

CIS 6 :: Lab 03 - Numbers in Python

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Task 1: Definitions & Concepts

Instructions: Answer the questions below.

1. What are the two Python number types:
=> **int for whole numbers, float for decimal numbers**
2. List a few samples examples to above number types:
=> **100, -29, 0 are examples of integers. 0.12, 1.0, 15.6666 are examples of floats**
3. List three Python math functions and explain what they are used for:
=> **math.exp(x) gives the exponential of x, math.sqrt(x) gives the square root of x, math.sin(x) gives the sine of x**
4. How many different numbers below bits can represent:
 - a. 1 byte (8 bits): **$2^{**8} = 256$**
 - b. 2 bytes (16 bits): **$2^{**16} = 65,536$**
 - c. 4 bytes (32 bits): **$2^{**32} = 2,147,483,648$**
 - d. 8 bytes (64 bits): **$2^{**64} = 18446744073709551615$**

5: Short Research

Computers can't really work with decimal numbers. What they do is an approximation of decimal numbers. Research and find out what that means. Briefly explain.

=> **The length of a number that a computer can accurately give is limited by the amount of memory available. It's much more memory efficient to store approximate float values rather than assigning more bits of memory to each number**

Task 2: Understanding Programming

1. Show the result of evaluating each expression and the types (int, float) or legal/illegal:
 - a. $4.0 / 10.0 + 3.5 * 2$: **7.4, float**
 - b. $10 \% 4 + 6 / 2$: **5.0, float**
 - c. $\text{abs}(4 - 20 // 3) ** 3$: **8, int**
 - d. $\text{sqrt}(4.5 - 5.0) + 7 * 3$: **illegal**
 - e. $3 * 10 // 3 + 10 \% 3$: **11, int**
 - f. $3 ** 3$: **27, int**
2. Translate below math expressions into Python expressions:
 - a. $(3 + 4) / 5$: **(3+4) / 5**
 - b. $\frac{n(n-1)}{2}$: **(n*(n-1))/2**
 - c. $4\pi^2$: **4*math.pi**2**

- d. $\sqrt{r(\cos a)^2 + r(\sin b)^2}$: `math.sqrt(r*(math.cos(a))**2 + r*(math.sin(b))**2)`
- e. $\frac{y_2 - y_1}{x_2 - x_1}$: `(y2 - y1) / (x2 - x1)`
3. Show the sequence of numbers that would be generated by below range expressions:
- `range(5)`: 0, 1, 2, 3, 4
 - `range(3, 5)`: 3, 4
 - `range(6, 20, 3)`: 6, 9, 12, 15, 18
 - `range(19, 6, -1)`: 19, 18, 17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7
 - `range(7, 8)`: 7

4. Assume that we execute the following assignment statements:

`width = 17`

`height = 12.0`

For each of the following expressions, write the value of the expression and the type (of the value of the expression).

- `width // 2`: 8, int
- `width / 2.0`: 8.5, float
- `height / 3`: 4.0, float
- `1 + 2 * 5`: illegal, the slash is facing the wrong way

Use the Python interpreter to check your answers.

Task 3: Programming Exercises

Instructions: Use Python IDLE to write and execute below exercises from the book chapter 3. Attach Snipping photos of your source code and executions of the code in Python shell. Make sure to create separate files for each exercise. **Your screenshots must be legible.**

Exercise 1: Write a program to calculate the volume and surface area of a sphere from its radius, given as input. Here are some formulas that might be useful:

$$V = \frac{4}{3}\pi r^3$$

$$A = 4\pi r^2$$

```
sphere.py - C:/Users/Admin/Desktop/School/CIS 6/sphere.py (3.9.1)
File Edit Format Run Options Window Help

import math

def main():
    print("This program will calculate the volume and surface")
    print("of a sphere given it's radius.")
    print("")

    r = eval(input("Enter the radius: "))

    v = (4 / 3) * math.pi * r ** 3
    print("The volume of the sphere is: ", v)

    a = 4 * math.pi * r ** 2
    print("The surface area of the sphere is: ", a)

main()

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/sphere.py =====
This program will calculate the volume and surface
of a sphere given it's radius.

Enter the radius: 6
The volume of the sphere is:  904.7786842338603
The surface area of the sphere is:  452.3893421169302
>>>
```

Exercise 2: Write a program that calculates the cost per square inch of a circular pizza, given its diameter and price. The formula for area is $A = \pi r^2$.

```
pizzacost.py - C:/Users/Admin/Desktop/School/CIS 6/pizzacost.py (3.9.1)
File Edit Format Run Options Window Help

#program to determine cost per square inch of pizza given price and diameter
import math

def main():
    print("Program to determine cost per square inch of pizza")
    cost = eval(input("How much did the pizza cost: "))
    d = eval(input("What is the diameter of the pizza in inches: "))
    a = math.pi * (d/2) ** 2
    inchprice = a / cost
    print("The pizza cost ", inchprice, "per square inch")

main()

Ln: 12 Col: 6

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/pizzacost.py =====
Program to determine cost per square inch of pizza
How much did the pizza cost: 10
What is the diameter of the pizza in inches: 4
The pizza cost  1.2566370614359172 per square inch
>>>

Ln: 44 Col: 4
```

Exercise 4: Write a program that determines the distance to a lightning strike based on the time elapsed between the flash and the sound of thunder. The speed of sound is approximately 1100 ft/ sec and 1 mile is 5280 ft.

```
lightning.py - C:/Users/Admin/Desktop/School/CIS 6/lightning.py (3.9.1)
File Edit Format Run Options Window Help

#Program to determine the distance to a lightning strike in miles

def main():
    print("This program will determine the distance to a lightning strike in miles.")
    print()
    light = eval(input("Enter the time in seconds between seeing the lightning and hearing the thunder: "))
    dist = light * 1100 / 5280
    print("The lightning strike was", dist, "miles away")

main()

Ln: 11 Col: 0

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/lightning.py =====
This program will determine the distance to a lightning strike in miles.

Enter the time in seconds between seeing the lightning and hearing the thunder: 9
The lightning strike was 1.875 miles away
>>>

Ln: 62 Col: 4
```

Exercise 5: The Konditorei coffee shop sells coffee at \$10.50 a pound plus the cost of shipping. Each order ships for \$0.86 per pound + \$1.50 fixed cost for overhead. Write a program that calculates the cost of an order.

```
coffeecost.py - C:/Users/Admin/Desktop/School/CIS 6/coffeecost.py (3.9.1)
File Edit Format Run Options Window Help
#A program to determine price of a coffee order given shipping and per pound cost

def main():
    print("This program calculates the cost of a coffee order.")
    print()
    pounds = eval(input("How many pounds of coffee are in the order: "))
    cost = ((10.50 + .86) * pounds) + 1.50
    print("The total total cost of the order is", cost)

main()

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/coffeecost.py =====
=====
This program calculates the cost of a coffee order.

How many pounds of coffee are in the order: 10
The total total cost of the order is 115.1
>>>
```

Exercise 6: Two points in a plane are specified using the coordinates (x1, y1) and (x2, y2). Write a program that calculates the slope of a line through two (non-vertical) points entered by the user

$$\text{slope} = \frac{y2 - y1}{x2 - x1}$$

```
slope.py - C:/Users/Admin/Desktop/School/CIS 6/slope.py (3.9.1)
File Edit Format Run Options Window Help
#program to determine the slope of a line through 2 points

def main():
    print("This program determines the slope of a line through 2 points.")
    print()

    px1, py1 = eval(input("Input the first point in x, y format: "))
    px2, py2 = eval(input("Input the second point in x, y format: "))
    slopey = py2 - py1
    slopex = px2 - px1
    print("The slope is", slopey, '/', slopex)

main()

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/slope.py =====
This program determines the slope of a line through 2 points.

Input the first point in x, y format: 12, 9
Input the second point in x, y format: 22, 16
The slope is 7 / 10
>>>
```

Exercise 7: Write a program that accepts two points (see previous problem) and determines the distance between them.

$$\text{distance} = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$


```
distance.py - C:\Users\Admin\Desktop\School\CIS 6\distance.py (3.9.1)
File Edit Format Run Options Window Help

#program to determine the distance between 2 points
import math

def main():
    print("This program determines the distance between 2 points.")
    print()

    px1, py1 = eval(input("Input the first point in x, y format: "))
    px2, py2 = eval(input("Input the second point in x, y format: "))
    slopey = py2 - py1
    slopex = px2 - px1
    print("The slope is", slopey, '/', slopex)
    dis = math.sqrt(slopex + slopey)
    print("The distance between the points is", dis)

main()

Ln: 16 Col: 6

>>>
===== RESTART: C:\Users\Admin\Desktop\School\CIS 6\distance.py =====
This program determines the distance between 2 points.

Input the first point in x, y format: 8, 13
Input the second point in x, y format: 15, 22
The slope is 9 / 7
The distance between the points is 4.0
>>>
```

Exercise 9: Write a program to calculate the area of a triangle given the length of its three sides - a, b, and c - using these formulas:

$$s = \frac{a+b+c}{2} \quad A = \sqrt{s(s-a)(s-b)(s-c)}$$

```
trianglearea.py - C:/Users/Admin/Desktop/School/CIS 6/trianglearea.py (3.9.1)
File Edit Format Run Options Window Help

import math

def main():
    print("Program to calculate the area of a triangle.")
    print("")
    a, b, c = eval(input("Enter the length of each side seperated by commas: "))
    s = (a + b + c)/2
    area = math.sqrt(s*(s-a)*(s-b)*(s-c))
    print("The area of the triangle is ", area)

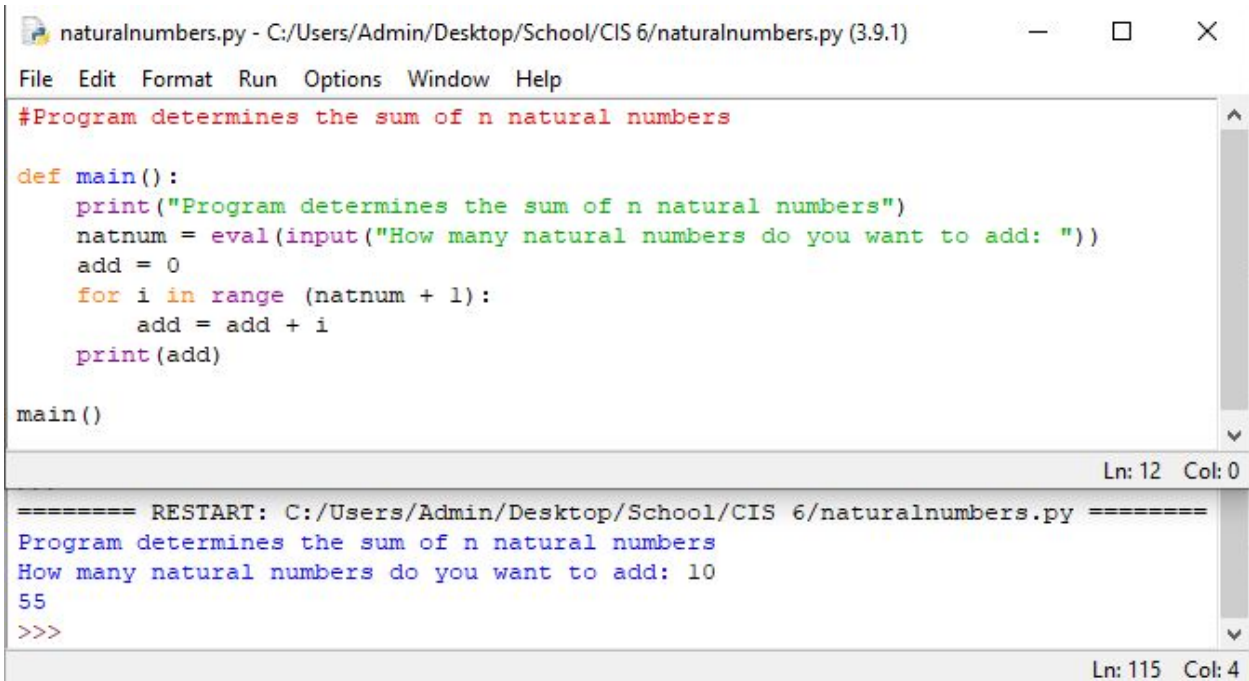
main()

Ln: 12 Col: 0

===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/trianglearea.py =====
Program to calculate the area of a triangle.

Enter the length of each side seperated by commas: 7, 12.5, 8
The area of the triangle is 25.828082463667332
>>>
```

Exercise 11: Write a program to find the sum of the first n natural numbers, where the value of n is provided by the user.



The screenshot shows a Python IDE window titled "naturalnumbers.py - C:/Users/Admin/Desktop/School/CIS 6/naturalnumbers.py (3.9.1)". The menu bar includes File, Edit, Format, Run, Options, Window, and Help. The code in the editor is as follows:

```
#Program determines the sum of n natural numbers

def main():
    print("Program determines the sum of n natural numbers")
    natnum = eval(input("How many natural numbers do you want to add: "))
    add = 0
    for i in range (natnum + 1):
        add = add + i
    print(add)

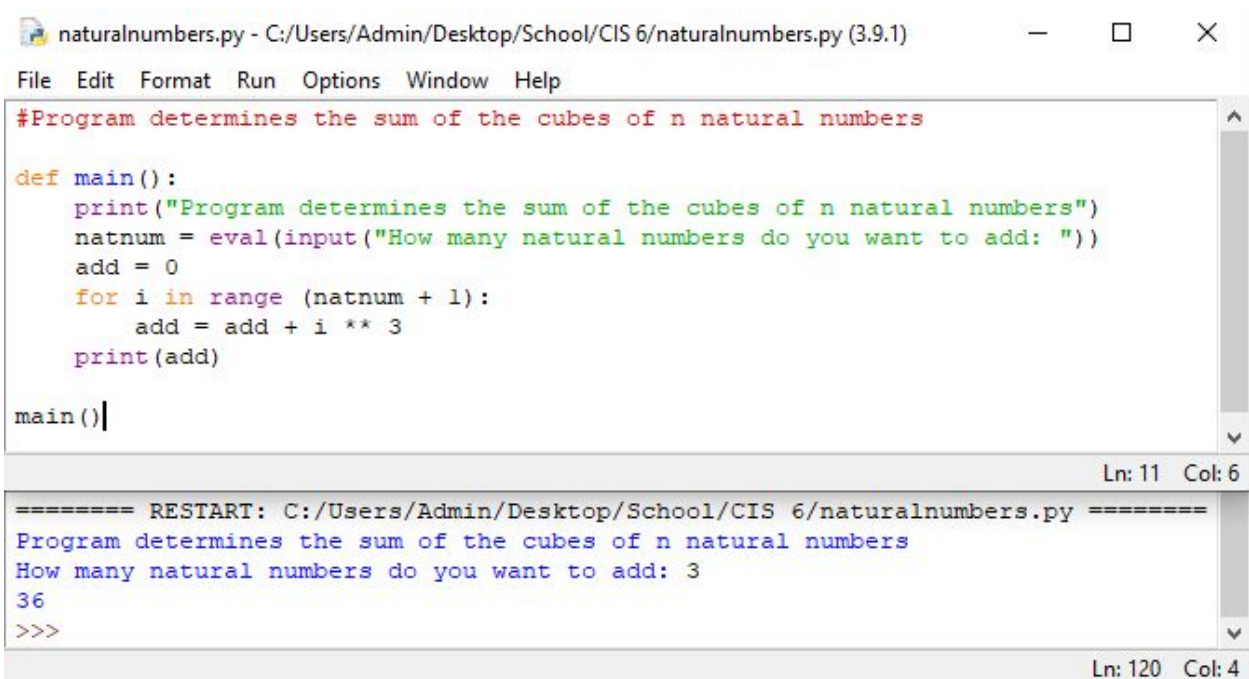
main()
```

The status bar at the bottom right indicates "Ln: 12 Col: 0". Below the code editor, the output of the program is displayed:

```
===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/naturalnumbers.py =====
Program determines the sum of n natural numbers
How many natural numbers do you want to add: 10
55
>>>
```

The status bar at the bottom right of the output area indicates "Ln: 115 Col: 4".

Exercise 12: Write a program to find the sum of the cubes of the first n natural numbers where the value of n is provided by the user.



The screenshot shows a Python IDE window titled "naturalnumbers.py - C:/Users/Admin/Desktop/School/CIS 6/naturalnumbers.py (3.9.1)". The menu bar includes File, Edit, Format, Run, Options, Window, and Help. The code in the editor is as follows:

```
#Program determines the sum of the cubes of n natural numbers

def main():
    print("Program determines the sum of the cubes of n natural numbers")
    natnum = eval(input("How many natural numbers do you want to add: "))
    add = 0
    for i in range (natnum + 1):
        add = add + i ** 3
    print(add)

main()
```

The status bar at the bottom right indicates "Ln: 11 Col: 6". Below the code editor, the output of the program is displayed:

```
===== RESTART: C:/Users/Admin/Desktop/School/CIS 6/naturalnumbers.py =====
Program determines the sum of the cubes of n natural numbers
How many natural numbers do you want to add: 3
36
>>>
```

The status bar at the bottom right of the output area indicates "Ln: 120 Col: 4".

Exercise 13 (optional):

Exercise 14 (Optional):