

The background of the slide is a close-up, high-quality image from the Pixar movie 'Up'. It features the character Mr. Farnsworth, an elderly man with a large, prominent orange nose, wearing a brown hat and glasses. He is looking down at a small, fluffy dog, which is also looking up at him. The scene is set outdoors with soft lighting.

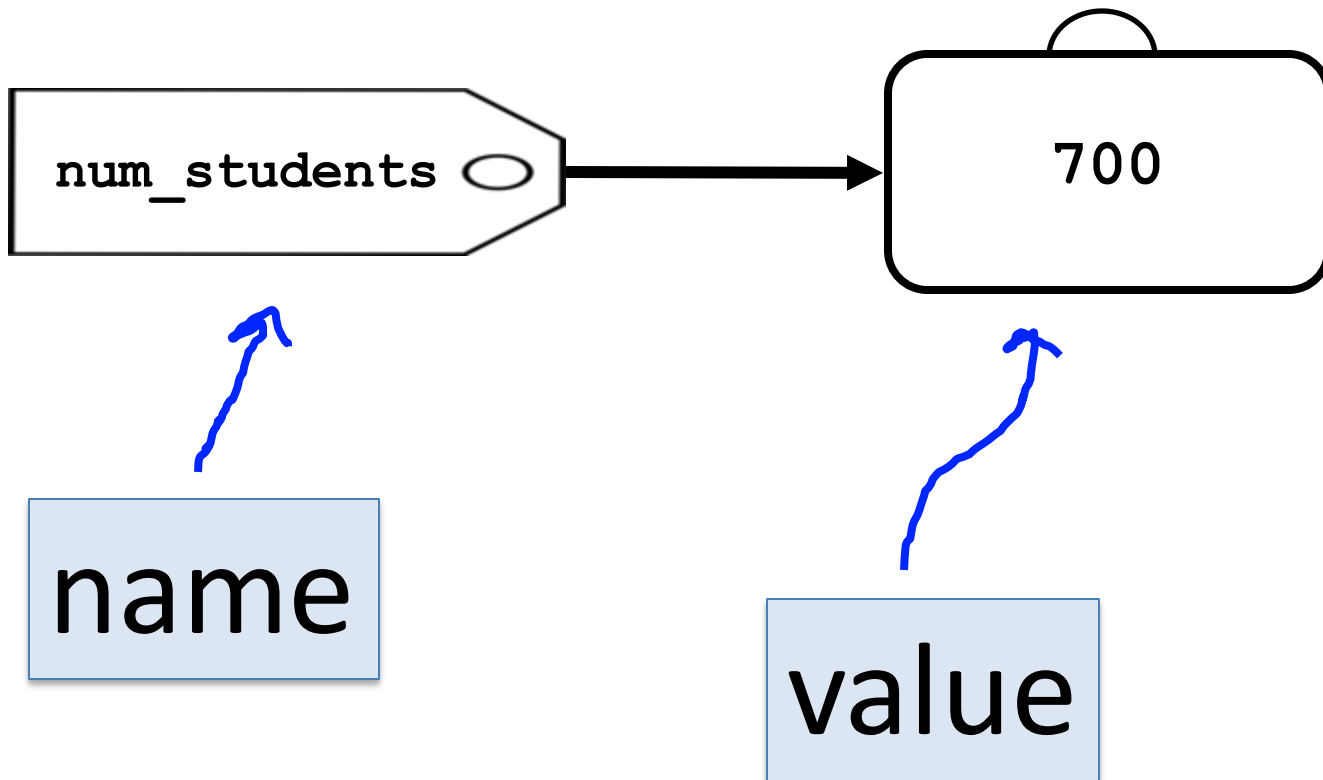
# While/If Revisited

Chris Piech and Mehran Sahami  
Stanford University

Review

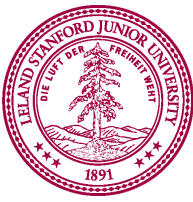
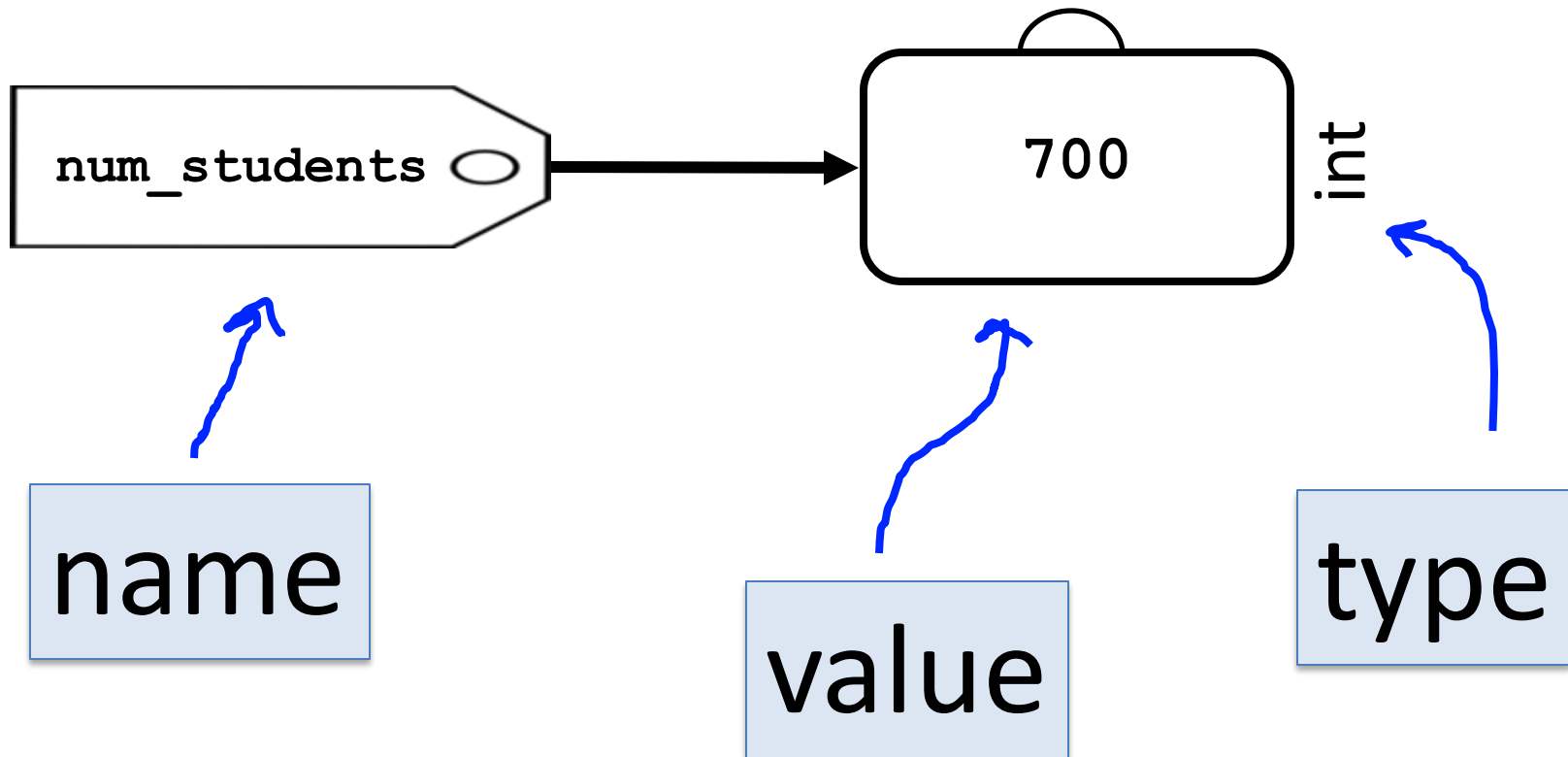
# Variables are like Boxes

```
num_students = 700
```

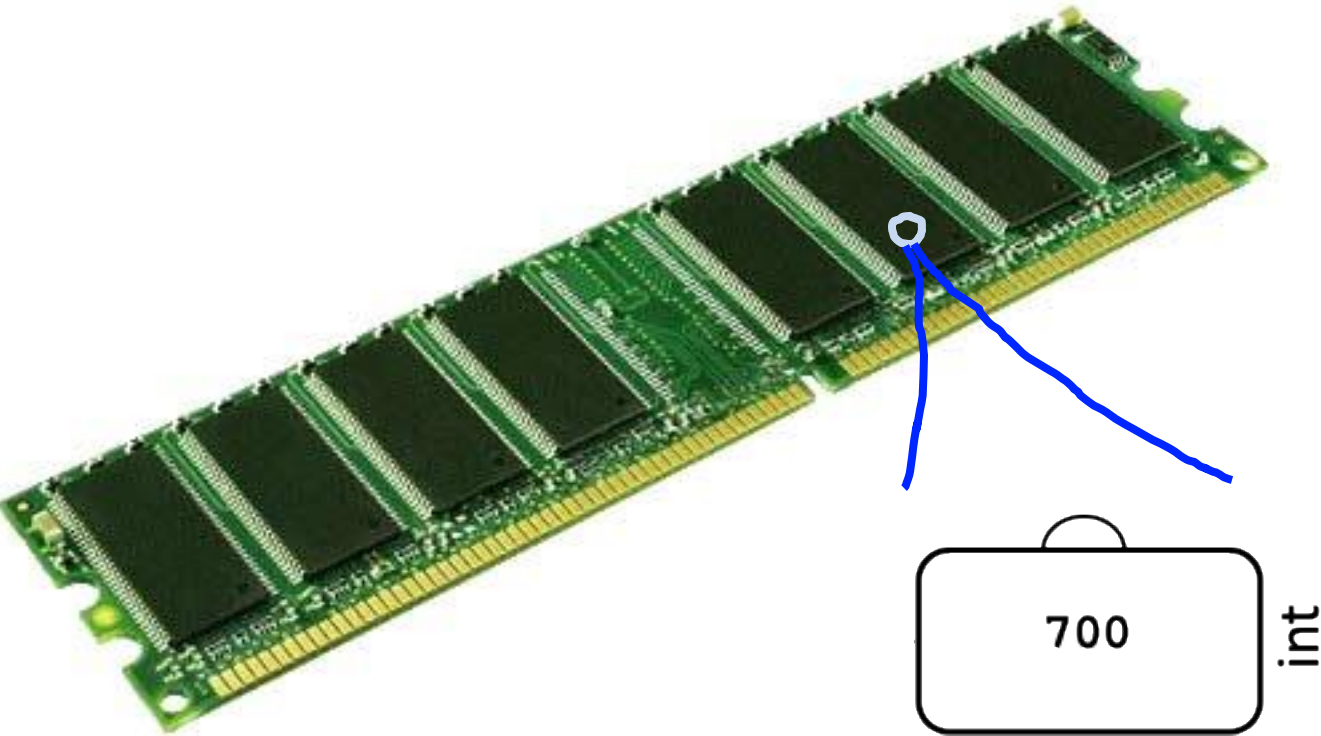


# Variables are like Boxes

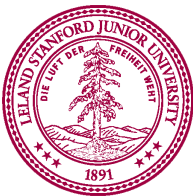
```
num_students = 700
```



# Teeny Tiny Boxes



My computer has space for  
about 10 billion boxes



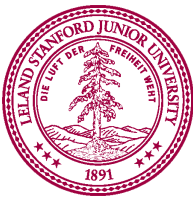
# Create, Modify, Use

```
# Create a variable, of type int  
# called age.
```

```
age = 37
```

```
# Use the value in age (output it)  
print(f"age is: {age}")
```

```
# Modify age to be one greater.  
age = age + 1
```



# Create, Modify, Use

```
# Create a variable, of type int  
# called age.  
age = 37
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# Use the value in age (output it)  
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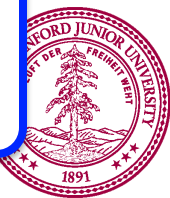
## Arithmetic Operators

+ Addition

\* Multiplication

- Subtraction

/ Division



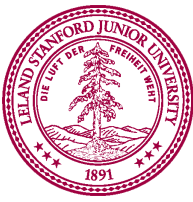


# Review Example: Bolt Calculator



Usain Bolt has the record speed for any human

He was recorded going 10.44 meters per second





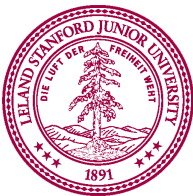
# Review: Bolt Calculator

SPEED = 10.44 # Bolt's speed in meters / second

```
def main():  
    time_str = input("Run time (s): ")  
    time = float(time_str)  
    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

terminal

```
% python main.py
```



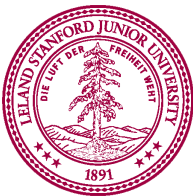
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terminal

```
% python main.py
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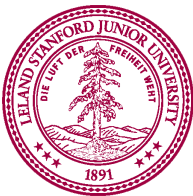
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## terminal

```
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```



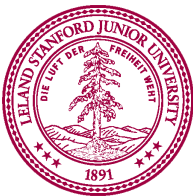
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    time = float(time_str)  
    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s):
```



# Review: Bolt Calculator

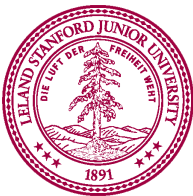
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    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py
```

```
Run time (s):
```



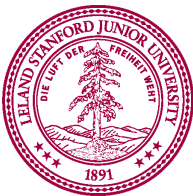
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    time = float(time_str)  
    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60
```



# Review: Bolt Calculator

SPEED = 10.44 # Bolt's speed in meters / second

def main():

time\_str = input("Run time (s): ")

time = float(time\_str)

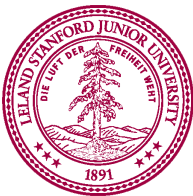
distance = SPEED \* time

print(f"Bolt can run {distance} meters.")

terminal

```
% python main.py
```

```
Run time (s): 60
```





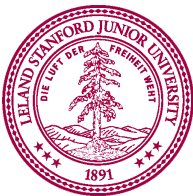
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def main():  
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    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60
```



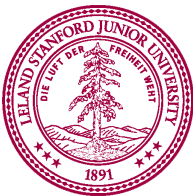
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    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60
```



# Review: Bolt Calculator

SPEED = 10.44 # Bolt's speed in meters / second

```
def main():
```

```
    time_str = input("Run time (s): ")
```

```
    time = float(time_str)
```

```
    distance = SPEED * time
```

```
    print(f"Bolt can run {distance} meters.")
```

626.4

## terminal

```
% python main.py
```

```
Run time (s): 60
```

str

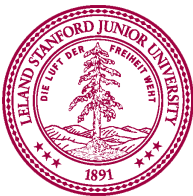
"60"

time\_str

float

60.0

time



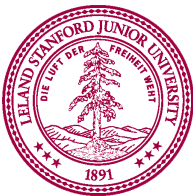
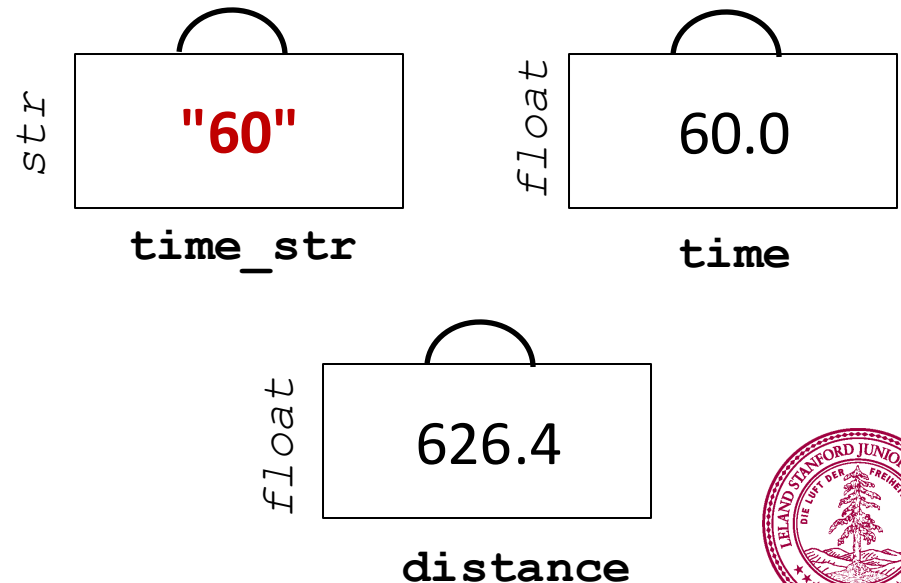
# Review: Bolt Calculator

SPEED = 10.44 # Bolt's speed in meters / second

```
def main():  
    time_str = input("Run time (s): ")  
    time = float(time_str)  
    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60
```



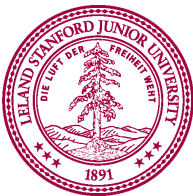
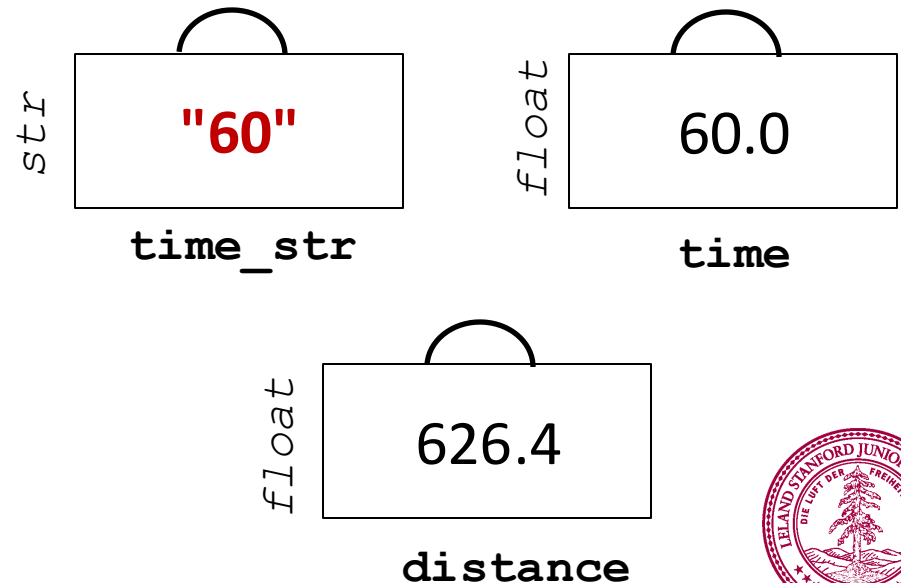
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    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60
```



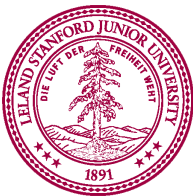
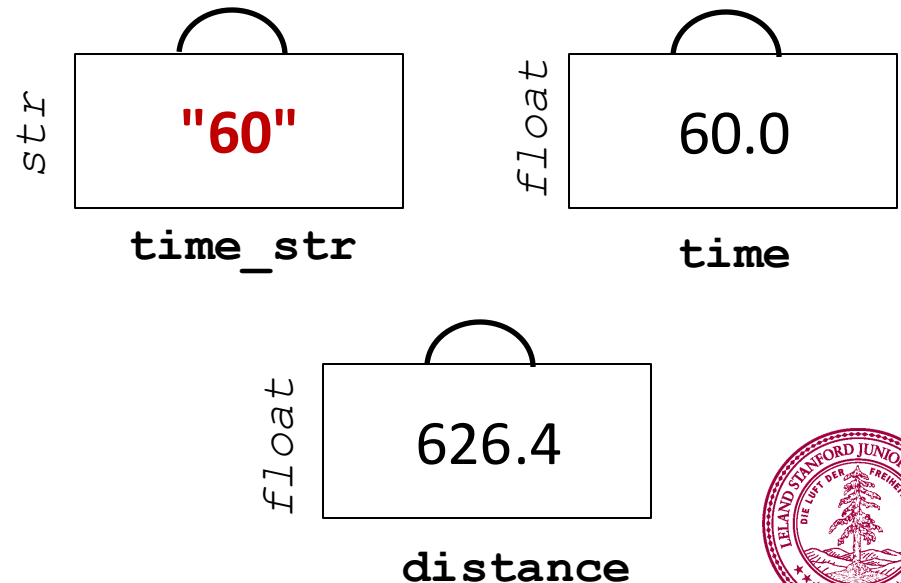
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```
def main():  
    time_str = input("Run time (s): ")  
    time = float(time_str)  
    distance = SPEED * time  
    print(f"Bolt can run {distance} meters.")
```

## terminal

```
% python main.py  
Run time (s): 60  
Bolt can run 626.4 meters
```

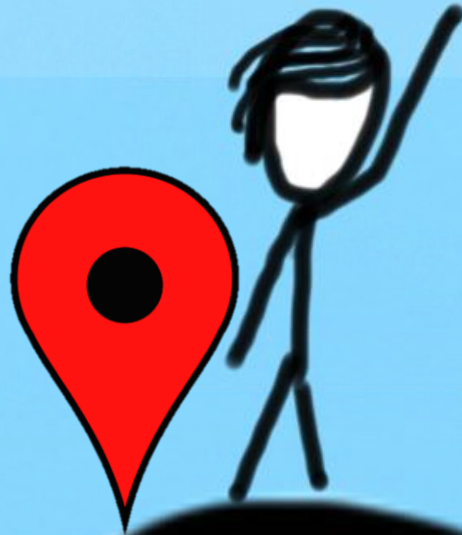


End Review

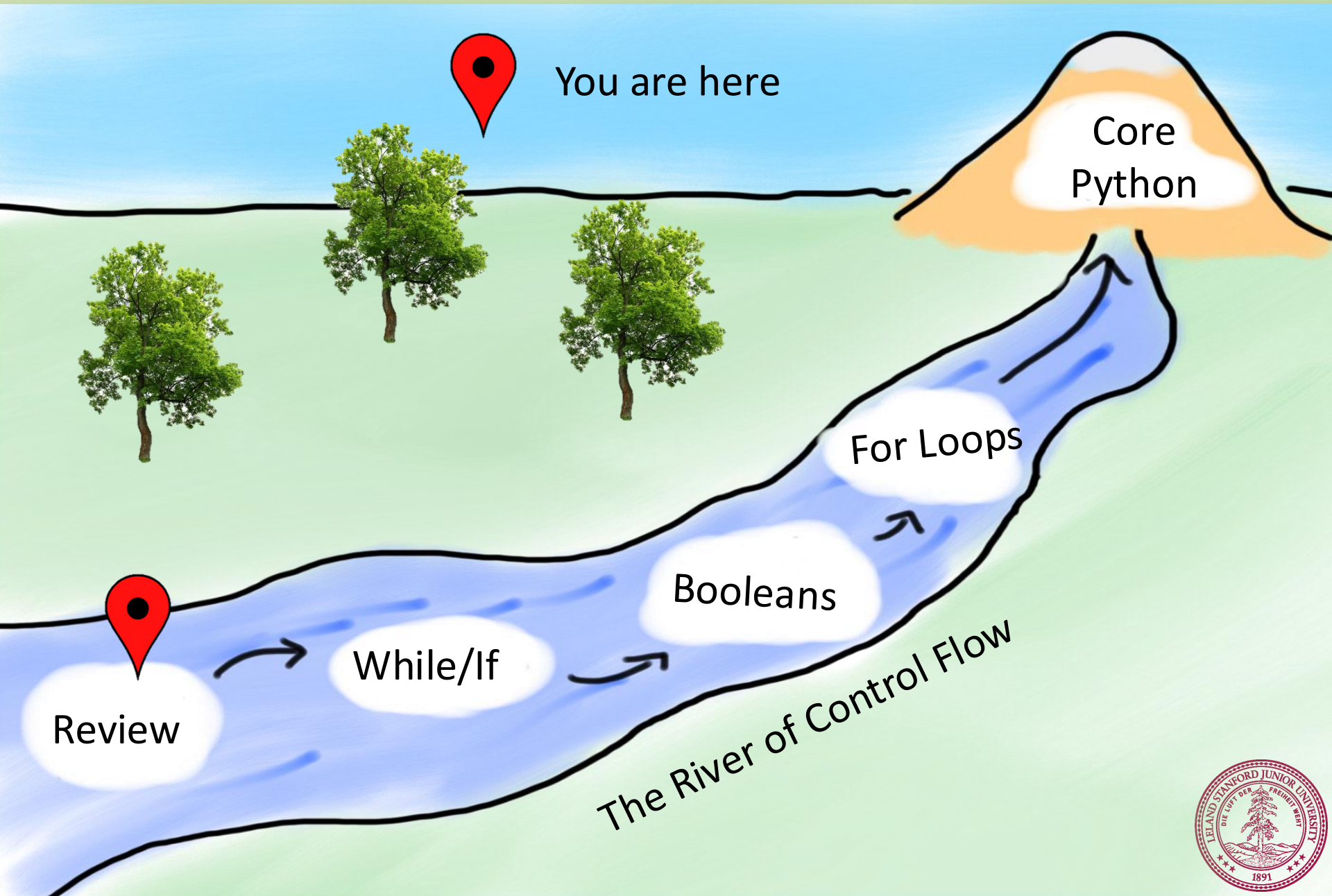


# Today's Goal

1. Be able to use For / While / If in Python

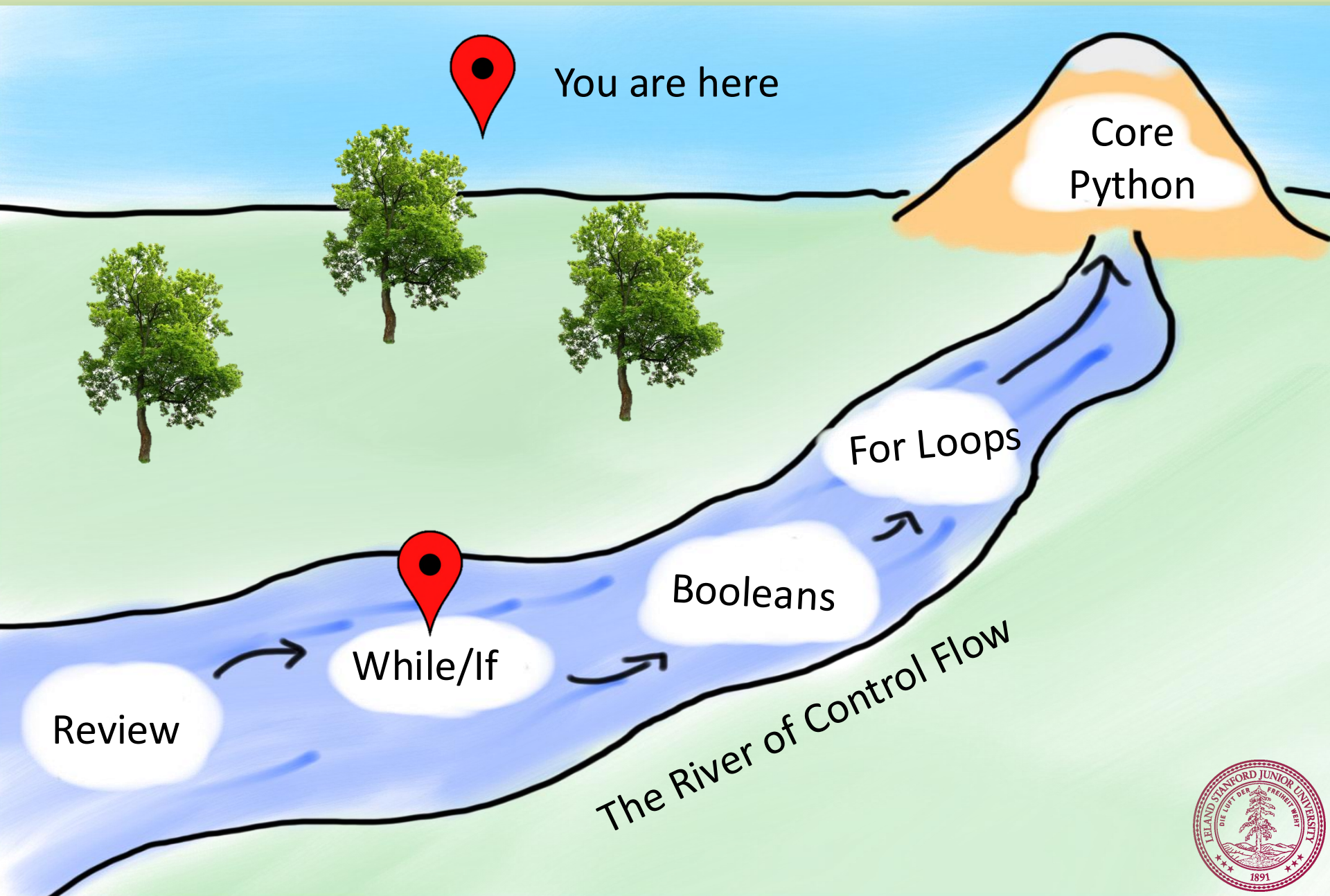


# Today's Route





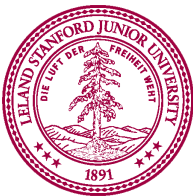
# Today's Route



# While Loop in Karel

```
while front_is_clear() :  
    body
```

```
if beepers_present() :  
    body
```

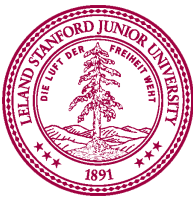


# While Loop Redux

**while** *condition* :  
    *body*

**if** *condition* :  
    *body*

The condition should be a **boolean** which is  
either **True** or **False**



# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

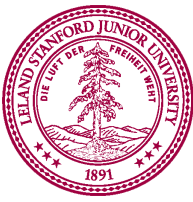
```
def main():
```

```
    time_str = input("Run time (s): ")
```

```
    time = float(time_str)
```

```
    distance = SPEED * time
```

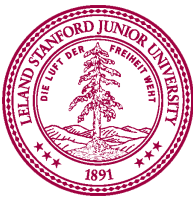
```
    print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():  
    while True:  
        time_str = input("Run time (s): ")  
        time = float(time_str)  
        distance = SPEED * time  
        print(f"Bolt can run {distance} meters.")
```





# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():
```

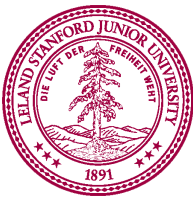
```
    while True:
```

```
        time_str = input("Run time (s): ")
```

```
        time = float(time_str)
```

```
        distance = SPEED * time
```

```
        print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
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```
def main():
```

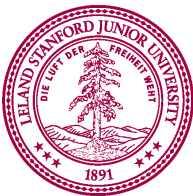
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    while True:
```

```
        time_str = input("Run time (s): ")
```

```
        time = float(time_str)
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```
        distance = SPEED * time
```

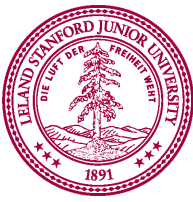
```
        print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

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def main():  
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```



# While Loop: Bolt Distance

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```
def main():
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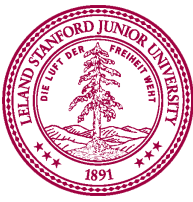
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    while True:
```

```
        time_str = input("Run time (s): ")
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```
        time = float(time_str)
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```
        distance = SPEED * time
```

```
        print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():
```

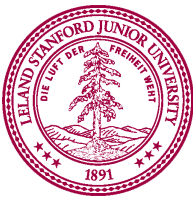
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# While Loop: Bolt Distance

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SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():
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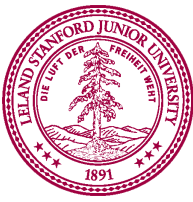
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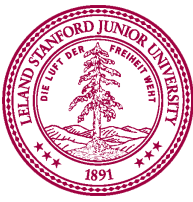
```
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```



# While Loop: Bolt Distance

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def main():  
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```





# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():
```

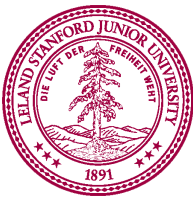
```
    while True:
```

```
        time_str = input("Run time (s): ")
```

```
        time = float(time_str)
```

```
        distance = SPEED * time
```

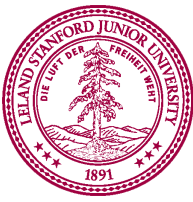
```
        print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

**SPEED = 10.44**    # Bolt's speed in meters / second

```
def main():  
    while True:   
        time_str = input("Run time (s): ")  
        time = float(time_str)  
        distance = SPEED * time  
        print(f"Bolt can run {distance} meters.")
```



# While Loop: Bolt Distance

```
SPEED = 10.44    # Bolt's speed in meters / second
```

```
def main():
```

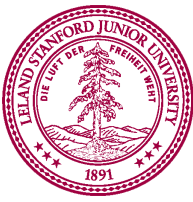
```
    while True:
```

```
        time_str = input("Run time (s): ")
```

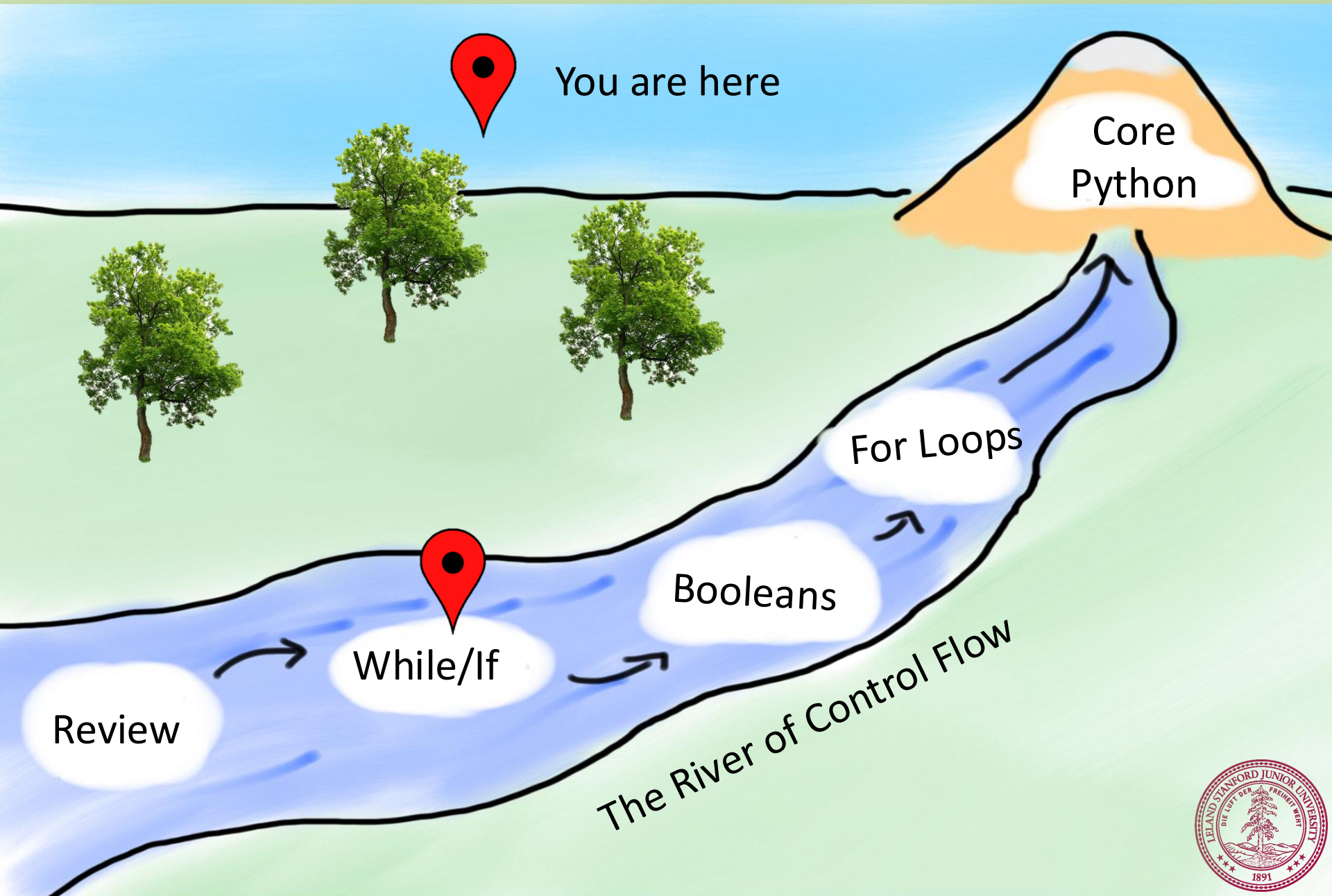
```
        time = float(time_str)
```

```
        distance = SPEED * time
```

```
        print(f"Bolt can run {distance} meters.")
```

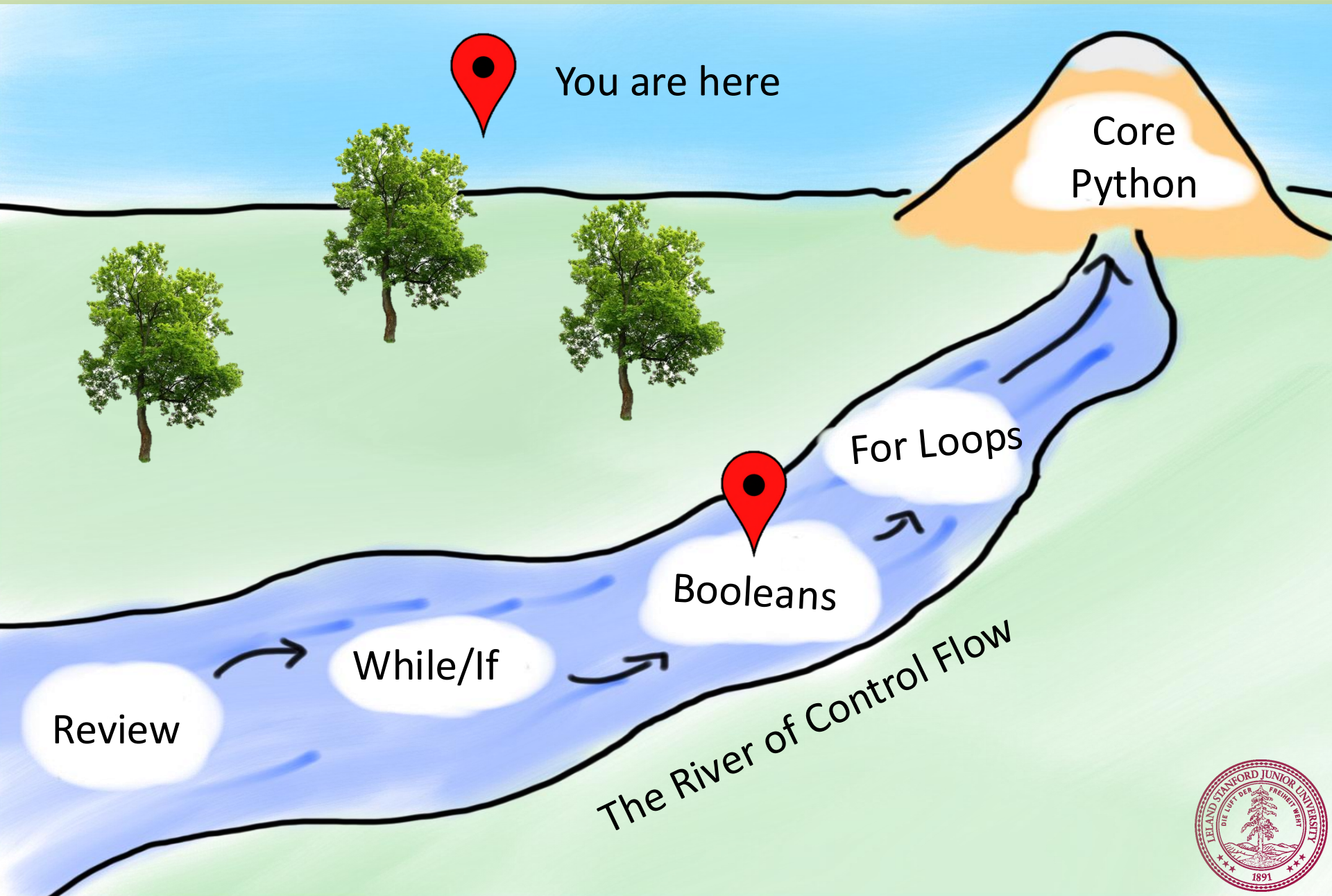


# Today's Route





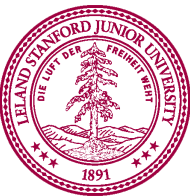
# Today's Route



# Booleans

`front_is_clear()`

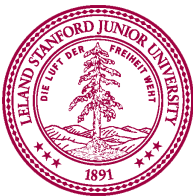
**True**



# Booleans

beepers\_present()

True

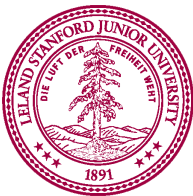


# Booleans

```
s = "123"
```

```
s.isdigit()
```

True

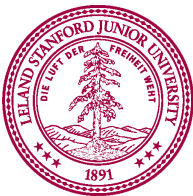




# Booleans

`my_var < 3`

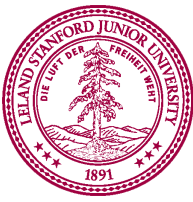
**True**



# Comparison Operators

Operator	Meaning	Example	Value
==	equals	1 + 1 == 2	True
!=	does not equal	3.2 != 2.5	True
<	less than	10 < 5	False
>	greater than	10 > 5	True
<=	less than or equal to	126 <= 100	False
>=	greater than or equal to	5.0 >= 5.0	True

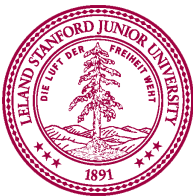
\* All have equal precedence



# Comparison Operators

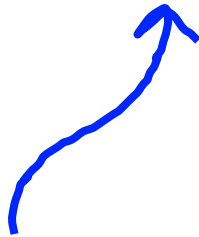
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>=	greater than or equal to	5.0 >= 5.0	True

\* All have equal precedence



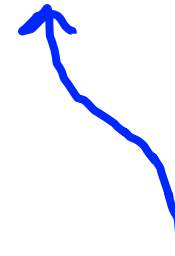
# Spot the difference #1

$x = 7$

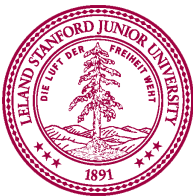


Sets the value of a variable named x to be 7. Creates the variable if it didn't exist.

$x == 7$

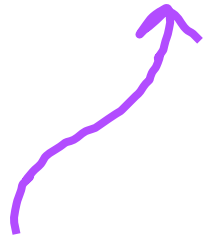


Checks if a variable named x has the value 7



# Spot the difference #2

`x == 5`

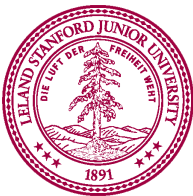


Checks if x is the  
number 5

`x == "5"`



Checks if x is the  
string 5

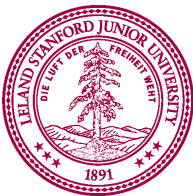


# Comparison Operators

```
if 1 < 2 :  
    print("1 is less than 2")
```

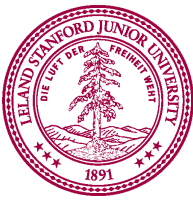
---

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("That number is 0")  
else :  
    print("That number is not 0.")
```



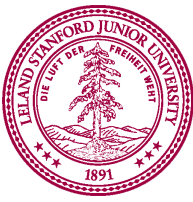
# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
else:  
    if num > 0:  
        print("Your number is positive")  
    else:  
        print("Your number is negative")
```



# If Else Revisited

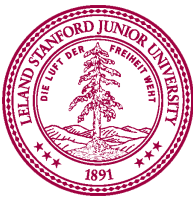
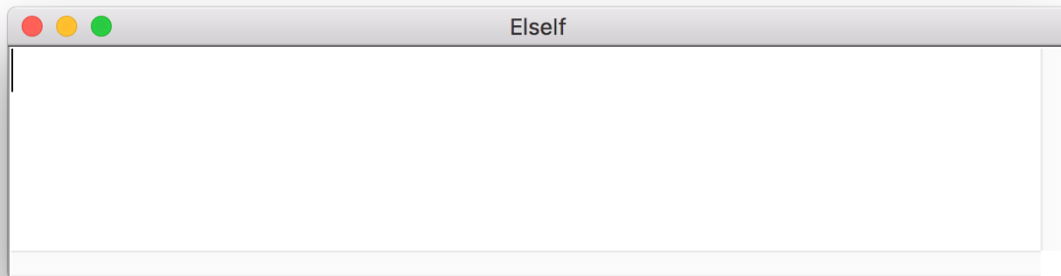
```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```





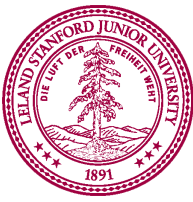
# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```



# If Else Revisited

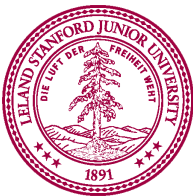
```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```



# If Else Revisited

"5"

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```



# If Else Revisited

5

"5"

```
num = int(input("Enter a number: "))
```

```
if num == 0:
```

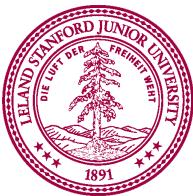
```
    print("Your number is 0 ")
```

```
elif num > 0:
```

```
    print("Your number is positive")
```

```
else:
```

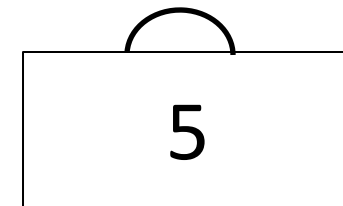
```
    print("Your number is negative")
```



# If Else Revisited

5

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```

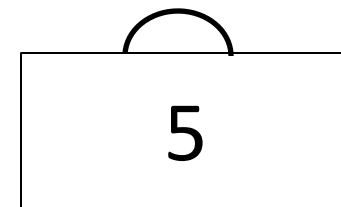


num



# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```

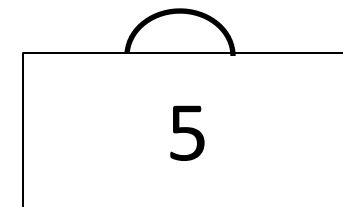


num



# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```

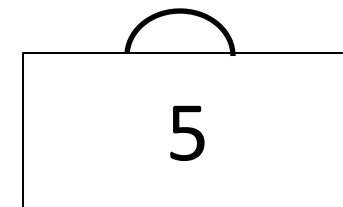
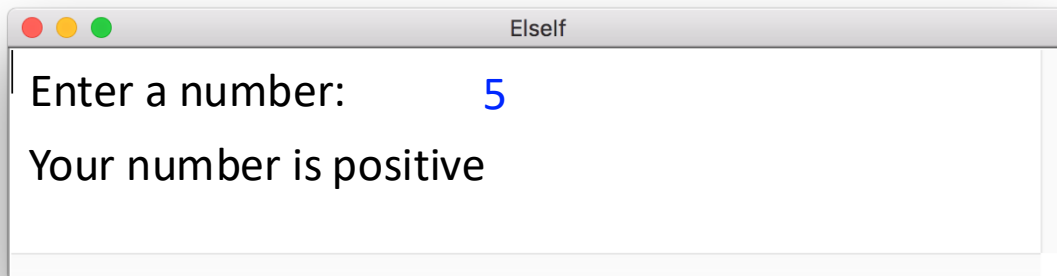


num



# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```



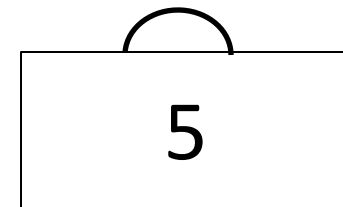
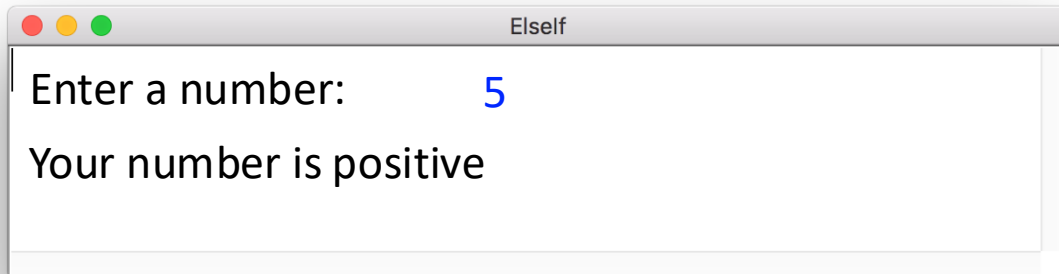
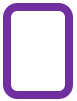
num



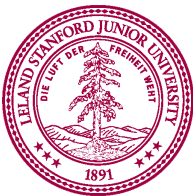


# If Else Revisited

```
num = int(input("Enter a number: "))  
if num == 0:  
    print("Your number is 0 ")  
elif num > 0:  
    print("Your number is positive")  
else:  
    print("Your number is negative")
```



num

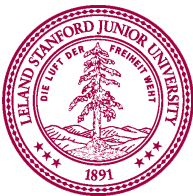


# Conditions in Python



Use **while** and **if** statements in Python.

They are the same as in Karel, except that the *test* can be any expression that evaluates to **True** or **False**



Amazing

# Guess My Number

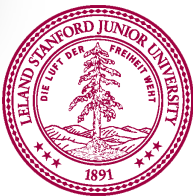
```
GuessMyNumber
I am thinking of a number between 0 and 99...
Enter a guess: 50
Your guess is too high

Enter a new number: 25
Your guess is too low

Enter a new number: 40
Your guess is too low

Enter a new number: 45
Your guess is too low

Enter a new number: 48
Congrats! The number was: 48
|
```

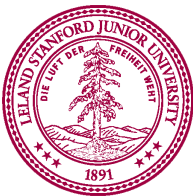
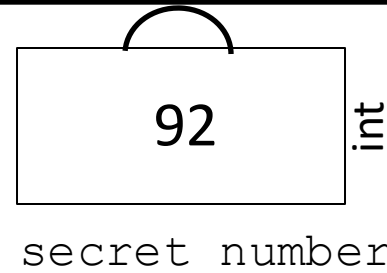


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
    # True if guess is less than secret number
    if guess < secret_number:
        print("Your guess is too low")
    else:
        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

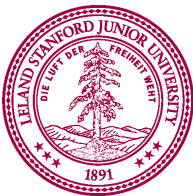
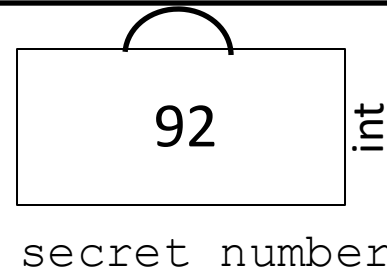


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
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        print("Your guess is too low")
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        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

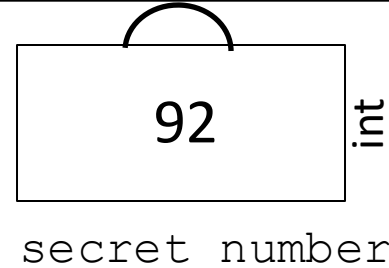
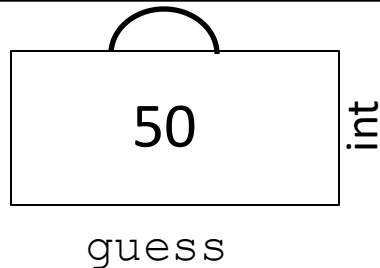


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
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    print("") # an empty line
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print(f"Congrats! The number was: {secret_number}")
```

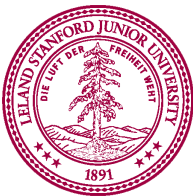
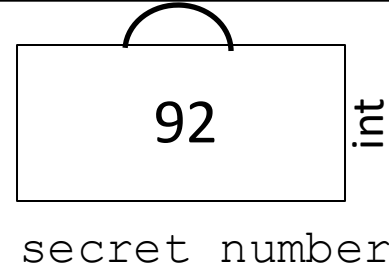
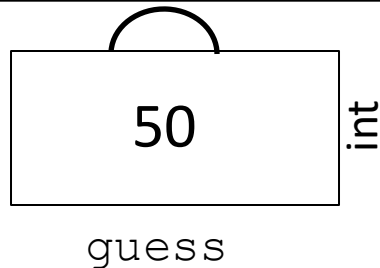


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    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```



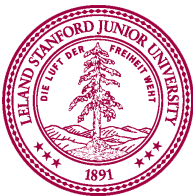
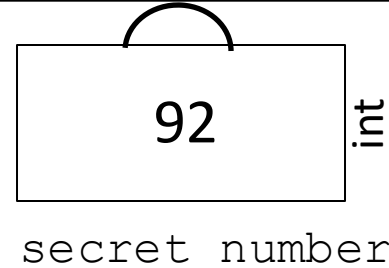
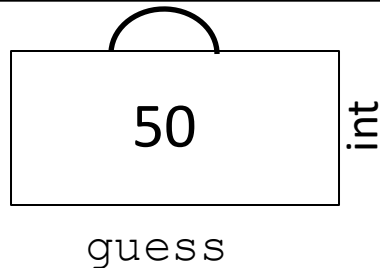


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    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

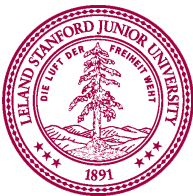
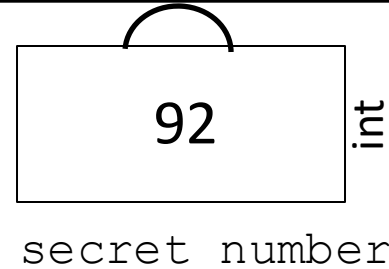
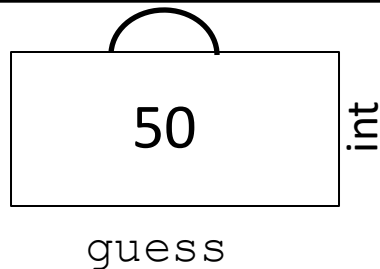


# Guess My Number

```
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print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
    # True if guess is less than secret number
    if guess < secret_number:
        print("Your guess is too low")
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    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

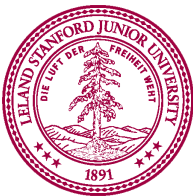
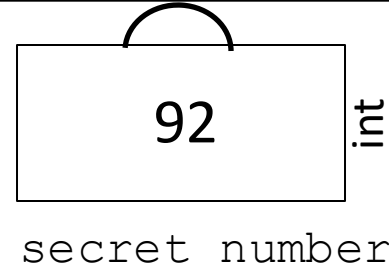
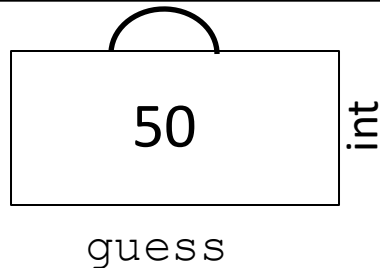


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
    # True if guess is less than secret number
    if guess < secret_number:
        print("Your guess is too low")
    else:
        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

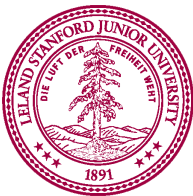
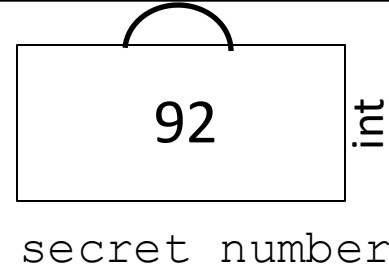
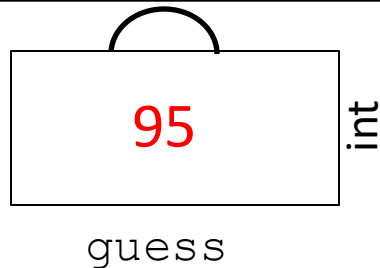


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
    # True if guess is less than secret number
    if guess < secret_number:
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    else:
        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

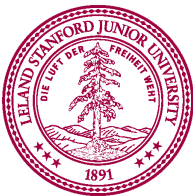
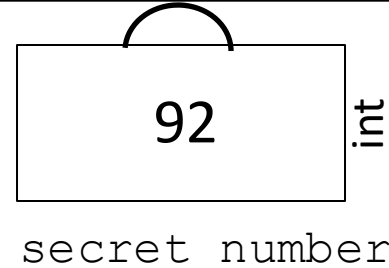
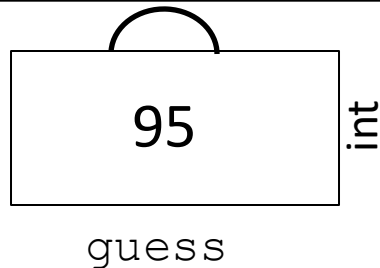


# Guess My Number

```
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print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
while guess != secret_number:
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    if guess < secret_number:
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    print("") # an empty line
    guess = int(input("Enter a new guess: "))


print(f"Congrats! The number was: {secret_number}")
```

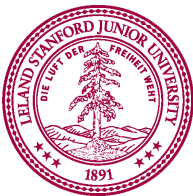
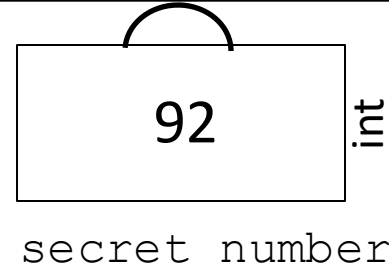
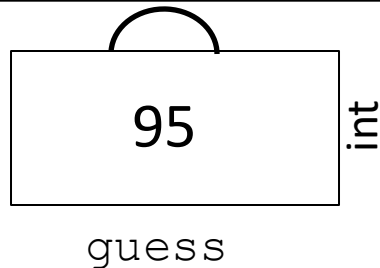


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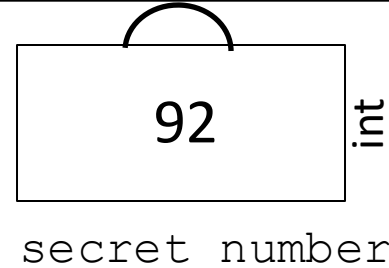
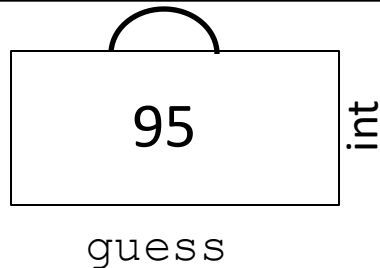


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        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

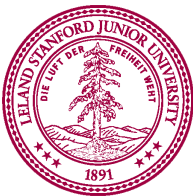
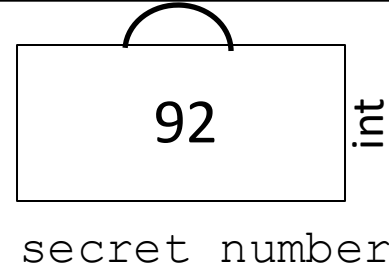
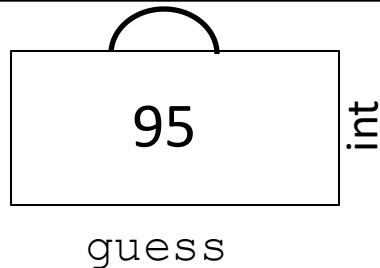


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# True if guess is not equal to secret number
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print("") # an empty line
guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```



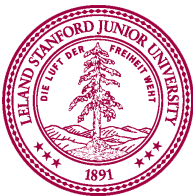
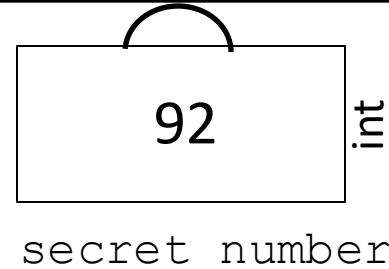
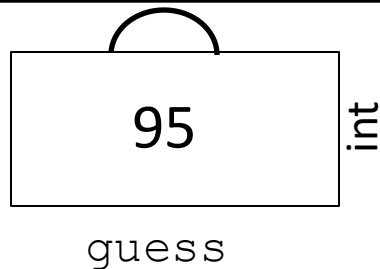


# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
# True if guess is not equal to secret number
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    # True if guess is less than secret number
    if guess < secret_number:
        print("Your guess is too low")
    else:
        print("Your guess is too high")

    print("") # an empty line
    guess = int(input("Enter a new guess: "))

print(f"Congrats! The number was: {secret_number}")
```

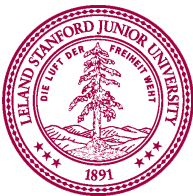
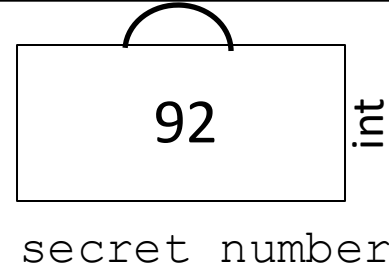
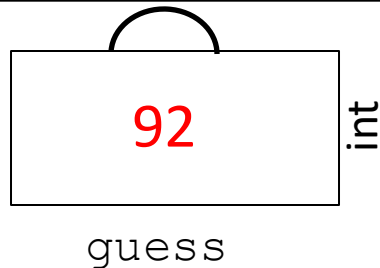


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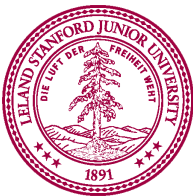
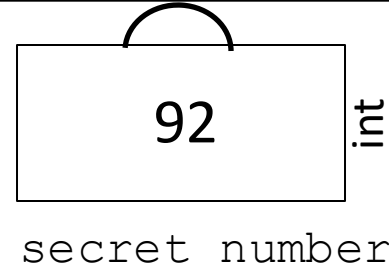
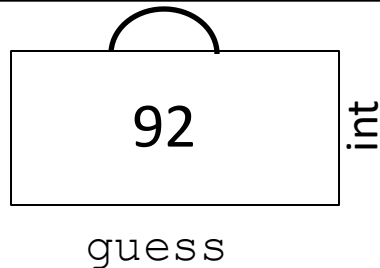


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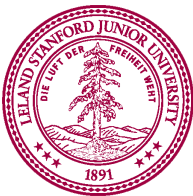
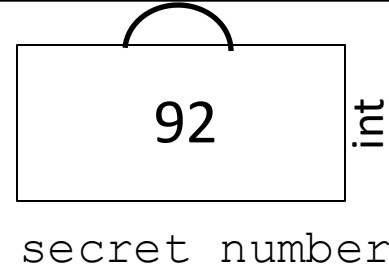
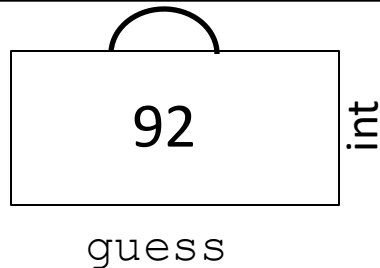


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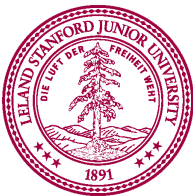
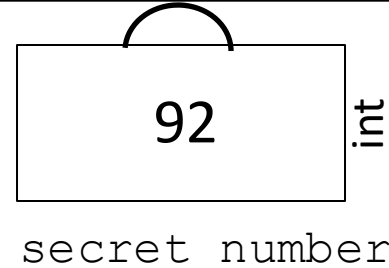
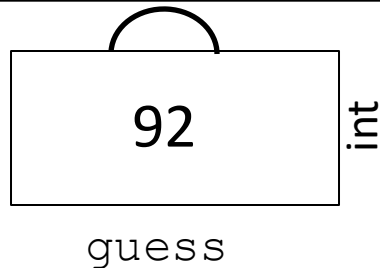


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```



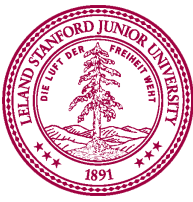
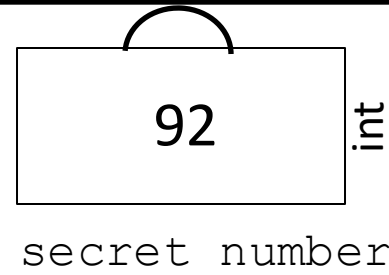
# Behind the Scenes



# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
```

```
print(f"Congrats! The number was: {secret_number}")
```



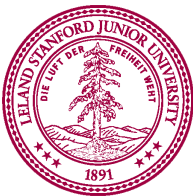
# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
```

```
while ???:  
    # Repeat some stuff???
```

```
print(f"Congrats! The number was: {secret_number}")
```

---





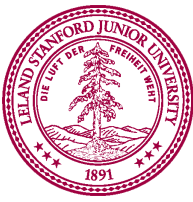
# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
```

```
while ???:  
    # Get a new guess  
  
    # Report high/low
```

```
print(f"Congrats! The number was: {secret_number}")
```

---



# Guess My Number

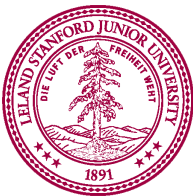
```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
```

```
while ???:  
    # Get a new guess  
    guess = int(input("Enter a guess: "))
```

```
    # Report high/low
```

```
print(f"Congrats! The number was: {secret_number}")
```

---



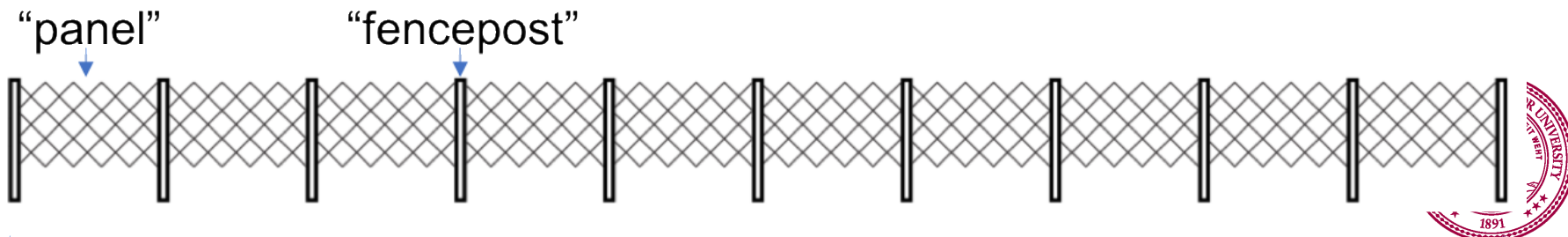
# Guess My Number

```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
```

```
while guess != secret_number:
    # Get a new guess
    guess = int(input("Enter a guess: "))
```

```
    # Report high/low
```

```
print(f"Congrats! The number was: {secret_number}")
```



# Guess My Number

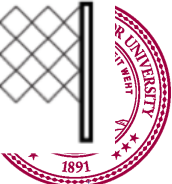
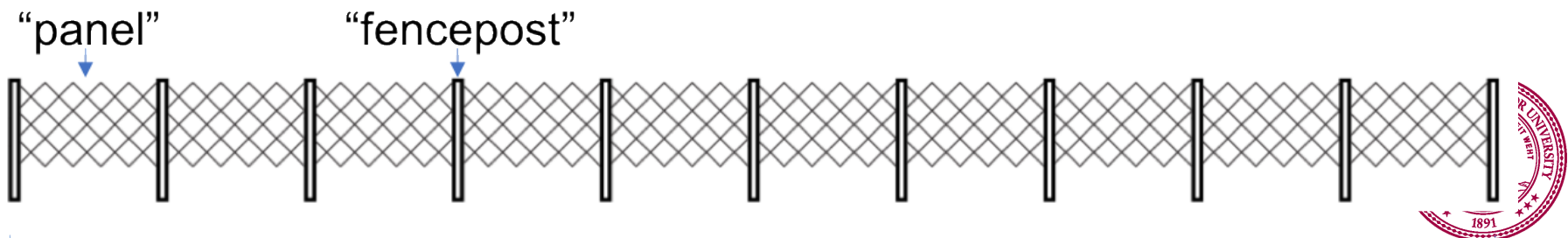
```
secret_number = random.randint(1, 99)
print("I am thinking of a number between 1 and 99...")
guess = int(input("Enter a guess: "))
```

```
while guess != secret_number:
    # Report high/low
```

```
# Get a new guess
```

```
    guess = int(input("Enter a guess: "))
```

```
print(f"Congrats! The number was: {secret_number}")
```



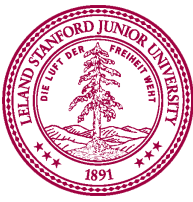
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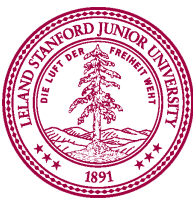
print(f"Congrats! The number was: {secret_number}")
```



# George Boole



English Mathematician teaching in Ireland 1815 – 1864  
Boole died of being too cool



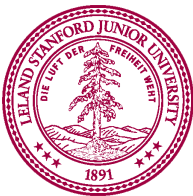
# Logical Operators

In order of precedence:

Operator	Example	Result
<code>not</code>	<code>not (2 == 3)</code>	<code>True</code>
<code>and</code>	<code>(2 == 3) and (-1 &lt; 5)</code>	<code>False</code>
<code>or</code>	<code>(2 == 3) or (-1 &lt; 5)</code>	<code>True</code>

Can "chain" tests

```
# is x between 2 and 10?  
2 <= x and x <= 10
```



# Boolean Variables

```
# Store expressions that evaluate to True/False
```

```
x = 1 < 2      # True
```

```
y = 5.0 == 4.0 # False
```

```
# Directly set to True/False
```

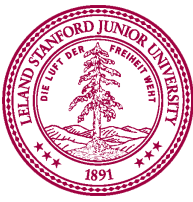
```
is_sheltering = True
```

```
is_raining = False
```

```
play_again = input('Play again? "y" or "n"') == 'y'
```

```
if play_again:
```

```
    ...
```





# Today's Route

