Assignment_02

The data set has COVID-19 fictional data from 3 planets: Tatooine, Naboo and Alderaan

For each Planet there is information for: Daily Cases, Recoveries and Deaths in this order for 4 cities

The dataset is created as lists below since file handling is not yet covered. Normally this sort of data is read into python from one or multiple files

The objective of this excercise is to teach you slicing, aggregating, plotting data in a numpy array

In [1]:
```
import numpy as np
import matplotlib.pyplot as plt
import numpy as np
import re
```

In [2]:
```
# Tatooine Data (Planet 1)
tatooine_data = [
    # City 1
    [100, 80, 5],
    # City 2
    [120, 90, 4],
    #City 3
    [110, 85, 6],
    # City 4
    [115, 88, 3],
]

# Naboo Data (Planet 2)
naboo_data = [
    [90, 70, 4],
    [110, 85, 3],
    [100, 80, 5],
    [95, 75, 2]
]


# Alderaan Data (Planet 3)
alderaan_data = [
    [85, 65, 3],
    [105, 80, 2],
    [95, 75, 4],
    [90, 70, 1]
]
```

Make one 3D numpy array from the data above that holds the data of all planets together. It should be in the order tatooine, naboo, alderaan

What is the shape of this array? Explain what this means. [5 marks]

Explain what this means.

- The shape of this array is (3,4,3).
- The first diemension 3 indicates there are 3 planets of data.
- The second diemension 4 shows cities/data points for each planet.
- The third diemension 3 shows values (columns) of data for each city.

In [4]:
```
#add the data of all three planets here into a single array. it should be in the order
all_data = np.array([tatooine_data,naboo_data,alderaan_data])
print(all_data)

# Display the shape of the 3D array to confirm
print("The shape of np_array_3d is:", all_data.shape)
```

```
[[[100  80   5]
  [120  90   4]
  [110  85   6]
  [115  88   3]]

 [[ 90  70   4]
  [110  85   3]
  [100  80   5]
  [ 95  75   2]]

 [[ 85  65   3]
  [105  80   2]
  [ 95  75   4]
  [ 90  70   1]]]
The shape of np_array_3d is: (3, 4, 3)
```

Can you find out the planet with the highest number of deaths?

First, let us make an array of deathtolls. This array should be a 2-D array:
- Each row represents one planet.
- Each row will have 4 values(columns), one for the deathtoll of each city
- Scroll up to the definition and see where exactly the number of deaths are stored. It is COLUMN at index 2 in each planet's data
- __Extract this deathtoll column for each planet from the all_data array. You will have to use indexing for 3-D arrays here__

The indexing for tatooine has already been done for you: all_data[0, :, 2]. Tatooine data is index 0 in the outermost dimension, then we need all rows so we use : and the column index is 2. [5 marks]

In [10]:
```
all_data = np.array([tatooine_data,naboo_data,alderaan_data])
death_tolls = np.zeros((3,4))
death_tolls [0,:] = all_data[0,:,2] # tatooine
death_tolls [1,:] = all_data[1,:,2] # naboo
death_tolls [2,:] = all_data[2,:,2] # alderaan_data
```

```
print(death_tolls)
```

```
[[5. 4. 6. 3.]
 [4. 3. 5. 2.]
 [3. 2. 4. 1.]]
```

Now, using the death_data array and the aggregate function np.sum, sum up the deathtoll of each planet. Remember that each row in death_data represents a planet. Use the axis argument here inside np.sum

note: summing death_date along rows using np.sum will automatically return a numpy array of rowsums. You don't need to create an array using np.array [5 marks]

In [12]:
```
total_deaths_per_planet = np.sum(death_tolls ,axis=1)
print(total_deaths_per_planet)
```

```
[18. 14. 10.]
```

First, simply find the highest death toll using np.max [5 marks]

In [13]:
```
most_deaths= np.max(total_deaths_per_planet)

print("Highest number of deaths:", most_deaths)
```

```
Highest number of deaths: 18.0
```

To just get the max no of deaths, you used the np.max function. But now, we don't just need the maximum number, we need the POSITION of that max as well in order to be able to tell which planet it corresponds to (recall that we compiled our data in the order tatooine, naboo and alderaan)

- Instead of just max, we also need the INDEX of the max. For this, google the np.argmax() function
- Once you have the index of the max, fetch the name from the list planet_names using that index

[5 marks]

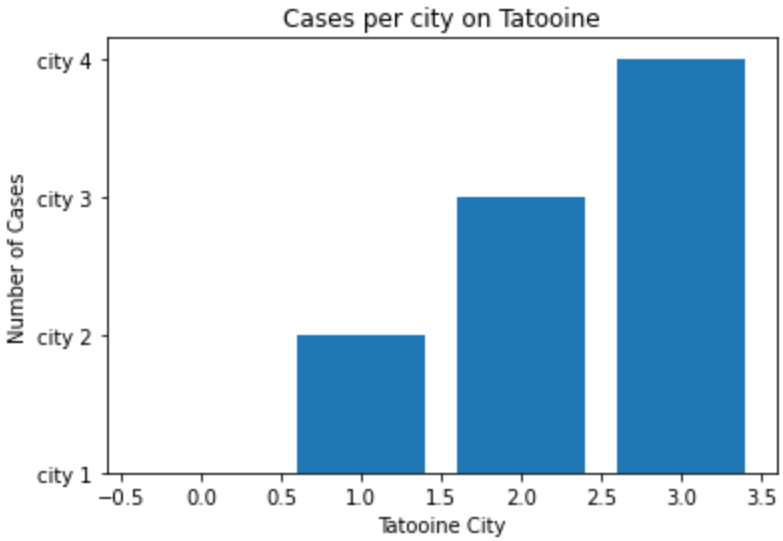
In [19]:
```
planet_names = ["Tatooine", "Naboo", "Alderaan"]

highest_death_index = np.argmax(death_tolls)
highest_death_planet = planet_names[highest_death_index]

print("Planet with the most deaths:", highest_death_planet)
```

```
Planet with the most deaths: Alderaan
```

Now, create a bar chart of number of cases for each city on Tatooine.

Extract this data from the all_data array. You will have to use 3d array indexing and remember that the data for tatooine is the data at index 0 in the outermost dimension of the all_data 3D array. Then from this, you need to extract the column for number of cases for all tatooine cities. [5 marks]

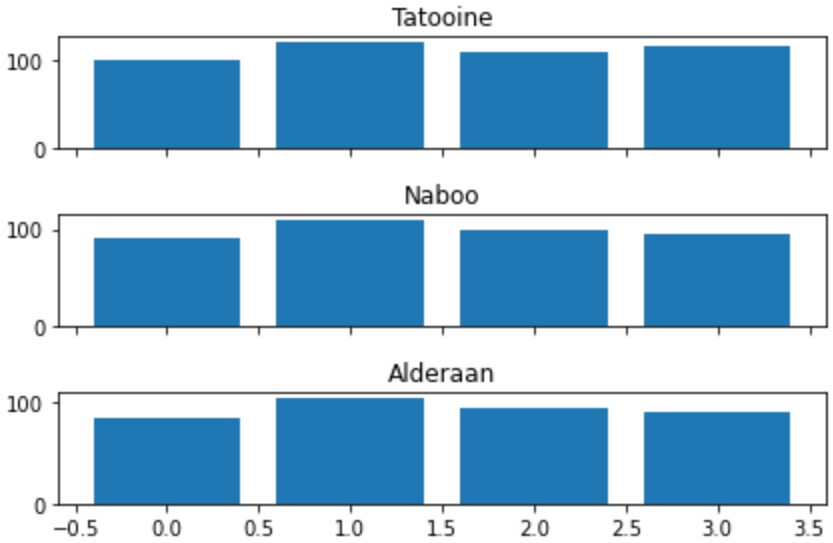
In [21]:
```
# Assuming np_array_3d is the 3D array you have created

# Extracting the cases data for each city on Tatooine
x_values = ["city1", "city2", "city3", "city4"]
cases_tatooine = all_data[0, :, 0] #essentially column 0 from the tatooine array insid


# Creating the bar chart of x_values against cases_tatooine. add your arguments below:
plt.figure()
plt.bar(range(len(cases_tatooine)),('city 1', 'city 2','city 3', 'city 4'))

#add a title
plt.title('Cases per city on Tatooine')

#add labels for x and y axis
plt.xlabel("Tatooine City")
plt.ylabel("Number of Cases")
plt.show()
```



Now try creating sub plots for each planet. Extract the cases data for each planet from the all_data array. x_values will be the same for each planet. [10 marks]

In [30]:
```
import numpy as np
import matplotlib.pyplot as plt

all_data = np.array([tatooine_data,naboo_data,alderaan_data])
fig,axs = plt.subplots(3 , sharex = True)

tatooine_cases = all_data[0,:,0]
axs[0].bar(range(len(tatooine_cases)), tatooine_cases)
axs[0].set_title("Tatooine")

naboo_cases = all_data[1,:,0]
axs[1].bar(range(len(naboo_cases)), naboo_cases)
axs[1].set_title("Naboo")

alderaan_cases = all_data[2,:,0]
axs[2].bar(range(len(alderaan_cases)), alderaan_cases)
axs[2].set_title("Alderaan")
```

```
plt.tight_layout()
plt.show()
```



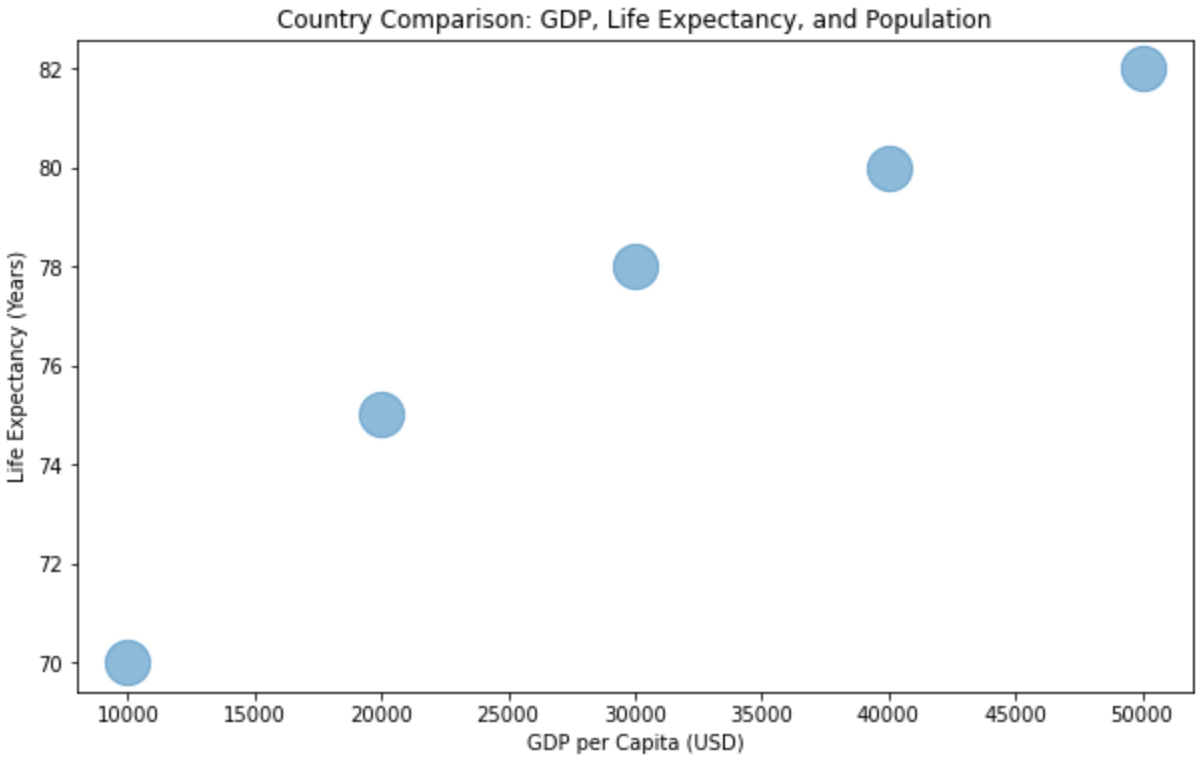
Please make scatter plot with X axis showing GDP per capita, Y axis showing life expectancy and the area of the bubble showing the size of population

Please pay attention to:

1. How to set bubble size based on parameter
2. How to label the individual bubbles with the country names

You can try googling or chat gpt if you are still unsure get in touch with TAs or the instructor [15 marks]

In [38]:
```
import matplotlib.pyplot as plt
import pandas as pd

# Example data
countries = ['Country A', 'Country B', 'Country C', 'Country D', 'Country E']
gdp_per_capita = [40000, 30000, 20000, 50000, 10000]  # in USD
life_expectancy = [80, 78, 75, 82, 70]  # in years
population = [50, 30, 80, 40, 90]  # in millions
bubble_size = 500
# Creating the scatter plot
plt.figure(figsize=(10, 6))
scatter = plt.scatter(gdp_per_capita, life_expectancy,s= bubble_size,  alpha=0.5)

# Adding labels and title
plt.xlabel('GDP per Capita (USD)')
plt.ylabel('Life Expectancy (Years)')
plt.title('Country Comparison: GDP, Life Expectancy, and Population')


# Showing the plot
plt.show()
```



RegEx

Please make a regular expression to find all RGB Hex Codes in a blurb of text. Google the format of RGB Hex Code and make your rules and then build out the expression [10 marks]

In [39]:
```
test_text = """
In this design, the primary colors are #FF5733, #33FF57, and #3357FF.
Make sure to also consider darker shades like #0A0A0A and lighter tones such as #FAFAF
Invalid codes like #12345, #XYZ123, and #A1B2G3 should not be matched.
"""

student_regex = 'YOUR_STUDENT_REGEX_HERE'

# Find all matches
rgb_regex = re.compile(r'#[0-9A-Faf]{6}|#[0-9A-Fa-f]{3}')
matches = re.findall(rgb_regex,test_text) #add your arguments here

# Displaying the matches
for match in matches:
    print(match)
```

```
#FF5733
#33FF57
#3357FF
#0A0A0A
#FAFAFA
#123
#A1B
```

_Recall capturing and non capturing groups when you do this question:__

We want to extract time from the log_text without the AM/PM. However, we need to add regex code for AM/PM in our pattern so that when we pick up digits like 09:45, we know it is being

followed by a space and then AM/PM to know for sure that the digits we picked are in fact time and not something else (like duration for example).

In the extracted match list, we just want the time without AM/PM, for e.g. the answer should be 09:45 and not 09:45 AM. But we still need to detect for AM/PM. Here, it would serve us well to put part of our pattern that we want into a capturing group and the part we don't want to see but still need to detect in a non-capturing group. [5 marks]

In [40]:
```
log_text = """
Error reported at 09:45 PM, system failure.
Warning issued at 05:30 AM, low battery.
Duration of failure 00:30 s.
Maintenance required at 11:15 AM, disk space full 25:32.
"""

pattern = r'(\d\d:\d\d)\s(?:[AP]M)'
matches = re.findall(pattern, log_text)

for match in matches:
    print(match)
```

```
09:45
05:30
11:15
```

Let us make a function that checks a string and returns True if the string has ONLY uppercase and lowercase alphabets, digits and spaces. If the string contains even a single character other than these, it returns False.

Approach:

- Construct a regex to detect a character other than uppercase and lowercase alphabets, digits and spaces
- Use re.search to look for such a character inside your string. Recall that re.search stops after first match. You only need to use re.search for this instead of re.findall or re.finditer because you just need to detect a single disallowed character instead of detecting all of them.
- Store the result from re.search inside a variable. If this variable is empty, our search did not find any disallowed character. If this variable contains a match, our search found a disallowed character.
- You can apply the bool function to this variable like bool(variable). If the variable is empty, bool will give False. If it contains a match, it will give True.
- Now your function needs to return the OPPOSITE or NEGATION of this boolean value i.e. True when search comes up empty and False when search finds a match to a disallowed character.

[10 marks]

In [57]:
```
import re
def string_check(string):

pattern = r'[^a-zA-Z0-9\s]'
```

```
match = re.search(pattern,string)

if match:
    return False
else:
    return True

print(string_check("I got a total of 80 marks in my Math exam"))
print(string_check("I scored 88% on my exam"))
print(string_check("I got a total of 80 marks in my exam."))
```

```
  Input In [57]
    pattern = r'[^a-zA-Z0-9\s]'
    ^
IndentationError: expected an indented block
```

Our string here contains some messed up websites.

- Detect all of these websites.
- Put the part after the intial https:// in a separate group.
- in each iteration over find_iter, print the whole match as well as the separate group after the :// part.

for example, if the website is

"httpss://www.example88.com"

you need to print the following:

httpss://www.example88.com
www.example88.com

[10 marks]

In [49]:
```
string = """
<html>
  <a href="https://www.example.com">Visit Example</a>dsaf
  <a href="httpss://www.example88.com">Visit Example</a>
  <a href="http://www.test-subjects.com">Test Website</a>
  <a href="httpp://www.ghost_website.edu">Test Website</a>
</html>
"""

pattern = r'href="(.*?)"'

matches = re.finditer(pattern,string)


for match in matches:
    print(match.group(0))
    print(match.group(1))
    print("\n")
```

```
href="https://www.example.com"
https://www.example.com


href="httpss://www.example88.com"
httpss://www.example88.com


href="http://www.test-subjects.com"
http://www.test-subjects.com


href="httpp://www.ghost_website.edu"
httpp://www.ghost_website.edu
```

In [ ]:

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