

# Testing Floating point inaccuracies

Introduction to Computer Science!



# What is the output of this code

```
#doubling.py  
def dbl( x ):  
    return  
    print('The double of ', x, 'is', x*2)
```

Any statement after the  
return is not executed

```
dbl(50)
```

- A. 100
- B. 50
- C. Error
- D. No output

# Program Bugs



- Syntax or logic errors in programs that prevent correct behavior
- Expect bugs to show up (its normal!)
- Learn to find and squash them (debug)

# Writing bug-free code via testing

```
#test dbl.py
import pytest
def dbl( x ):
    return 42

def test dbl_1():
    assert dbl(0)==0

def test dbl_2():
    assert dbl(2)==4

def test dbl_3():
    assert dbl("UCSB")=="UCSBUCSB"
```

Run these tests from the unix command line:

\$python3 [-m pytest] test dbl.py

*this means run the module pytest*

# Demo

- In class we will code a few functions and test them using pytest
- A good defensive programming strategy is to write the test code first
- Square a number
- Find the area of a circle with radius r

# Floating point inaccuracies

```
import math  
  
print(math.sqrt(2))  
print(math.sqrt(2) * math.sqrt(2) == 2)
```

$\sqrt{2}$  cannot be represented exactly. Only an approximate value is stored. This is why you should use

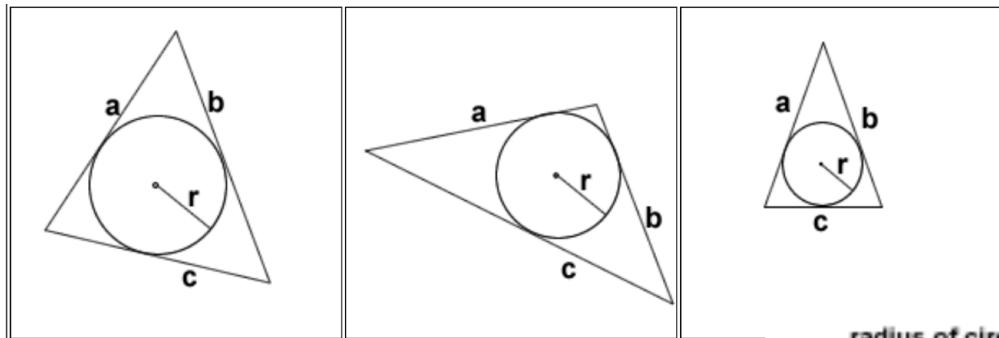
What is printed by the last line?

- A. True
- B. False
- C. Error

`pytest.approx` to compare floating point values

# Put it to practice

- Inside *every* triangle (it doesn't have to be any particular kind of triangle), it is possible to *inscribe a circle* as shown in the three below.



radius of circle inscribed in triangle,  
given sides of triangle, a,b,c

**First, let:**

$$s = \frac{a + b + c}{2}$$

**Then:**

$$r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}$$

- Write a function to computer the radius of a circle inscribed in a triangle