Starter: There are three mistakes in this program. What are the mistakes and how would you fix them?

In [ ]:

```python
carrots = input('How many carrots do you have? ')
rabbits = 6

if rabbits < carrots:
    print('There are not enough carrots')
elif rabbits > carrots:
    print('There are too many carrots')
else:
    print('You have the right number of carrots')
```

CODEFIRST:Girls

Python Session 4

This session:

1. Lists
2. Dictionaries

Lists

List: an ordered collection of values

List are written inside square brackets and separated by commas

A list of integers

```
In [3]: lottery_numbers = [4, 8, 15, 16, 23, 42]
```

A list of strings

```
In [ ]: student_names = ['Diedre', 'Hank', 'Helena', 'Salome']
```

Lists can be made up of values of one or more data types

```
In [ ]: person = ['Jess', 32]
```

List values can be accessed using their **index** in square brackets

```
In [7]: student_names = ['Diedre', 'Hank', 'Helena', 'Salome']

        print(student_names[2])
```

```
Helena
```

List indexes start counting from 0

```
In [8]: student_names = [
            'Diedre',     # index 0
            'Hank',       # index 1
            'Helena',     # index 2
            'Salome'      # index 3
        ]

        print(student_names[0])
```

```
Diedre
```

You can also set the values in lists using their indexes, similar to how you would set a variable

In [10]:
```python
student_names = [
    'Diedre',    # index 0
    'Hank',      # index 1
    'Helena',    # index 2
    'Salome'     # index 3
]

student_names[1] = 'Joshua'
print(student_names)
```

```
['Diedre', 'Joshua', 'Helena', 'Salome']
```

Exercise 4.1: When I'm travelling in the winter I often forget to pack warm clothes. Let's write a program to help me to remember the right clothes.

The program should check if the first item in the `clothes` list is `"shorts"`. If it is it should change the value to `"warm coat"`.

Extension: Change the other items in the list to clothing more appropriate to winter if the first item is `shorts`.

In [12]:
```
clothes = [
    "shorts",
    "shoes",
    "t-shirt",
]
```

```
['warm coat', 'shoes', 'jumper']
```

Solution

```
In [5]: clothes = [
            "shorts",
            "shoes",
            "t-shirt",
        ]

        if clothes[0] == 'shorts':
            clothes[0] = 'warm coat'

        print(clothes)
```

```
['warm coat', 'shoes', 't-shirt']
```

Extension Solution

In [4]:
```
clothes = [
    "shorts",
    "shoes",
    "t-shirt",
]

if clothes[0] == 'shorts':
    clothes[0] = 'warm coat'
    clothes[2] = 'jumper'

print(clothes)
```

```
['warm coat', 'shoes', 'jumper']
```

More list indexing

How do we get the last item from the list?

```
In [29]: clothes = ["shorts","shoes","t-shirt","dress","hat"]

         last_item = clothes[-1]

         print(last_item)
```

```
hat
```

List Slicing

List slicing enables us to get subsets of elements from lists, without using loops.

For example, if we want to get the first two items from our list:

```
In [30]: clothes = ["shorts","shoes","t-shirt","dress","hat"]

         first_two_items = clothes[: 2]

         print(first_two_items)
```

```
['shorts', 'shoes']
```

Get middle two items

```
In [31]: clothes = ["shorts","shoes","t-shirt","dress","hat"]

         middle_items = clothes[2 : 4]

         print(middle_items)
```

```
['t-shirt', 'dress']
```

Get last three items

```
In [32]: clothes = ["shorts","shoes","t-shirt","dress","hat"]

         last_items = clothes[2 :]

         print(last_items)

['t-shirt', 'dress', 'hat']
```

Exercise: Create a list with six items. Save as variables and print:

1) the second item

2) the last item

3) the first two items

4) the second, third and fourth items

5) the last two items

Solution

```
In [1]: animals = ["dog","cat","rabbit","hamster","mouse","bird"]

        # Get the second item
        second_item = animals[1]
        print(second_item)

        # Get the last item
        last_item = animals[-1]
        print(last_item)

        # Get the first two items
        first_two_items = animals[: 2]
        print(first_two_items)
```

```
cat
bird
['dog', 'cat']
```

In [2]:

```
animals = ["dog","cat","rabbit","hamster","mouse","bird"]

# Get the second, third and fourth items
middle_items = animals[1 : 4]
print(middle_items)

# Get the last two items
last_two_items = animals[4 :]
print(last_two_items)

# or:
last_two_items = animals[-2 :]
print(last_two_items)
```

```
['cat', 'rabbit', 'hamster']
['mouse', 'bird']
['mouse', 'bird']
```

List Functions

There are functions designed for lists

- `len()`: the number of items in a list
- `max()`: The biggest value in a list
- `min()`: The smallest value in a list

In [3]:
```
costs = [1.2, 4.3, 2.0, 0.5]

print(len(costs))
print(max(costs))
print(min(costs))
```

```
4
4.3
0.5
```

Functions for changing the order of a list

- `sorted()`: Sorts the list
- `reversed()`: Reverses the order of a list

In [4]:
```
costs = [1.2, 4.3, 2.0, 0.5]

print(sorted(costs))
print(list(reversed(costs))) # Need to convert back to a list with list()
```

```
[0.5, 1.2, 2.0, 4.3]
[0.5, 2.0, 4.3, 1.2]
```

`Sorted()` can also be used on lists of strings to sort items alphabetically

```
In [5]: animals = ['dog','cat','rabbit','hamster','mouse',"bird"]

        sort_animals = sorted(animals)
        print(sort_animals)
```

```
['bird', 'cat', 'dog', 'hamster', 'mouse', 'rabbit']
```

Exercise 4.2: Make a list of game scores. Using list functions write code to output information of the scores in the following format:

```
Number of scores: 10
Highest score: 200
Lowest score: 3
```

Extension: Output all of the scores in descending order

Solution

In [6]:
```
scores = [200, 3, 12, 25, 56, 72, 88, 3, 5, 16]
print('Number of scores: {}'.format(len(scores)))
print('Highest score: {}'.format(max(scores)))
print('Lowest score: {}'.format(min(scores)))
```

```
Number of scores: 10
Highest score: 200
Lowest score: 3
```

Extension solution

```
In [7]: sorted_scores = (sorted(scores))
        print(list(reversed(sorted_scores)))
```

```
[200, 88, 72, 56, 25, 16, 12, 5, 3, 3]
```

Alternatively:

If you want to sort the items and reverse the order, you can pass a second arguement into `Sorted()` , `reverse=True` to do both at the same time.

```
In [8]: sorted_scores_reverse = sorted(scores,reverse=True)
        print(sorted_scores_reverse)
```

```
[200, 88, 72, 56, 25, 16, 12, 5, 3, 3]
```

append() and in

You can check if an value is in a list using the `in` operator. If the value is in the list it will result in `True` and `False` if it is not.

In [20]:
```
student_name = input('Which student are you looking for? ')

students = [
    'Diedre', 'Hank', 'Helena', 'Salome',
]

if student_name in students:
    print('{} is in the class'.format(student_name))
else:
    print('{} is not in the class'.format(student_name))
```

```
Which student are you looking for? Bob
Bob is not in the class
```

To check if an item is not in a list, you can use the `not in` operator. If the value is not in the list it will result in `True` and `False` if it is.

```
In [15]: fridge = [
             'cheese',
             'pizza',
             'coke',
         ]

         if 'milk' not in fridge:
             print('You have no milk in the fridge')
```

```
You have no milk in the fridge
```

The `.append()` method is used to add items to a list

```
In [9]: students = [
            'Diedre', 'Hank', 'Helena', 'Salome',
        ]
        student_name = input('What is the name of the new student? ')

        students.append(student_name)

        print(students)
```

```
What is the name of the new student? bob
['Diedre', 'Hank', 'Helena', 'Salome', 'bob']
```

Exercise 4.3: Whenever I'm shopping and I buy some bread I always forget to buy butter. Create a list and if `'bread'` is in the list, add `'butter'` to the shopping list.

Try running the program with and without bread in the list to check that your program works.

Remember the `in` operator checks if an item is in a list and the `.append()` method adds an item to a list.

Extension: Only add butter to the list if it is not already in the list, using the operator `not in`.

Solution

```
In [10]: shopping_list = [
             'bread',
             'cheese',
             'pop tarts',
             'carrots',
         ]

         if 'bread' in shopping_list:
             shopping_list.append('butter')

         print(shopping_list)
```

```
['bread', 'cheese', 'pop tarts', 'carrots', 'butter']
```

```
In [ ]: Extension Solution
In [11]: shopping_list = [
             'bread',
             'cheese',
             'pop tarts',
             'carrots',
         ]

         if 'bread' in shopping_list:
             if 'butter' not in shopping_list:
                 shopping_list.append('butter')

         print(shopping_list)
```

```
['bread', 'cheese', 'pop tarts', 'carrots', 'butter']
```

For Loops ♥ Lists

Using lists and for loops together

```
In [12]: student_names = ['Diedre', 'Hank', 'Helena', 'Salome']

         for student_name in student_names:
             print(student_name)
```

```
Diedre
Hank
Helena
Salome
```

Counting the total number of items in a list using a for loop

```
In [16]: student_names = ['Diedre', 'Hank', 'Helena', 'Salome']
         count = 0

         for student_name in student_names:
             count = count + 1

         print(count)
```

```
4
```

Normally we would do this without a for-loop using `len()` , which returns the length of a list.

```
In [15]: student_names = ['Diedre', 'Hank', 'Helena', 'Salome']
         print(len(student_names))
```

```
4
```

Exercise 4.4: I want to work out how much money I've spent on lunch this week. I've created a list of what I spent each day.

Write a program that uses a `for` loop to calculate the total cost

In [14]:
```
costs = [8.30, 7.12, 5.01, 1.00, 0.99, 5.92, 3.50]
total_cost = 0
```

Extension: Work out the average that I spend on lunch for the week

Solution

```
In [18]:
costs = [8.30, 7.12, 5.01, 1.00, 0.99, 5.92, 3.50]
total_cost = 0

for cost in costs:
    total_cost = total_cost + cost

print(total_cost)
```

```
31.839999999999996
```

Extension solution

```
In [20]:
average_cost = total_cost / len(costs)
print(average_cost)
```

```
4.548571428571428
```

There is an easier way to do the last program without a for loop. The `sum()` function can be used to add up all of the values in a list:

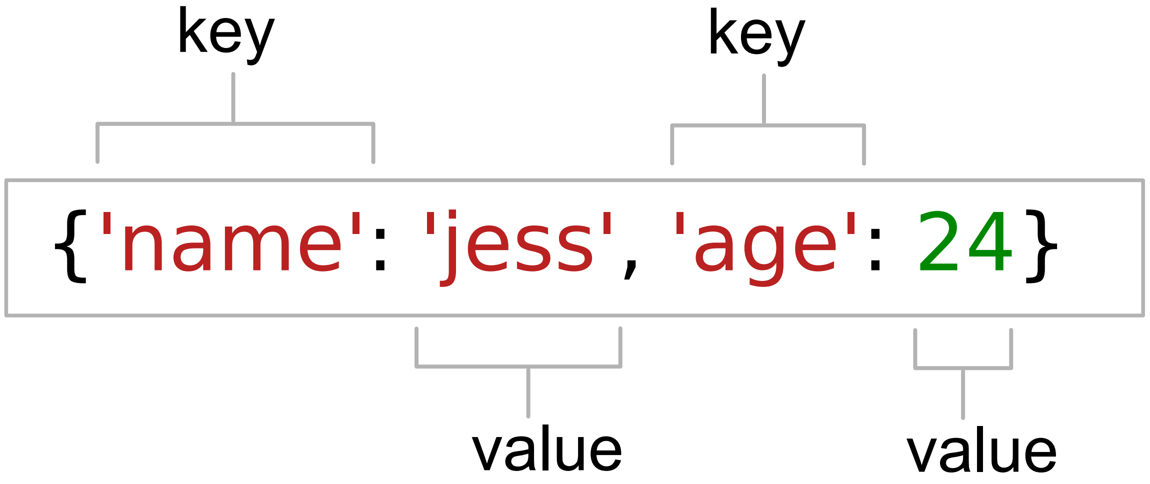
```
In [21]: costs = [8.30, 7.12, 5.01, 1.00, 0.99, 5.92, 3.50]
         total = sum(costs)

         print(total)
```

```
31.839999999999996
```

Dictionaries

Dictionary: Stores a collection of labelled items. Each item has a *key* and a *value*

```
In [ ]: person = {
            'name': 'Jessica',
            'age': 23,
            'height': 172
        }
```


key
key
{'name': 'jess', 'age': 24}
value
value

Values in a dictionary are accessed using their keys

```
In [23]: person = {
             'name': 'Jessica',
             'age': 23,
             'height': 172
         }

         print(person['name'])
         print(person['age'])
         print(person['height'])
```

```
Jessica
23
172
```

Exercise 4.5: Print the values of `name`, `post_code` and `street_number` from the dictionary

In [17]:
```
place = {
    'name': 'The Anchor',
    'post_code': 'E14 6HY',
    'street_number': '54',
    'location': {
        'longitude': 127,
        'latitude': 63,
    }
}
```

Extension: Print the values of `longitude` and `latitude` from the inner dictionary

Solution

In [18]:
```
place = {
    'name': 'The Anchor',
    'post_code': 'E14 6HY',
    'street_number': '54',
    'location': {
        'longitude': 127,
        'latitude': 63,
    }
}

print(place['name'])
print(place['post_code'])
print(place['street_number'])
```

```
The Anchor
E14 6HY
54
```

Extension solution:

```
In [19]: print(place['location']['longitude'])
         print(place['location']['latitude'])
```

```
127
63
```

Explanation: `location` is another dictionary nested inside place.

We can also extract the `location` dictionary from `place`:

```
In [20]: location = place['location']

         print(location['longitude'])
         print(location['latitude'])
```

```
127
63
```

Dictionaries in Lists

Putting dictionaries inside a list is very common

```
In [21]: people = [
             {'name': 'Jessica', 'age': 23},
             {'name': 'Trisha', 'age': 24},
         ]

         for person in people:
             print(person['name'])
             print(person['age'])
```

```
Jessica
23
Trisha
24
```

Exercise 4.6: Using a for loop, output the values `name`, `colour` and `price` of each dictionary in the list

In [ ]:
```
fruits = [
    {'name': 'apple', 'colour': 'red', 'price': 0.12},
    {'name': 'banana', 'colour': 'yellow', 'price': 0.2},
    {'name': 'pear', 'colour': 'green', 'price': 0.19},
]
```

Extension: Add more items to the list.

Solution

```
In [22]:
fruits = [
    {'name': 'apple', 'colour': 'red', 'price': 0.12},
    {'name': 'banana', 'colour': 'yellow', 'price': 0.2},
    {'name': 'pear', 'colour': 'green', 'price': 0.19},
]

for fruit in fruits:
    print(fruit['name'])
    print(fruit['colour'])
    print(fruit['price'])
```

```
apple
red
0.12
banana
yellow
0.2
pear
green
0.19
```

Extension solution:

```
In [23]: fruits.append({'name': 'grapes', 'colour': 'green', 'price': 2.50})

         print(fruits)
```

```
[{'name': 'apple', 'colour': 'red', 'price': 0.12}, {'name': 'banana', 'colour': 'yel
low', 'price': 0.2}, {'name': 'pear', 'colour': 'green', 'price': 0.19}, {'name': 'gr
apes', 'colour': 'green', 'price': 2.5}]
```

Random Choice

The `choice()` function in the random module returns a random item from a list

```
In [25]: import random

         colours = ['red', 'green', 'blue']
         chosen_colour = random.choice(colours)

         print(chosen_colour)
```

```
blue
```

Exercise 4.7: Write a program to create a random name. You should have a list of random firstnames and a list of lastnames. Choose a random item from each and display the result.

Extension: Create a list of verbs and a list of nouns. Using the four lists create randomised sentences eg. `Alice Brown codes Python`

Solution

In [37]:
```python
import random

first_names = ['Alice', 'Bob', 'Dierdre', 'Edith']
surnames = ['Johnson', 'Smith', 'Brown']

first_name = random.choice(first_names)
surname = random.choice(surnames)

print("{} {}".format(first_name, surname))
```

```
Dierdre Brown
```

Extension solution

```
In [31]: import random

         first_names = ['Alice', 'Bob', 'Dierdre', 'Edith']
         surnames = ['Johnson', 'Smith', 'Brown']

         verbs = ["plays", "watches", "cooks", "codes"]
         nouns = ["football", "Python", "pasta"]

         first_name = random.choice(first_names)
         surname = random.choice(surnames)

         verb = random.choice(verbs)
         noun = random.choice(nouns)

         print("{} {} {} {}".format(first_name, surname, verb, noun))
```

```
Alice Johnson cooks pasta
```

Recap

This session:

1. Lists
2. Dictionaries

Question 1: What shape brackets are used for creating a list and what shape brackets are used for creating a dictionary?

Question 2: What is the result of this program?

```
In [ ]: cheeses = [
            'brie',
            'cheddar',
            'wensleydale',
            'edam',
        ]

        print(cheeses[4])
```

Question 3: This program raises an error when I run it. What do I need to change to get it to run?

```
In [ ]:
```

```
trees = [
{'leaf_colour': 'green', 'height': 2120},
{'leaf_colour': 'green', 'height': 2300},

new_tree = {
'leaf_colour': 'green',
'height': 1020
}
trees.append(new_tree)
print(trees)
```

Homework: Session 4 homework questions on the mini-site