Python Session 5

Install SciPy now!

Use the PyCharm terminal

```
python -m pip install --user numpy scipy matplotlib ipython jupyter
```

Download files from google drive and save them together into your CFG folder:

‘book_analysis_code.py’ and ‘book_dataset.csv’

All work will be done in the ‘book_analysis_code.py’ file.

Part 1 (today):

1. String operations and using counter
2. What is SciPy?
3. How to use documentation and searching for answers
4. Try out plotting with Matplotlib

Part 2 (optional session next week):

1. Introduction to numpy & more Matplotlib

Dataset- Bookshop sales

We will all work with the book dataset which can be downloaded from Google Drive.

	A	B	C	D	E	F	G	H	I	J
1	**Book**	**Genre**	**Num_copies_stock**	**Price**	**Jan**	**Feb**	**March**	**April**	**May**	**Jun**
2	Blue Moon	Crime	3	6.32	33	14	4	10	15	18
3	Cat in the hat	Children	2	3.45	14	15	20	10	19	1
4	City of Bones	Teen	3	3.73	32	10	4	5	8	20
5	Death on the nile	Crime	3	6.78	24	13	18	8	6	21
6	Dracula	Horror	7	5.5	21	7	22	6	12	19
7	Frankenstein	Horror	3	4.75	33	16	18	6	17	14
8	Game of Thrones	Fantasy	18	6.27	14	10	25	7	7	3
9	Harry Potter	Children	22	6.23	15	15	15	10	5	28

Loading in the dataset

-The dataset will be read in as a list, where each element in the list is a dictionary.

-Each dictionary contains the data of a single book.

-This includes the name, genre, stock, price and sales for each month.

The file book_analysis_code.py will load the .csv data in for you.

Run this now.

In [16]:
```
"""Workbook for data analysis session """
import csv

# Open the dataset
with open('book_dataset.csv', newline='') as csvfile:
    reader = csv.DictReader(csvfile)

    # read the headers of the csv
    headers = reader.fieldnames

    # create list to store the book data
    book_data = []

    # add book data dictionaries to list from .csv
    for row in reader:
        book_data.append(row)

# display the book data list
print(book_data[0])
```

```
OrderedDict([('Book', 'Blue Moon'), ('Genre', 'Crime'), ('Num_copies_stock', '3'),
('Price', '6.32'), ('Jan', '33'), ('Feb', '14'), ('March', '4'), ('April', '10'), ('M
ay', '15'), ('Jun', '18')])
```

In [17]:
```
print(book_data[1])
```

```
OrderedDict([('Book', 'Cat in the hat'), ('Genre', 'Children'), ('Num_copies_stock',
'2'), ('Price', '3.45'), ('Jan', '14'), ('Feb', '15'), ('March', '20'), ('April', '1
0'), ('May', '19'), ('Jun', '1')])
```

Questions about our dataset:

- How many books of each genre are there?
- What is the current value of all out stock?
- How much revenue did we make each month?

How many books of each genre are there?

Solution: Count number of occurrences of each ‘genre’ string for all the books.

	A	B	C	D	E	F	G	H	I	J
1	**Book**	**Genre**	**Num_copies_stock**	**Price**	**Jan**	**Feb**	**March**	**April**	**May**	**Jun**
2	Blue Moon	Crime	3	6.32	33	14	4	10	15	18
3	Cat in the hat	Children	2	3.45	14	15	20	10	19	1
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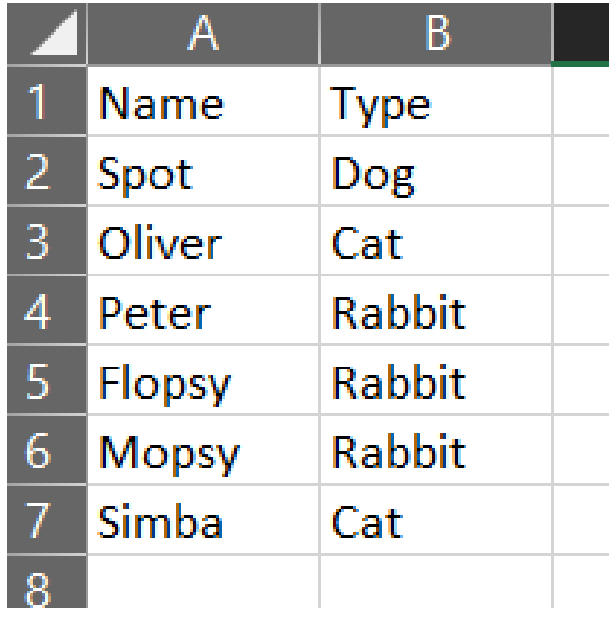
6	Dracula	Horror	7	5.5	21	7	22	6	12	19
7	Frankenstein	Horror	3	4.75	33	16	18	6	17	14
8	Game of Thrones	Fantasy	18	6.27	14	10	25	7	7	3
9	Harry Potter	Children	22	6.23	15	15	15	10	5	28

How do we do this?

1. Extract a list of all the genres
2. Count the number of occurances of each book genre

Example dataset



	A	B
1	Name	Type
2	Spot	Dog
3	Oliver	Cat
4	Peter	Rabbit
5	Flopsy	Rabbit
6	Mopsy	Rabbit
7	Simba	Cat
8		

Step 1 example: Extracting a list from a dictionary

In [3]:

```
import csv

with open('animal_data.csv', newline='') as csvfile:
    reader = csv.DictReader(csvfile)
    headers = reader.fieldnames
    animal_data = []

    for row in reader:
        animal_data.append(row)

print(animal_data)
```

```
[OrderedDict([('Name', 'Spot'), ('Type', 'Dog')]), OrderedDict([('Name', 'Oliver'),
('Type', 'Cat')]), OrderedDict([('Name', 'Peter'), ('Type', 'Rabbit')]), OrderedDict
([('Name', 'Flopsy'), ('Type', 'Rabbit')]), OrderedDict([('Name', 'Mopsy'), ('Type',
'Rabbit')]), OrderedDict([('Name', 'Simba'), ('Type', 'Cat')])]
```

In [4]:

```
# Create list to hold all the animal types
all_animals = []

# iterate through dictionary and create a list of all animal types
for animal in animal_data:
    all_animals.append(animal['Type'])

print(all_animals)
```

```
['Dog', 'Cat', 'Rabbit', 'Rabbit', 'Rabbit', 'Cat']
```

Exercise 5.1:

Extract a list of genres from the book data.

Solution

In [18]:
```
# Open the dataset- already in your file
with open('book_dataset.csv', newline='') as csvfile:
    reader = csv.DictReader(csvfile)
    headers = reader.fieldnames
    book_data = []
    for row in reader:
        book_data.append(row)
```

In [19]:
```
# Create an empty list called book_genres
book_genres = []

# Use a for-loop and append each genre to the list
for book in book_data:
    book_genres.append(book['Genre'])

print(book_genres)
```

```
['Crime', 'Children', 'Teen', 'Crime', 'Horror', 'Horror', 'Fantasy', 'Children', 'Fa
ntasy', 'Teen', 'Children', 'Action', 'Romance', 'Romance', 'Children', 'Teen', 'Chil
dren', 'Children', 'Crime', 'Children', 'Fantasy', 'Crime', 'Romance', 'Teen']
```

Step 2: Counter

In [7]:
```
print(all_animals)
```

```
['Dog', 'Cat', 'Rabbit', 'Rabbit', 'Rabbit', 'Cat']
```

What we want the output to be:

- dog: 1
- cat: 2
- rabbit: 3

`Counter()` is a function in the collections package.

It can be used to count the number of times an item occurs in a list.

In [8]:
```
import collections # remember to import the collections package

count_animals = collections.Counter(all_animals) # use the Counter

print(count_animals)

animal_types, type_counts = zip(*count_animals.items()) # convert into animal types and
 a count of each type.

print(animal_types)
print(type_counts)
```

```
Counter({'Rabbit': 3, 'Cat': 2, 'Dog': 1})
('Dog', 'Cat', 'Rabbit')
(1, 2, 3)
```

Exercise 5.2:

Count the number of books in each genre using the `Counter()` method

Exercise Solution

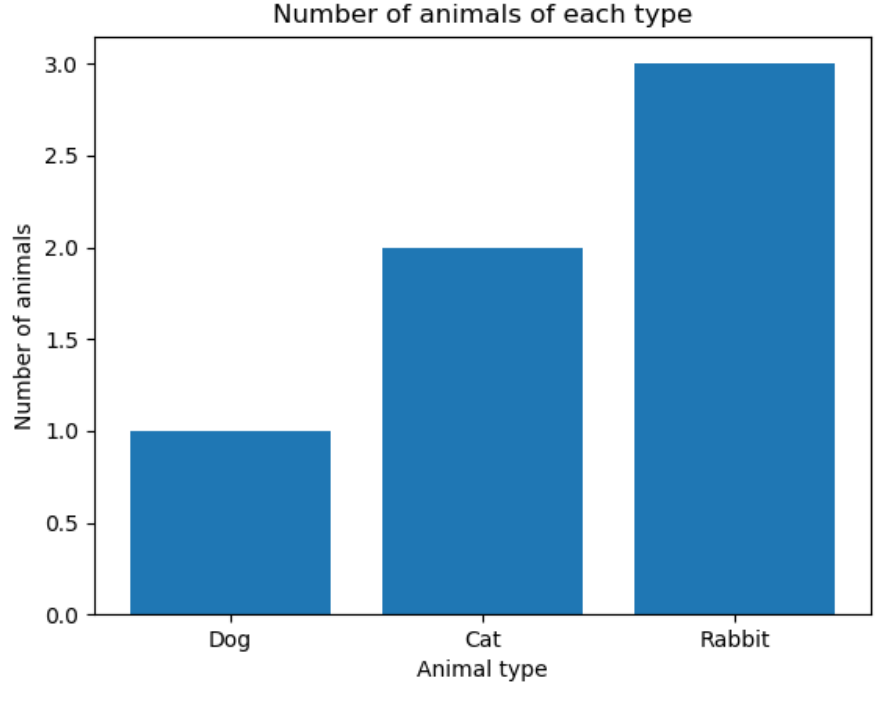
In [9]:
```
# Use the counter method to calculate the number of books in each genre
import collections

genre_collection = collections.Counter(book_genres)

genres, genre_count = zip(*genre_collection.items())

print(genres)

print(genre_count)
```

```
('Crime', 'Children', 'Teen', 'Horror', 'Fantasy', 'Action', 'Romance')
(4, 7, 4, 2, 3, 1, 3)
```

Visualising your result

How can we make a plot of the counts of genres?

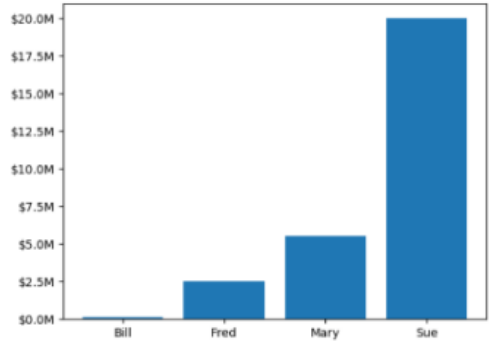
Use Matplotlib in the SciPy package!



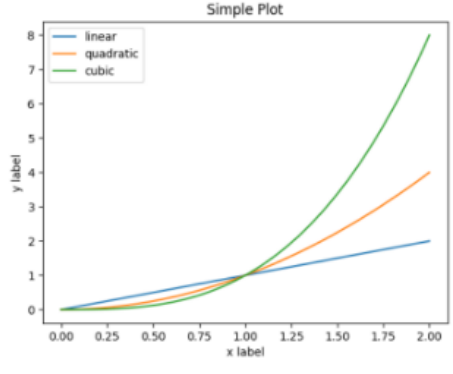
What is SciPy?

Introduction to Matplotlib

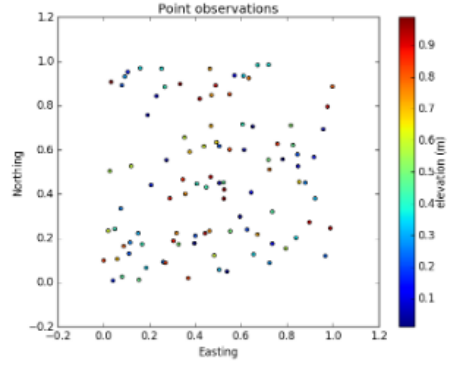
Matplotlib is a graphing package which is able to produce different types of plots. Including:



Bar



Line



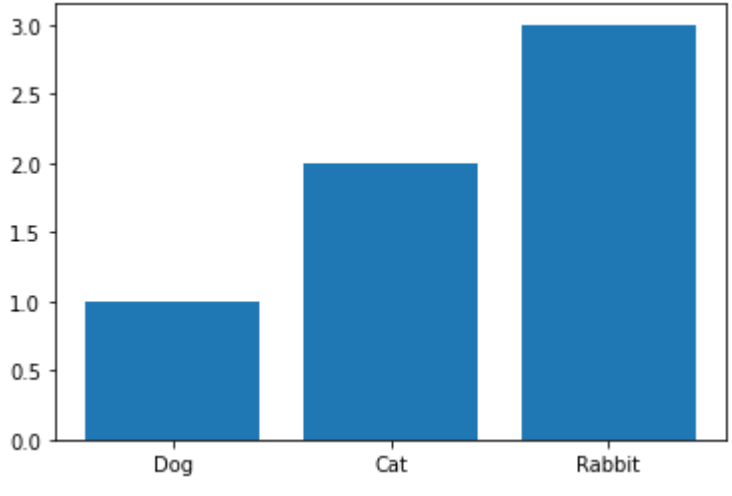
Scatter

How to import matplotlib

```
import matplotlib.pyplot as plt

plt.bar(labels, values)
```

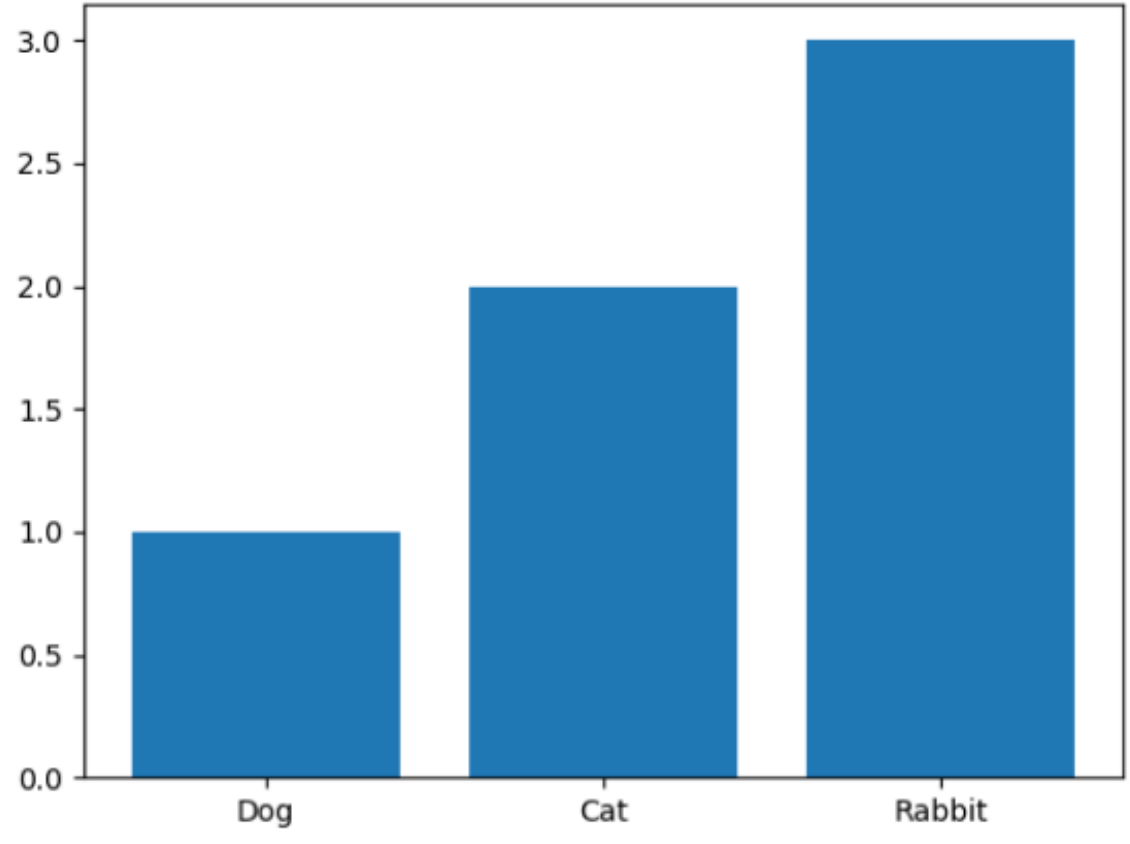
Creating a bar chart - Plotting the number of animal types

In [12]:
```
import matplotlib.pyplot as plt # import matplotlib

plt.figure() # create an empty figure

plt.bar(animal_types, type_counts) # create the bar chart

plt.show() # Show the bar chart
```



Plot title ??

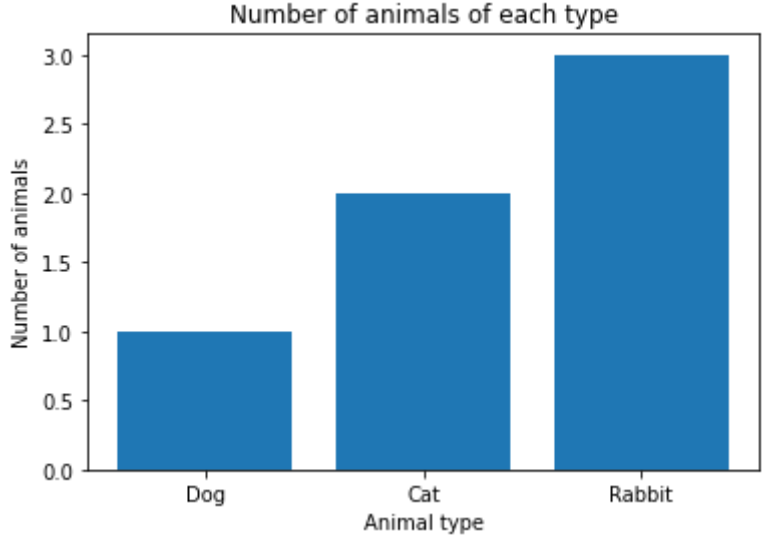
y axis label??

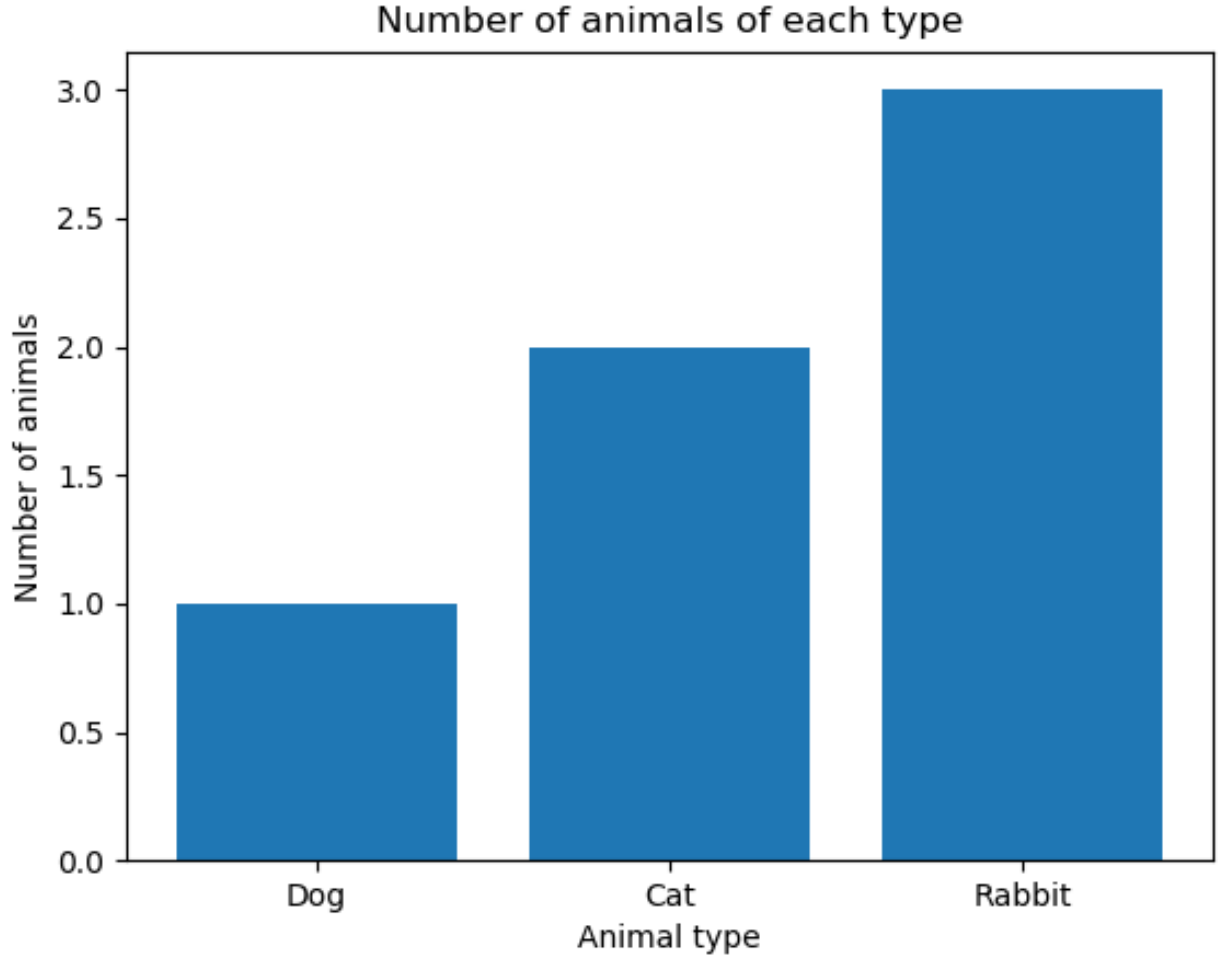


x axis label ??

Adding titles and axis labels

In [13]:
```
plt.figure()
plt.bar(animal_types, type_counts)

plt.ylabel('Number of animals') # Y axis label

plt.xlabel('Animal type') # X axis label

plt.title('Number of animals of each type') # plot title

plt.savefig('animal_count.png') # Save the figure as a .png file

plt.show()
```



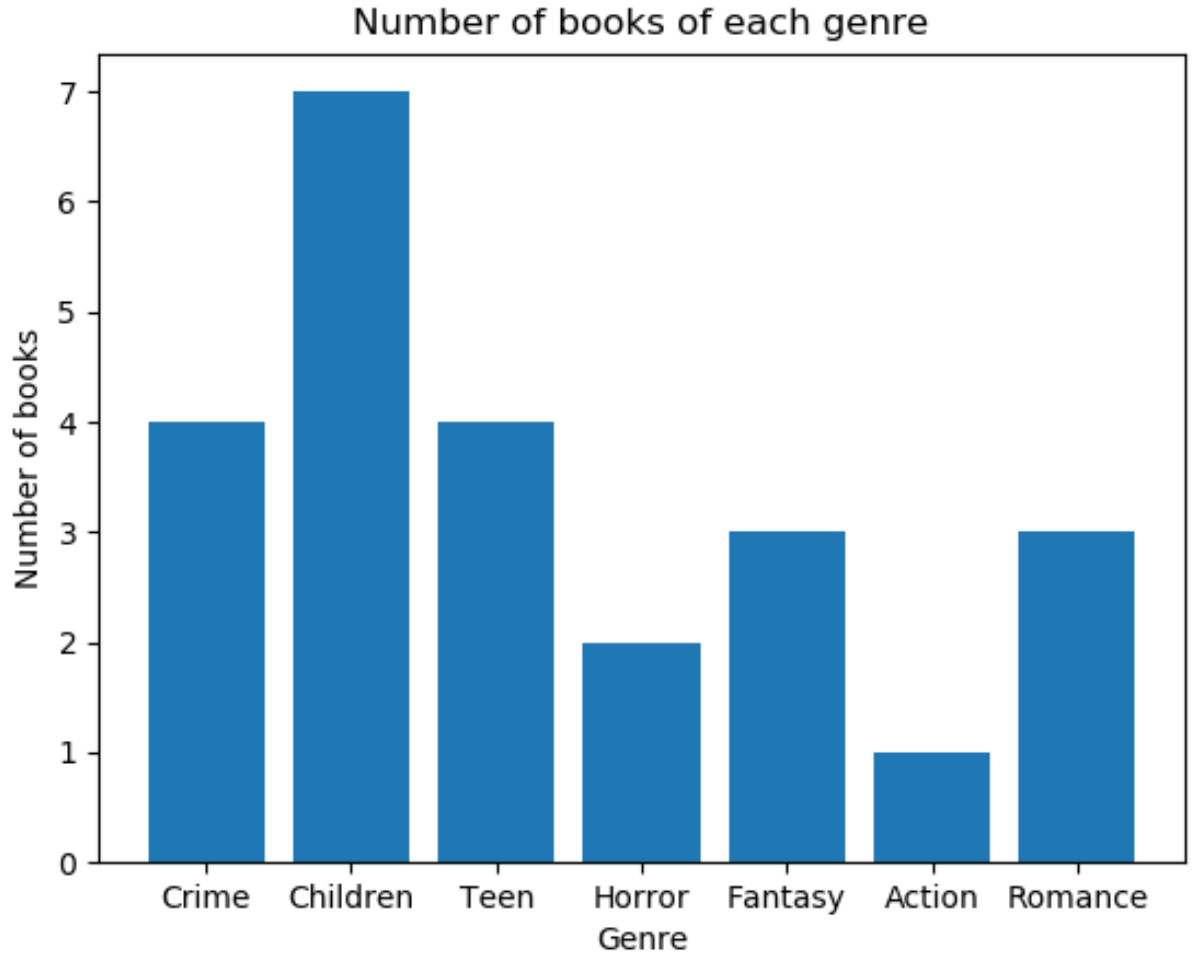

Number of animals of each type
Number of animals
3.0
2.5
2.0
1.5
1.0
0.5
0.0
Dog
Cat
Rabbit
Animal type

Exercise 5.3: Create a bar chart of the number of books for each genre. Add suitable axis labels and a title.

Exercise solution

In [ ]:

```
plt.figure()
plt.bar(genres,genre_count)
plt.ylabel('Number of books')
plt.xlabel('Genre')
plt.title('Number of books of each genre')
plt.savefig('Book_genre_count.png')
plt.show()
```


Number of books of each genre
Number of books
0
1
2
3
4
5
6
7
Crime
Children
Teen
Horror
Fantasy
Action
Romance
Genre

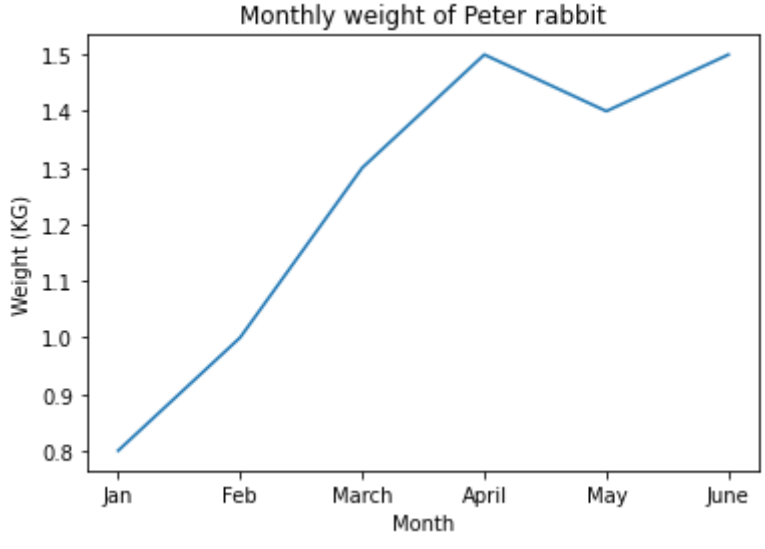
Other types of plots

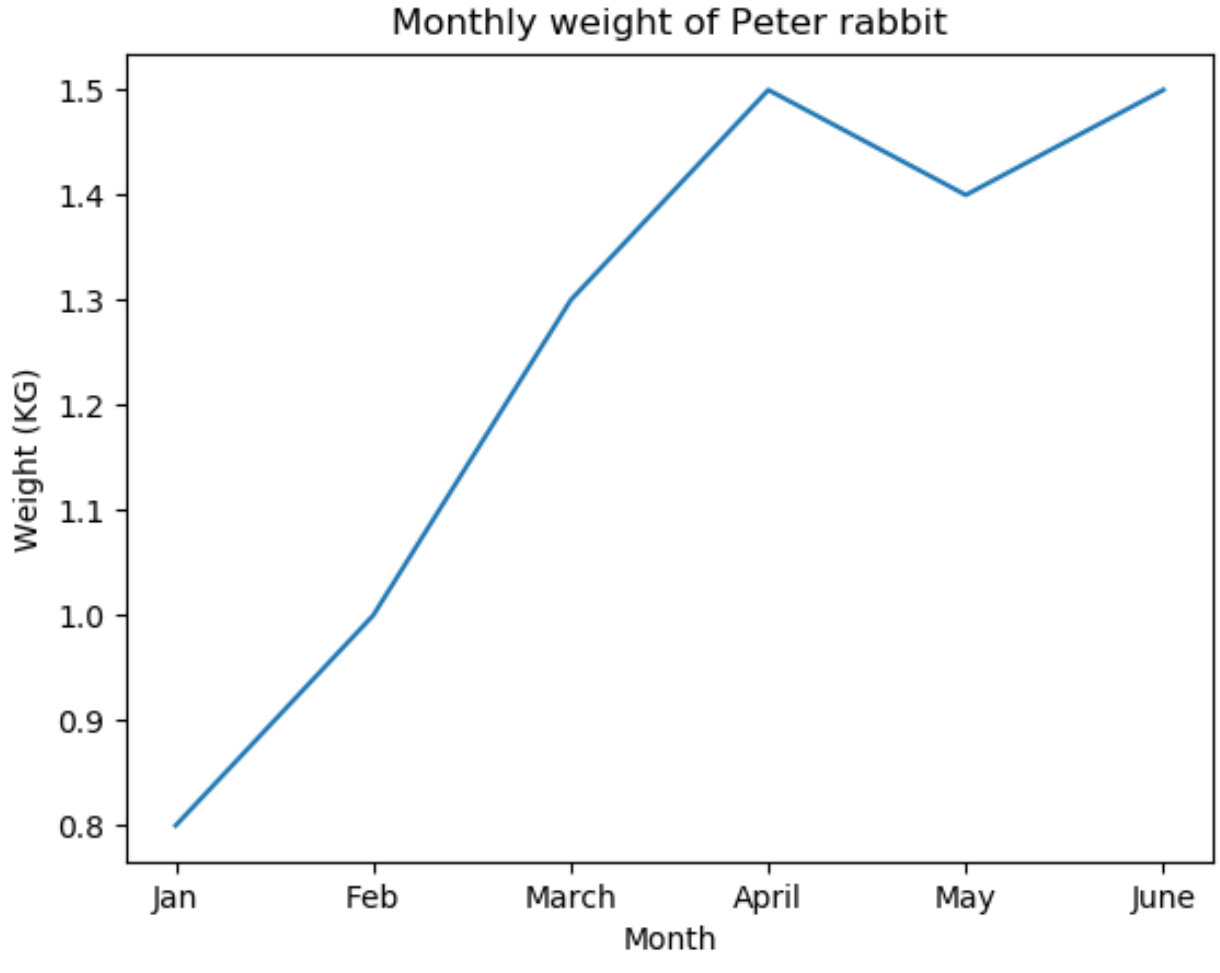
Line plots

What is the weight of our pet rabbit over time?

In [14]:

```
# Create a line plot with weight for each month
weight = [0.8, 1, 1.3, 1.5, 1.4, 1.5]
months = ['Jan', 'Feb', 'March', 'April', 'May', 'June']

plt.figure()
plt.plot(months, weight) # use plt.plot for a line plot
plt.xlabel('Month')
plt.ylabel('Weight (KG)')
plt.title('Monthly weight of Peter rabbit')
plt.savefig('animal_weight.png')
plt.show()
```



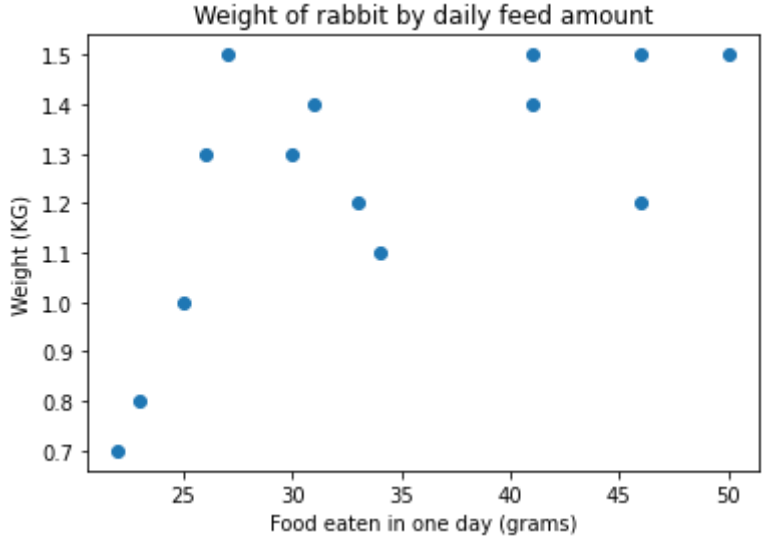

Monthly weight of Peter rabbit
Weight (KG)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
Jan
Feb
March
April
May
June
Month

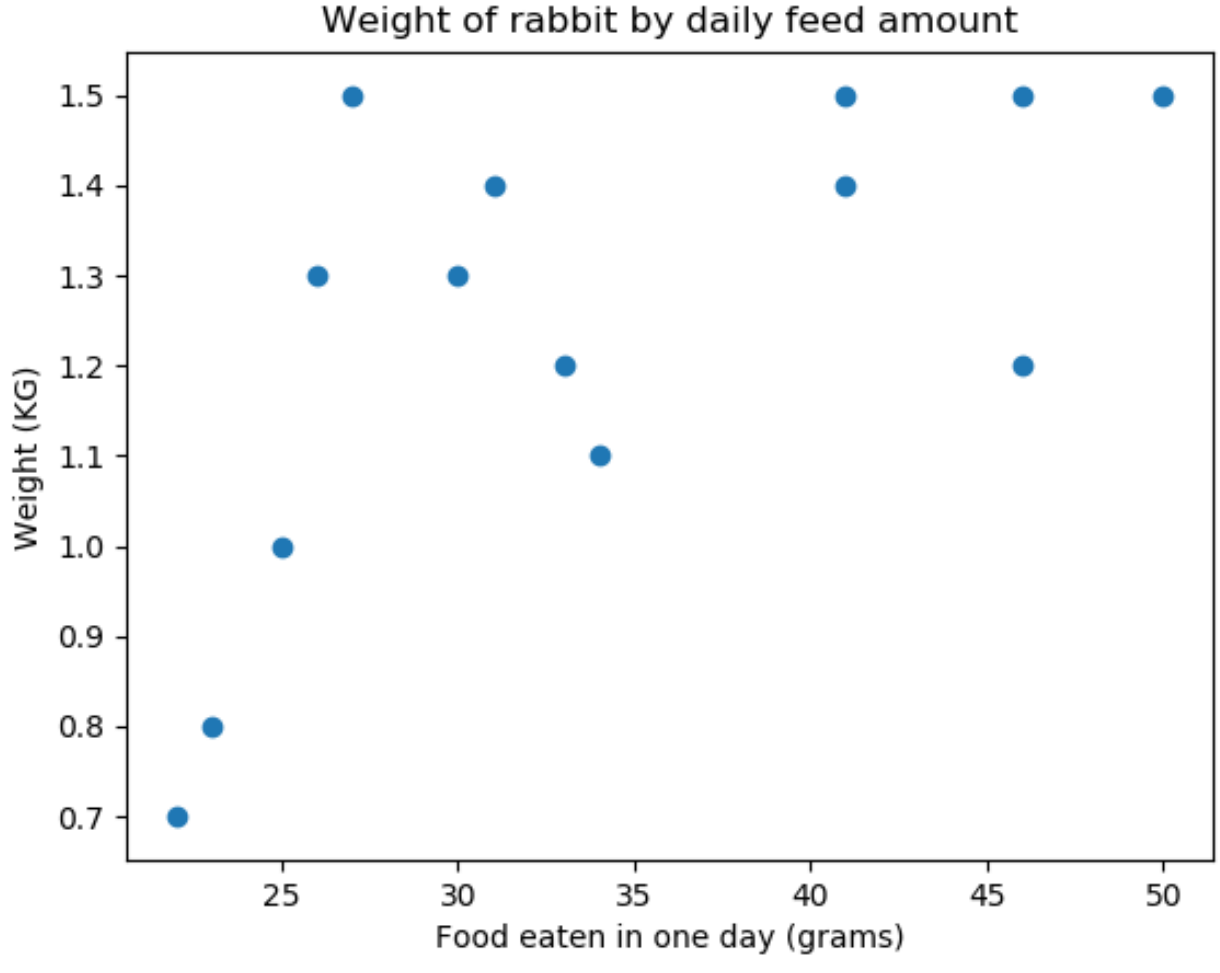
Scatter plots

Is there any relationship between the weight of a rabbit and how much it eats?

In [15]:

```
# Create scatter plot of amount of food each rabbit eats and their weight
weight = [0.8, 1, 1.3, 1.2, 1.5, 1.4, 1.5, 0.7, 1.1, 1.3, 1.2, 1.5, 1.4, 1.5]
feed = [23, 25, 30, 33, 41, 31,27, 22,34,26, 46, 46,41, 50]

plt.figure()
plt.scatter(feed, weight) # use plt.scatter for a scatter plot
plt.xlabel('Food eaten in one day (grams)')
plt.ylabel('Weight (KG)')
plt.title('Weight of rabbit by daily feed amount')
plt.savefig('animal_weight_feed.png')
plt.show()
```




Weight of rabbit by daily feed amount
Weight (KG)
1.5
1.4
1.3
1.2
1.1
1.0
0.9
0.8
0.7
25
30
35
40
45
50
Food eaten in one day (grams)

Next time: Using Numpy for data analysis