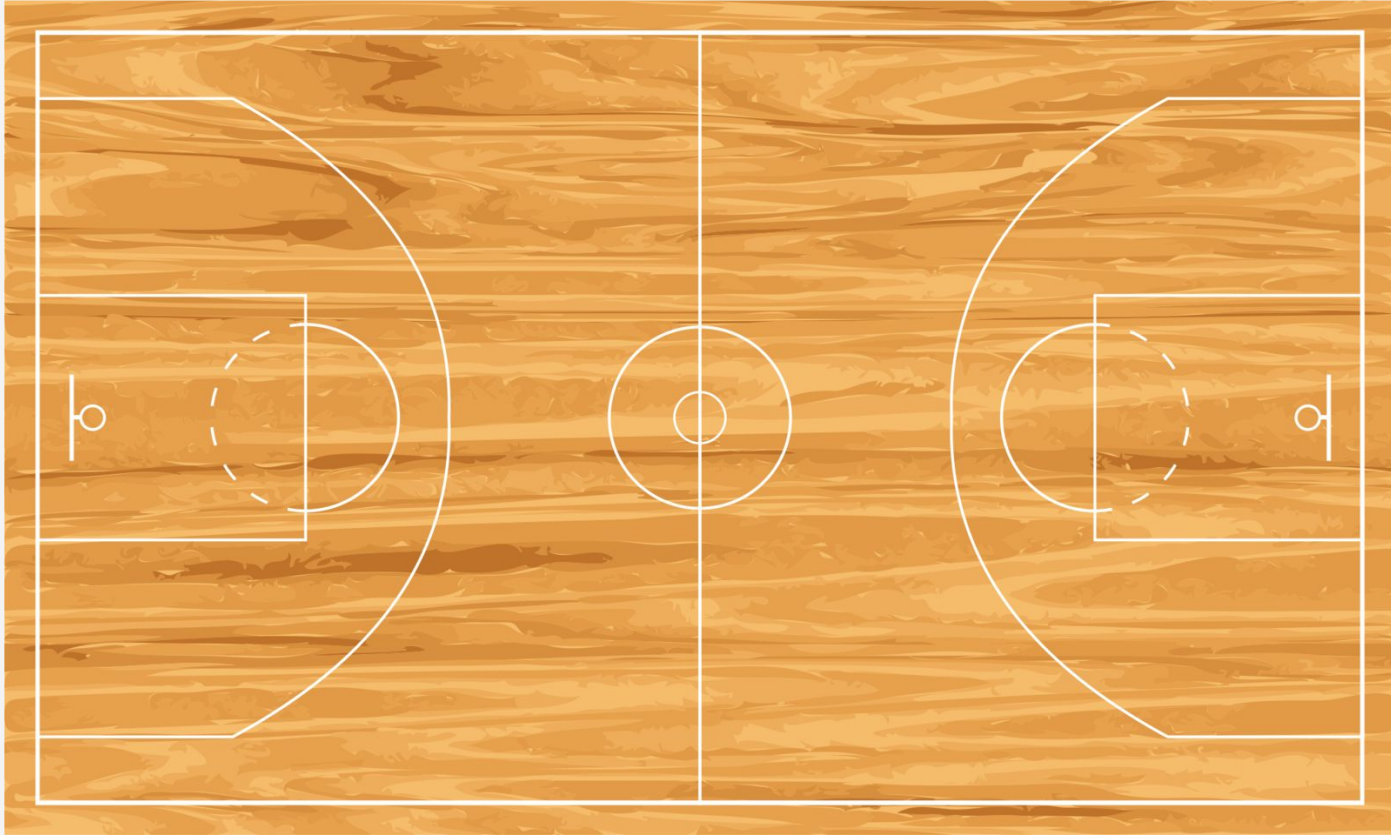
An Example from Basketball

- 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
Player B: Takes only 2's, makes 10/15

Which is better?

Shooting Percentage

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

Regular shooting percentage doesn't tell the whole story!

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

Player B: Takes only 2's, makes 10/15

Which is better?

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):

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

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%

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

tsp.py

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

tsp.py

```python
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

```python
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

```python
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)) + '%' )
```