

Module 2: Conditionals and Loops



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If Statement

Execute a certain block of code only if a certain condition is true

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If Statement

Execute a certain block of code only if a certain condition is true

```
x=6  
  
if x>5:  
    print(x)
```

Conditional: must
return boolean

If statements always begin
with an "if"

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If Statement

Execute a certain block of code only if a certain condition is true

```
x=6  
  
if x>5:  
    print(x)
```

Conditional: must
return boolean

If statements always begin
with an "if"

```
x = 6  
#is x greater than 5?  
x>5
```

True

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If Statement

Execute a certain block of code only if a certain condition is true

```
x=6
if x>5:
    print(x)
```

Conditional: must return boolean

":" ends statement

If statements always begin with an "if"

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If Statement

Execute a certain block of code only if a certain condition is true

```
x=6
if x>5:
    print(x)
```

Conditional: must return boolean

":" ends statement

If statements always begin with an "if"

If condition is true, then indented line of code will run

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If Statement

```
x = 6
#is x greater than 5?
if x>5:
    print(x)
```

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If + Else Statement

Else statement allows us to specify separate directions if the condition with the if is False.

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If + Else Statement

Else statement allows us to specify separate directions if the condition with the if is False.

```
x = 4
#is x greater than 5?
if x>5:
    print(x)
else:
    print("Below 5")
```

- Else **always** executes when the if condition is False.
- Match if + else by indentation
- Else is optional, meaning an if statement doesn't have to have an accompanying else.

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If + Else Statement

```
x = 4
#is x greater than 5?
if x>5:
    print(x)
else:
    print("Below 5")
```

Below 5

If condition is False, so code inside of else executes

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If + Elif + Else Statement

How do I specify multiple conditions?...

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If + Elif + Else Statement

How do I specify multiple conditions?...elif

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If + Elif + Else Statement

How do I specify multiple conditions?...elif

```
x = 'killer rabbit'
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
else:
    print("Run!!!!")
```

- Comes between if and else
- Can have arbitrary number of elifs
- First if/elif condition that is true is executed and only this block is executed
 - If no if/elif condition is true then else is executed
- Indentation matches up if/elif/else statements

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If + Elif + Else Statement

```
x = 'killer rabbit'
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
else:
    print("Run!!!!")
```

```
x == 'roger'
```

False

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If + Elif + Else Statement

```
x = 'killer rabbit'
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
else:
    print("Run!!!!")
```

```
x == 'bugs'
```

False

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If + Elif + Else Statement

```
x = 'killer rabbit'
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
else:
    print("Run!!!!")
```

```
x == 'bugs'
```

False

Since all if/elif conditions were False, else statement executes

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If + Elif + Else Statement

```
x = 'killer rabbit'
▼ if x == 'roger':
    print("hello jessica")
▼ elif x == 'bugs':
    print("What's up doc")
▼ else:
    ➡ print("Run!!!!")
```

Run!!!!

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If + Elif + Else Statement

We can just have an if + elif, with no else:

```
x = 'killer rabbit'
▼ if x == 'roger':
    print("hello jessica")
▼ elif x == 'bugs':
    print("What's up doc")
```

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If + Elif + Else Statement

We can just have an if + elif, with no else:

```
x = 'killer rabbit'
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
```

Nothing is printed since neither if not elif condition is true

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If + Elif + Else Statement


Example with multiple elif conditions:

```
x = 'killer rabbit'
season = "winter"
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
elif season == "winter":
    print("no bunnies")
else:
    print("Run!!!!")
```

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If + Elif + Else Statement

Example with multiple elif conditions:




```
x = 'killer rabbit'
season = "winter"
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
elif season == "winter":
    print("no bunnies")
else:
    print("Run!!!!")
```

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If + Elif + Else Statement

Example with multiple elif conditions:




```
x = 'killer rabbit'
season = "winter"
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
elif season == "winter":
    print("no bunnies")
else:
    print("Run!!!!")
```

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If + Elif + Else Statement

Example with multiple elif conditions:




```
x = 'killer rabbit'
season = "winter"
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
elif season == "winter":
    print("no bunnies")
else:
    print("Run!!!!")
```

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If + Elif + Else Statement

Example with multiple elif conditions:



```
x = 'killer rabbit'
season = "winter"
if x == 'roger':
    print("hello jessica")
elif x == 'bugs':
    print("What's up doc")
elif season == "winter":
    print("no bunnies")
else:
    print("Run!!!!")
```

no bunnies

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If + Elif + Else Statement

Example with multiple elif conditions:

```

x = 'killer rabbit'
season = "winter"
❌ if x == 'roger':
    print("hello jessica")
❌ elif x == 'bugs':
    print("What's up doc")
😊 elif season == "winter":
    print("no bunnies")
❌ else:
    print("Run!!!!")

```

no bunnies

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Nested Conditionals

We can have if statements nested within if statements:

```

#Nested if statement
age = 22
activity = "eat"

if age >= 21:
    if activity == 'eat':
        print("food menu")
    elif activity == "drinks":
        print("drink menu")
    else:
        print("wrong place")
else:
    print("You are underaged")

```

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Nested Conditionals

We can have if statements nested within if statements:

```

#Nested if statement
age = 22
activity = "eat"

if age >=21:
    if activity == 'eat':
        print("food menu")
    elif activity == "drinks":
        print("drink menu")
    else:
        print("wrong place")
else:
    print("You are underaged")
  
```

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Nested Conditionals

We can have if statements nested within if statements:

```


#Nested if statement
age = 22
activity = "eat"

if age >=21:
    if activity == 'eat':
        print("food menu")
    elif activity == "drinks":
        print("drink menu")
    else:
        print("wrong place")
else:
    print("You are underaged")
  
```

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Nested Conditionals


We can have if statements nested within if statements:



```

#Nested if statement
age = 22
activity = "eat"

if age >=21:
    if activity == 'eat':
        print("food menu")
    elif activity == "drinks":
        print("drink menu")
    else:
        print("wrong place")
else:
    print("You are underaged")
  
```



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Nested Conditionals


We can have if statements nested within if statements:



```

#Nested if statement
age = 22
activity = "eat"

if age >=21:
    if activity == 'eat':
        print("food menu")
    elif activity == "drinks":
        print("drink menu")
    else:
        print("wrong place")
else:
    print("You are underaged")
  
```



food menu

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Specifying Multiple Conditions

How do you specify multiple conditions in a conditional statements?

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Specifying Multiple Conditions - and

How do you specify multiple conditions in a conditional statements?

```
#And  
x = 10  
x > 5 and x % 2 == 0
```

Condition 1

Condition 2


Conditional statements
w/ "and"

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Specifying Multiple Conditions - and

How do you specify multiple conditions in a conditional statements?

```
#And
x = 10
x > 5 and x % 2 == 0
```



Condition 1 Condition 2

AND

- All conditions must evaluate to True
- Can have arbitrary number of conditions

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Specifying Multiple Conditions - and

How do you specify multiple conditions in a conditional statements?

```
#And
x = 10
x > 5 and x % 2 == 0
```

True

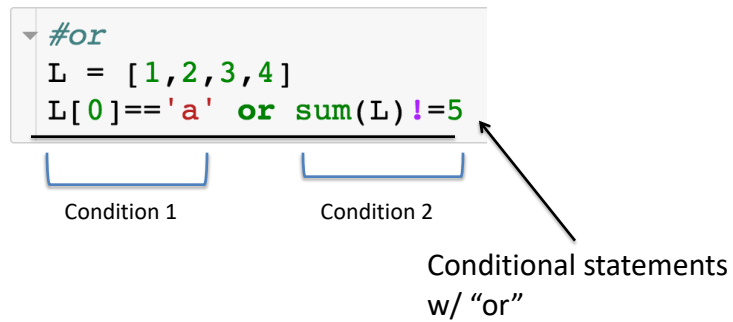
```
#Another example
name = 'Jake'
name[0] == 'J' and len(name) > 5
```

False

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Specifying Multiple Conditions - or

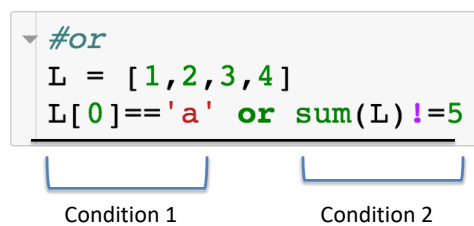
How do you specify multiple conditions in a conditional statements?



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Specifying Multiple Conditions - or

How do you specify multiple conditions in a conditional statements?



OR

- At least one condition must evaluate to True
- Can have arbitrary number of conditions

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Specifying Multiple Conditions

How do you specify multiple conditions in a conditional statements?

```

#or
L = [1,2,3,4]
L[0]=='a' or sum(L)!=5
True

```

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Specifying Multiple Conditions

How do you specify multiple conditions in a conditional statements?

```

#or
L = [1,2,3,4]
L[0]=='a' or sum(L)!=5
True

```

```

#And + or
(name=="Joe" or 'a' in name) and 5 not in L
True

```

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Nested Conditionals + and/or

```
#Nested Conditionals
bat_avg = 0.312
hr = 39
rbi = 103
if bat_avg > 0.33:
    print("all-star")
else:
    if hr > 40 or rbi > 150:
        print("all-star")
    elif bat_avg > 0.3 and hr > 30 and rbi > 100:
        print("all-star")
    else:
        print("nope")
```

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Nested Conditionals

```
#Nested Conditionals
bat_avg = 0.312
hr = 39
rbi = 103
if bat_avg > 0.33:
    print("all-star")
else:
    if hr > 40 or rbi > 150:
        print("all-star")
    elif bat_avg > 0.3 and hr > 30 and rbi > 100:
        print("all-star")
    else:
        print("nope")
```

all-star

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For Loops

Use cases of for loops:

- Iterate over the elements of a list or string
 - For each element, perform some sort of operation - count or sum
- Perform some action a specified number of times
 - Deal out 5 cards
 - Have a student go through all 100 lockers

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For Loops w/ List

- Compute sum of elements of a list
- Use for loop to iterate over the elements of the list

```
list_nums = [2,4,6,8]
total = 0

for num in list_nums:
    total+=num
```

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For Loops w/ List

- Compute sum of elements of a list
- Use for loop to iterate over the elements of the list

```
list_nums = [2,4,6,8]
total = 0
```

Keyword "for" → **for** num in list_nums:
 Loop variable – takes on each value of loop target → **num**
 Loop target – object to be iterated over → list_nums:
 total+=num

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For Loops w/ List

Can call loop variable whatever you want

```
num = 2
total = 0
```

↓

```
list_nums = [2,4,6,8]
total = 0
```

→ **for** num in list_nums:
 total+=num

Block of code to run each iteration of for loop

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For Loops w/ List

```
num = 2  
total = 2  
list_nums = [2, 4, 6, 8]  
total = 0  
  
for num in list_nums:  
    → total += num
```

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For Loops w/ List

```
num = 4  
total = 2  
list_nums = [2, 4, 6, 8]  
total = 0  
  
→ for num in list_nums:  
    total += num
```

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For Loops w/ List

```
num = 4  
total = 6  
list_nums = [2, 4, 6, 8]  
total = 0  
  
for num in list_nums:  
    → total += num
```

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For Loops w/ List

```
num = 6  
total = 6  
list_nums = [2, 4, 6, 8]  
total = 0  
  
→ for num in list_nums:  
    total += num
```

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For Loops w/ List

```
num = 6  
total = 12  
list_nums = [2, 4, 6, 8]  
total = 0  
  
for num in list_nums:  
    → total += num
```

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For Loops w/ List

```
num = 8  
total = 12  
list_nums = [2, 4, 6, 8]  
total = 0  
  
→ for num in list_nums:  
    total += num
```

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For Loops w/ List

```

num = 8
total = 20
list_nums = [2, 4, 6, 8]
total = 0

for num in list_nums:
    total += num

```

Diagram annotations: A green line is under the list `list_nums`. A black arrow points down to the element `8` in the list. A blue arrow points to the `total += num` line.

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For Loops w/ Strings

- Now the loop target is a string
- Compute the number of words in sentence

```

sentence = "Charlie likes walks"
count = 0
for c in sentence:
    if c == " ":
        count += 1

total_words = count + 1

```

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For Loops w/ Strings

c = "C"

count = 0



sentence = "Charlie likes walks"

count = 0

for c in sentence:

if c == " ":

count += 1

total_words = count + 1

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For Loops w/ Strings

c = "C"

count = 0



sentence = "Charlie likes walks"

count = 0

for c in sentence:

if c == " ":

count += 1

total_words = count + 1

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For Loops w/ Strings

```
c = "h"  
count = 0  
↓  
sentence = "Charlie likes walks"  
count = 0  
→ for c in sentence:  
    if c == " ":  
        count += 1  
  
total_words = count + 1
```

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For Loops w/ Strings

```
c = "h"  
count = 0  
↓  
sentence = "Charlie likes walks"  
count = 0  
→ for c in sentence:  
    if c == " ":  
        count += 1  
  
total_words = count + 1
```

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For Loops w/ Strings

```

c = "e"
count = 0
... ↓
sentence = "Charlie likes walks"
count = 0
→ for c in sentence:
    if c == " ":
        count += 1

total_words = count + 1

```

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For Loops w/ Strings

```

c = "e"
count = 0
↓
sentence = "Charlie likes walks"
count = 0
→ for c in sentence:
    if c == " ":
        count += 1

total_words = count + 1

```

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For Loops w/ Strings

```

c = " "
count = 0
sentence = "Charlie likes walks"
count = 0
for c in sentence:
    if c == " ":
        count+=1
total_words = count+1

```

Diagram illustrating the execution of the code. A blue arrow points to the `for c in sentence:` line, and a black arrow points to the `count+=1` line.

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For Loops w/ Strings

```

c = " "
count = 0
sentence = "Charlie likes walks"
count = 0
for c in sentence:
    if c == " ":
        count+=1
total_words = count+1

```

Diagram illustrating the execution of the code. A blue arrow points to the `if c == " ":` line, and a black arrow points to the `count+=1` line.

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For Loops w/ Strings

```

c = " "
count = 1
sentence = "Charlie likes walks"
count = 0
for c in sentence:
    if c == " ":
        count += 1
total_words = count + 1

```

Diagram: A black arrow points from the space character in the string "Charlie likes walks" to the space character in the condition `c == " "`. A blue arrow points from the `count += 1` line to the `count + 1` in the final `total_words` calculation.

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For Loops w/ Strings

```

c = "l"
count = 1
sentence = "Charlie likes walks"
count = 0
for c in sentence:
    if c == " ":
        count += 1
total_words = count + 1

```

Diagram: A blue arrow points from the left to the `for c in sentence:` line. A black arrow points from the space character in the string "Charlie likes walks" to the space character in the condition `c == " "`.

And so on...

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Summary: For Loops w/ Strings or Lists

- The loop target can be a string or a list
 - If the loop target is a list – iterate over the elements of the list by increasing index
 - If the loop target is a string – iterate over the characters of the string by increasing index
- We will see other python objects that can be loop for targets

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Range

Built-in range function →

```
#Using range
range(0, 5)
```

start (defaults to 0 if left off) →

end (non-inclusive) →

```
range(0, 5)
```

```
list(range(5))
```

```
[0, 1, 2, 3, 4]
```

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Range

Built-in range function →

```
#Using range
range(0,5)
```

start (defaults to 0 if left off) →

end (non-inclusive) →

```
range(0, 5)
```

```
list(range(5))
```

```
[0, 1, 2, 3, 4]
```

- Can use range(0,n) as loop target
 - Need consecutive integers
 - Need to repeat something n times

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For Loops w/ Range

- Using range() as loop target to get consecutive integers
- Compute even numbers ≥ 0

```
even_nums = []
for i in range(5):
    if i%2==0:
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = []  
i = 0
```

→

```
even_nums = []  
for i in range(5):  
    if i%2==0:  
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = []  
i = 0
```

```
even_nums = []  
for i in range(5):  
    → if i%2==0:  
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0]
i = 0
```

```
even_nums = [ ]
for i in range(5):
    if i%2==0:
        → even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0]
i = 1
```

```
→ even_nums = [ ]
for i in range(5):
    if i%2==0:
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0]
i = 1
```

```
even_nums = [ ]
for i in range(5):
    → if i%2==0:
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0]
i = 2
```

```
→ even_nums = [ ]
for i in range(5):
    if i%2==0:
        even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0]
i = 2
```

```
even_nums = [ ]
for i in range(5):
    → if i%2==0:
        even_nums+= [i]
```

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For Loops w/ Range


```
even_nums = [0, 2]
i = 2
```

```
even_nums = [ ]
for i in range(5):
    if i%2==0:
        → even_nums+= [i]
```

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For Loops w/ Range

```
even_nums = [0, 2]  
i = 3
```



```
even_nums = []  
for i in range(5):  
    if i%2==0:  
        even_nums+= [i]
```

And so on...

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For Loops w/ Range

- Using range() as loop target to do something n times.
 - Loop variables will not be used
- Get n random samples of U[0,1]


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For Loops w/ Range

- Using range() as loop target to do something n times.
 - Loop variables will not be used
- Get n random samples of U[0,1]

```
n = 10
random_nums = []
for i in range(n):
    x = np.random.uniform()
    random_nums += [x]
```

Loop will run n times




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For Loops w/ Range

- Using range() as loop target to do something n times.
 - Loop variables will not be used
- Get n random samples of U[0,1]

```
n = 10
random_nums = []
for i in range(n):
    x = np.random.uniform()
    random_nums += [x]
```

Loop will run n times



Generates U[0,1]



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For Loops w/ Range

How do I iterate over the indices of a list using a for loop?

```
L = [3, "S", 5, [7, 8, 9]]
```

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For Loops w/ Range

How do I iterate over the indices of a list using a for loop?

```
L = [3, "S", 5, [7, 8, 9]]
```

```
for i in range(len(L)):  
    print(L[i])
```

```
3  
S  
5  
[7, 8, 9]
```

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For Loops w/ Range

How do I iterate over the indices of a list using a for loop?

```
L = [3, "S", 5, [7, 8, 9]]
```

```
for i in range(len(L)):  
    print(L[i])
```

```
3  
S  
5  
[7, 8, 9]
```

Why would I ever need to do this?