Starter: Rewrite this code to use a for loop and the `range()` function:

In [8]:
```python
print('~' * 0)
print('~' * 1)
print('~' * 2)
print('~' * 3)
print('~' * 4)
print('~' * 5)
print('~' * 6)
print('~' * 7)
print('~' * 8)
```

```
~
~~
~~~
~~~~
~~~~~
~~~~~~
~~~~~~~
~~~~~~~~
```

Starter solution

In [9]:
```python
for number in range(9):
    print('~' * number)
```

```
~
~~
~~~
~~~~
~~~~~
~~~~~~
~~~~~~~
~~~~~~~~
```

Python Session 3

Topics in this session:

1. Comparison Operators
2. Logical Operators
3. If Statements

Comparisons and Logical Operators

Boolean: A data-type that is either `True` or `False`

Comparison operator: compare values to determine wheter something is `True` or `False`

This code checks if the user has input `'Monday'` using the `==` operator

```
In [10]:   today = input('What day is it? ')

           is_monday = today == 'Monday'

           print('Today is Monday: {}'.format(is_monday))
```

```
What day is it? Monday
Today is Monday: True
```

Summary of comparison operators in Python

Name	Python
Equal to	==
Not equal	!=
Greater than	>
Less than	<
Greater than or equal	>=
Less than or equal	<=

`float()` can convert strings to floats

This code checks if the current temperature is freezing:

```
In [11]:   temperature = input('What is the temperature? ')

           is_freezing = float(temperature) <= 0.0

           print('The temperature is freezing: {}'.format(is_freezing))
```

```
What is the temperature? 18
The temperature is freezing: False
```

Exercise 3.1: You have a budget of £10 and want to write a program to decide which burger restaurant to go to.

1. Input the `price` of a burger using `input()`
2. Check whether the `price` is less than or equal (`<=`) `10.00`
3. Print the result in the format below

```
Burger is within budget: True
```

Hint: remember to convert the input from a string to a decimal with `float()`

Solution

```
In [12]:  price = input('How much is a burger? ')

          within_budget = float(price) <= 10.00

          print('Burger is within budget: {}'.format(within_budget))
```

```
How much is a burger? 8.99
Burger is within budget: True
```

There are logical operators to combine multiple checks

Python	What it does
and	both expressions are `True`
or	at least one expression is `True`
not	reverse the expression (`True` becomes `False` and vice-versa)

This program will work out if you should visit Mars based on whether you want to visit and if you can afford it:

```
In [13]: mars_choice = input('Would you like to visit Mars? y/n ')
         is_willing = mars_choice == 'y'

         affordable = input('Can you afford to visit Mars? y/n ')
         can_afford = affordable == 'y'

         should_visit_mars = is_willing and can_afford

         print('You should visit Mars: {}'.format(should_visit_mars))
```

```
Would you like to visit Mars? y/n y
Can you afford to visit Mars? y/n n
You should visit Mars: False
```

Exercise 3.2: Add code to your burger program to input whether the restaurant has a vegetarian option

The output should say whether the cost is within budget **AND** has a vegetarian option

```
Restaurant meets criteria: True
```

Solution:

In [14]:
```python
price = input('How much is a burger? ')
vegetarian = input('Is there a vegetarian option? (y/n) ')

within_budget = float(price) <= 10.00
has_vegetarian = vegetarian == 'y'

is_good_choice = within_budget and has_vegetarian

print('Restaurant meets criteria: {}'.format(is_good_choice))
```

```
How much is a burger? 7.99
Is there a vegetarian option? (y/n) y
Restaurant meets criteria: True
```

If Statements

if statement: used to run a block of code depending on whether a condition is `True` or `False`

In [15]:
```python
password = input('password: ')

if password == 'jumanji':
    print('Success!')
```

```
password: jumanji
Success!
```

An `if` statement has the following:

1. The `if` keyword
2. A condition (comparison)
3. A colon
4. Body (indented four spaces)

condition

```
if house_number = 12:
    print('this is the house')
```

body
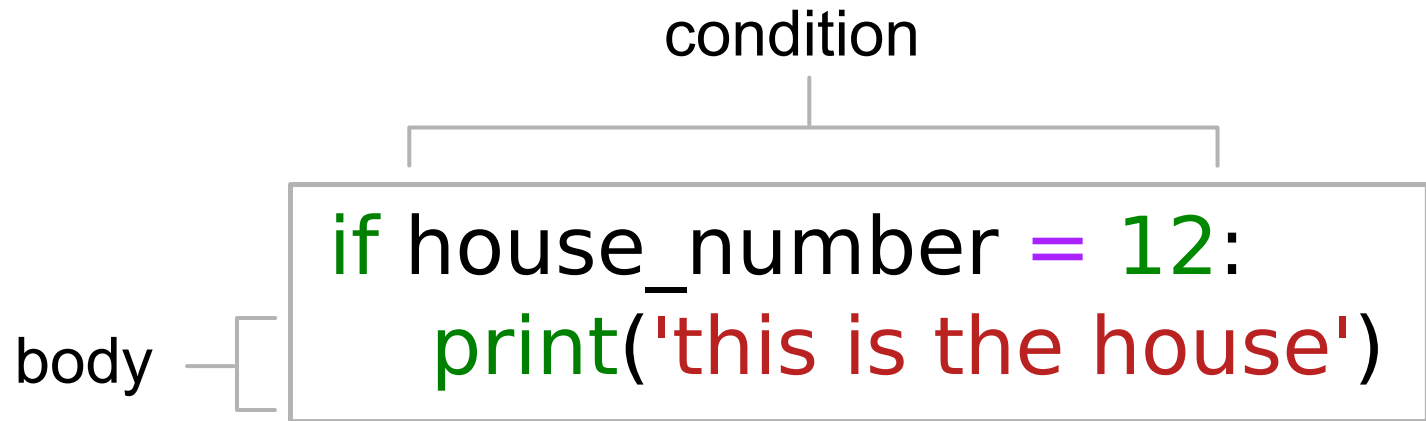
This program checks whether you are an admin and you have entered the right password:

In [16]:
```python
name = input("What is your name? ")
is_admin = name == 'admin'

password = input("What is your password? ")
is_password_correct = password == 'dinosaurs'

if is_admin and is_password_correct:
    print('Welcome')

if not is_admin or not is_password_correct:
    print('Go away')
```

```
What is your name? admin
What is your password? tigers
Go away
```

Exercise 3.3: Rewrite the output of your burger program to use if statements

If it is a good choice it should be:

```
This restaurant is a great choice!
```

If it is **not** a good choice it should be:

```
Probably not a good idea
```

Solution

In [18]:
```python
price = input('How much is a burger? ')
vegetarian = input('Is there a vegetarian option? (y/n) ')

within_budget = float(price) <= 10.00
has_vegetarian = vegetarian == 'y'

is_good_choice = within_budget and has_vegetarian

if is_good_choice:
    print('This restaurant is a great choice!')

if not is_good_choice:
    print('Probably not a good idea')
```

```
How much is a burger? 8.99
Is there a vegetarian option? (y/n) y
This restaurant is a great choice!
```

Else Statements

else statement: Used with an `if` statement and will run when the `if` condition is `False`

In [17]:

```python
password = input('password: ')

if password == 'jumanji':
    print('Success!')
else:
    print('Failure!')
```

```
password: jumanji
Success!
```

Here's the admin program rewritten to use `else`:

In [19]:
```python
name = input("What is your name? ")
is_admin = name == 'admin'

password = input("What is your password? ")
is_password_correct = password == 'dinosaurs'

if is_admin and is_password_correct:
    print('Welcome')

else:
    print('Go away')
```

```
What is your name? admin
What is your password? tigers
Go away
```

Exercise 3.4: Now that you've finished your burger, you want to pay for your food. Let's write a program to calculate your meal and apply a discount if applicable.

If your total meal costs more than £20 and you have a discount, the price will be reduced by 10%. The program should print "Discount applied" or "No discount" depending on whether the discount criteria was met.

```python
In [ ]:  meal_price = float(input('How much did the meal cost? '))

         discount_choice = input('Do you have a discount? y/n ')
         discount_applicable = discount_choice == 'y'
```

Solution

```
In [ ]:  meal_price = float(input('How much did the meal cost? '))

         discount_choice = input('Do you have a discount? y/n ')
         discount_applicable = discount_choice == 'y'

         if discount_applicable:
             meal_price = meal_price * 0.9
             print('Discount applied')
         else:
             print('No discount')

         print('Total cost: {}'.format(meal_price))
```

Elif Statements

elif statement: used after `if` statements to check whether another condition is `True` or `False`

```
In [21]:  dog_size = int(input('How big is the dog in kilograms? '))

          if dog_size > 75:
              print('That is a big dog')

          elif dog_size < 25:
              print('That is a small dog')

          else:
              print('That is an average dog')
```

```
How big is the dog in kilograms? 24
That is a small dog
```

You can use multiple `elif` statements together

```
In [22]:  dog_size = int(input('How big is the dog in kilograms? '))

          if dog_size > 75:
              print('That is a big dog')

          elif dog_size < 10:
              print('That dog could fit in my pocket')

          elif dog_size < 25:
              print('That is a small dog')

          else:
              print('That is an average dog')
```

```
How big is the dog in kilograms? 76
That is a big dog
```

Exercise 3.5: You're cooking a pizza and need to check that the oven is at the right temperature.

Write a program to:

- Ask the user to input the temperature
- Prints "The oven is too hot" if the temperature is over 200
- Prints "The oven is too cold" if the temperature is under 150
- Prints "The oven is at the perfect temperature" if the temperature is 180
- Prints "The temperature is close enough" for any other temperature

Solution

```
In [ ]:  temperature = float(input('What is the temperature of the oven? '))

         if temperature > 200:
             print('The oven is too hot')
         elif temperature < 150:
             print('The oven is too cold')
         elif temperature == 180:
             print('The oven is at the perfect temperature')
         else:
             print('The temperature is close enough')
```

Random

Python has a built-in library for random data

```
In [ ]:  import random

         random_integer = random.randint(1, 100)

         print(random_integer)
```

The `randint()` function generates a random number between two values

This program uses `randint()` to simulate dice with any number of sides

In [23]:

```python
import random

sides = int(input('How many sides does the die have? '))
random_integer = random.randint(1, sides)

print('You rolled a {}'.format(random_integer))
```

```
How many sides does the die have? 6
You rolled a 4
```

To practice if statements we will complete three different programs. The starting code for these programs in on the mini-site. Please download the three files now and save them in your CFG folder (with your other code):

- Exercise 3.6: Flip a coin
- Exercise 3.7: Rock, Paper, Scissors
- Exercise 3.8: Roulette

Exercise 3.6: This program uses random to simulate a coin flip.

To finish the program you will need to add the following:

- If the random coin flip matches the choice input by the user then they win
- Ohterwise if the random coin flip does not match the choice input by the user then they lose

Extension: Make the program still run even if the user enters their input in capitals or lowercase.

In [ ]:
```python
import random

def flip_coin():
    random_number = random.randint(1, 2)
    if random_number == 1:
        side = 'heads'
    else:
        side = 'tails'
    return side

choice = input('heads or tails: ')
result = flip_coin()

print('The coin landed on {}'.format(result))
```

Solution

```python
import random

def flip_coin():
    random_number = random.randint(1, 2)
    if random_number == 1:
        side = 'heads'
    else:
        side = 'tails'
    return side

choice = input('heads or tails: ')
result = flip_coin()

print('The coin landed on {}'.format(result))

if choice == result:
    print('You win!')
else:
    print('You lose')
```

```
heads or tails: heads
The coin landed on heads
You win!
```

Extension solution

```
In [2]:  import random

         def flip_coin():
             random_number = random.randint(1, 2)
             if random_number == 1:
                 side = 'heads'
             else:
                 side = 'tails'
             return side

         choice = input('heads or tails: ')
         result = flip_coin()

         print('The coin landed on {}'.format(result))

         if choice.lower() == result.lower():
             print('You win!')
         else:
             print('You lose')
```

```
heads or tails: heads
The coin landed on heads
You win!
```

Exercise 3.7: This program simulates rock, paper, scissors. The first winning condition has been added. To finish the program you'll need to add all of the other winning and losing conditions.

- Paper wins rock
- Rock wins scissors
- Scissors wins paper

Remember: The same choice causes players to draw! For example scissors vs. scissors is a draw.

```
In [3]:  import random

         def random_choice():
             choice_number = random.randint(1, 3)

             if choice_number == 1:
                 choice = 'rock'
             elif choice_number == 2:
                 choice = 'scissors'
             else:
                 choice = 'paper'

             return choice

         my_choice = input('Choose rock, scissors or paper: ')
         opponent_choice = random_choice()

         print('Your opponent chose {}'.format(opponent_choice))

         if my_choice == 'rock' and opponent_choice == 'scissors':
             print('You win!')
```

Choose rock, scissors or paper: paper
Your opponent chose paper

Solution

```
In [4]:   if my_choice == 'rock' and opponent_choice == 'scissors':
              print('You win!')

          elif my_choice == 'scissors' and opponent_choice == 'paper':
              print('You win!')

          elif my_choice == 'paper' and opponent_choice == 'rock':
              print('You win!')

          elif my_choice == opponent_choice:
              print('We draw!')

          else:
              print('You lose!')
```

```
We draw!
```

Solution (full program):

```python
import random

def random_choice():
    choice_number = random.randint(1, 3)

    if choice_number == 1:
        choice = 'rock'
    elif choice_number == 2:
        choice = 'scissors'
    else:
        choice = 'paper'

    return choice

my_choice = input('Choose rock, scissors or paper: ')
opponent_choice = random_choice()

print('Your opponent chose {}'.format(opponent_choice))

if my_choice == 'rock' and opponent_choice == 'scissors':
    print('You win!')

elif my_choice == 'scissors' and opponent_choice == 'paper':
    print('You win!')

elif my_choice == 'paper' and opponent_choice == 'rock':
    print('You win!')

elif my_choice == opponent_choice:
    print('We draw!')

else:
    print('You lose!')
```

In [5]:

```
Choose rock, scissors or paper: paper
Your opponent chose paper
We draw!
```

we draw.

Exercise 3.8: Not Quite Roulette

Ask the user to enter the following three things using `input()` : (1) The amount they want to bet. (2) a colour - red or black (3) and a number between 1 and 100

After generating a random number and colour:

- If the colour matches, the users keeps the amount that was bet
- If the number matches, the users wins double the amount that was bet
- If the colour and number matches, the users wins 100 times the amount that was bet
- When neither the colour or number matches the user wins 0
- Output: winning colour, winning number and the amount the user won

The following code will generate a random number and colour:

```
In [ ]:  import random

         def colour():
             random_number = random.randint(1, 2)

             if random_number == 1:
                 colour = 'red'
             else:
                 colour = 'black'

             return colour


         random_number = random.randint(1, 100)
         random_colour = colour()
```

Solution (add underneath provided code)

In [7]:
```python
bet = input('How much do you want to bet? ')
chosen_colour = input('Pick a colour (red or black): ')
chosen_number = input('Pick a number (between 1 and 100): ')

print('The wining colour is: ' + str(random_number))
print('The wining number is: ' + str(random_colour))

if chosen_colour == random_colour and chosen_number == random_number:
    win_value = float(bet)*100
    print('You win: ' + str(win_value))

elif chosen_colour == random_colour:
    print('You win: ' + bet)

elif chosen_number == random_number:
    win_value = float(bet)*2
    print('You win: ' + str(win_value))

else:
    print('You win: 0')
```

```
How much do you want to bet? 100
Pick a colour (red or black): red
Pick a number (between 1 and 100): 100
The wining colour is: 55
The wining number is: red
You win: 100
```

Full solution

```python
import random

def colour():
    random_number = random.randint(1, 2)

    if random_number == 1:
        colour = 'red'
    else:
        colour = 'black'

    return colour

random_number = random.randint(1, 100)
random_colour = colour()

bet = input('How much do you want to bet? ')
chosen_colour = input('Pick a colour (red or black): ')
chosen_number = input('Pick a number (between 1 and 100): ')

print('The wining colour is: ' + str(random_number))
print('The wining number is: ' + str(random_colour))

if chosen_colour == random_colour and chosen_number == random_number:
    win_value = float(bet)*100
    print('You win: ' + str(win_value))

elif chosen_colour == random_colour:
    print('You win: ' + bet)

elif chosen_number == random_number:
    win_value = float(bet)*2
    print('You win: ' + str(win_value))

else:
    print('You win: 0')
```

Recap

This session:

1. Comparison operators
2. Logical Operators
3. If Statements

Question 1: Equals to (==) is a comparison operator. Name two more comparison operators

Question 2: What is the output of this code?

```
In [ ]:  print(True and True)
         print(True and False)
         print(True or True)
         print(True or False)
```

Question 3: I expect this code to output "This is too many apples", but instead it outputs "That is a sensible number of apples". Why does this happen?

```python
apples = 100

if apples >= 10:
    print('That is a sensible number of apples')
elif apples > 50:
    print('This is too many apples')
elif apples < 10:
    print('That is not enough apples')
```

Homework: Session 3 homework questions on the mini-site