# FIT1043 Intro to Data Science

# Assignment 1

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# Introduction

This assignment will take a logical approach to analyze the given data through the use of various python libraries and built in functions within it. The purpose of this study is to compare the Life Expectancy, Adult Mortality, Infant Deaths and GDPperCapita in South East Asian Countries

# Importing Libraries

The first step is to import libraries. In this case we use Pandas and rename it as pd to make it easier to access. This library will be used for various purposes such as using the dataFrame structure and reading data files We will also use the matplotlib to visualize the data later on.

In [1]:
```
import pandas as pd
```

In [2]:
```
from matplotlib import pyplot as plt
```

# Reading the Life Expectancy data file and Wrangling the useful data

Using the panda library, we read the csv file and store them as a data frame We also use the head function to output the top of the dataframe to check if the file has been read correctly

In [3]:
```
life = pd.read_csv('data/LifeExpectancyData-v2.csv')
life.shape
```

Out[3]:
```
(2938, 15)
```

In [4]:
```
life.head()
```

Out[4]:

| | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B | Mea |
|---|---|---|---|---|---|---|---|---|---|---|

| | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B | Mea |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | Afghanistan | 2015 | Developing | 65.0 | 62 | 263.0 | 19.1 | 0.01 | 65.0 | |
| **1** | Afghanistan | 2014 | Developing | 59.9 | 64 | 271.0 | 18.6 | 0.01 | 62.0 | |
| **2** | Afghanistan | 2013 | Developing | 59.9 | 66 | 268.0 | 18.1 | 0.01 | 64.0 | |
| **3** | Afghanistan | 2012 | Developing | 59.5 | 69 | 272.0 | 17.6 | 0.01 | 67.0 | |
| **4** | Afghanistan | 2011 | Developing | 59.2 | 71 | 275.0 | 17.2 | 0.01 | 68.0 | |

## Checking the basic statistics of the values in the files.

In [5]:

```
life.info
```

Out[5]:

```
<bound method DataFrame.info of          country  Year      Status  Life expectancy  infant deaths  \
0     Afghanistan  2015  Developing             65.0             62
1     Afghanistan  2014  Developing             59.9             64
2     Afghanistan  2013  Developing             59.9             66
3     Afghanistan  2012  Developing             59.5             69
4     Afghanistan  2011  Developing             59.2             71
...           ...   ...         ...              ...            ...
2933     Zimbabwe  2004  Developing             44.3             27
2934     Zimbabwe  2003  Developing             44.5             26
2935     Zimbabwe  2002  Developing             44.8             25
2936     Zimbabwe  2001  Developing             45.3             25
2937     Zimbabwe  2000  Developing             46.0             24

      Adult Mortality   BMI  Alcohol consumption  Hepatitis B  Measles   \
0               263.0  19.1                 0.01         65.0     1154
1               271.0  18.6                 0.01         62.0      492
2               268.0  18.1                 0.01         64.0      430
3               272.0  17.6                 0.01         67.0     2787
4               275.0  17.2                 0.01         68.0     3013
...               ...   ...                  ...          ...      ...
2933            723.0  27.1                 4.36         68.0       31
2934            715.0  26.7                 4.06          7.0      998
2935             73.0  26.3                 4.43         73.0      304
2936            686.0  25.9                 1.72         76.0      529
2937            665.0  25.5                 1.68         79.0     1483

      Polio  Diphtheria   HIV/AIDS  Income composition of resources  \
0       6.0         65.0       0.1                            0.479
1      58.0         62.0       0.1                            0.476
2      62.0         64.0       0.1                            0.470
3      67.0         67.0       0.1                            0.463
4      68.0         68.0       0.1                            0.454
...     ...          ...       ...                              ...
2933   67.0         65.0      33.6                            0.407
2934    7.0         68.0      36.7                            0.418
2935   73.0         71.0      39.8                            0.427
2936   76.0         75.0      42.1                            0.427
2937   78.0         78.0      43.5                            0.434

      Schooling
0          10.1
1          10.0
2           9.9
```

```
3           9.8
4           9.5
...         ...
2933        9.2
2934        9.5
2935       10.0
2936        9.8
2937        9.8

[2938 rows x 15 columns]>
```

# Cleaning the data

Changing name 'Viet Nam' to 'Vietnam' and 'Timor-Leste' to 'East Timor'

In [6]:
```
life.loc[life['country'] == 'Viet Nam','country'] = 'Vietnam'
life.loc[life['country'] == 'Timor-Leste','country'] = 'East Timor'
life.loc[life['country'] == 'Lao People\'s Democratic Republic','country'] = 'Laos'
```

# Group the dataframe by country and status and use agg function

In [7]:
```
fun = {'Life expectancy ':{'max', 'mean'}, 'Adult Mortality': 'mean', ' BMI ': 'mean
Life_Expectancy = life.groupby(['country', 'Status']).agg(fun)
```

# Drop the top level in column hierarchy and output final dataframe

In [8]:
```
#Life_Expectancy.columns = Life_Expectancy.columns.droplevel(0)
Life_Expectancy.columns = ['Mean Life Expectancy', 'Max Life Expectancy', 'Mean Adul
Life_Expectancy = Life_Expectancy.reset_index()
Life_Expectancy
```

Out[8]:

| | country | Status | Mean Life Expectancy | Max Life Expectancy | Mean Adult Mortality | Mean BMI | Mean Income Composition of Resources | Mean Schooling |
|---|---|---|---|---|---|---|---|---|
| **0** | Afghanistan | Developing | 65.0 | 58.19375 | 269.0625 | 15.51875 | 0.415375 | 8.21250 |
| **1** | Albania | Developing | 77.8 | 75.15625 | 45.0625 | 49.06875 | 0.709875 | 12.13750 |
| **2** | Algeria | Developing | 75.6 | 73.61875 | 108.1875 | 48.74375 | 0.694875 | 12.71250 |
| **3** | Angola | Developing | 56.0 | 49.01875 | 328.5625 | 18.01875 | 0.458375 | 8.04375 |
| **4** | Antigua and Barbuda | Developing | 76.4 | 75.05625 | 127.5000 | 38.42500 | 0.488625 | 8.84375 |
| **...** | ... | ... | ... | ... | ... | ... | ... | ... |
| **188** | Venezuela (Bolivarian Republic of) | Developing | 74.1 | 73.38750 | 163.0000 | 54.48750 | 0.726812 | 12.78750 |

| | country | Status | Mean Life Expectancy | Max Life Expectancy | Mean Adult Mortality | Mean BMI | Mean Income Composition of Resources | Mean Schooling |
|---|---|---|---|---|---|---|---|---|
| **189** | Vietnam | Developing | 76.0 | 74.77500 | 126.5625 | 11.18750 | 0.627062 | 11.51250 |
| **190** | Yemen | Developing | 68.0 | 63.86250 | 211.8125 | 33.48750 | 0.475500 | 8.50625 |
| **191** | Zambia | Developing | 63.0 | 53.90625 | 354.3125 | 17.45000 | 0.498437 | 11.21250 |
| **192** | Zimbabwe | Developing | 67.0 | 50.48750 | 462.3750 | 25.13750 | 0.439125 | 9.82500 |

193 rows × 8 columns

# Filtering out South East Asian Countries for the Life Expectancy DataFrame

We create a tuple of South East Asian Countries as

In [9]:
```
Life_Expectancy['country'].unique()
```

Out[9]:
```
array(['Afghanistan', 'Albania', 'Algeria', 'Angola',
       'Antigua and Barbuda', 'Argentina', 'Armenia', 'Australia',
       'Austria', 'Azerbaijan', 'Bahamas', 'Bahrain', 'Bangladesh',
       'Barbados', 'Belarus', 'Belgium', 'Belize', 'Benin', 'Bhutan',
       'Bolivia (Plurinational State of)', 'Bosnia and Herzegovina',
       'Botswana', 'Brazil', 'Brunei Darussalam', 'Bulgaria',
       'Burkina Faso', 'Burundi', 'Cabo Verde', 'Cambodia', 'Cameroon',
       'Canada', 'Central African Republic', 'Chad', 'Chile', 'China',
       'Colombia', 'Comoros', 'Congo', 'Cook Islands', 'Costa Rica',
       'Croatia', 'Cuba', 'Cyprus', 'Czechia', "Côte d'Ivoire",
       "Democratic People's Republic of Korea",
       'Democratic Republic of the Congo', 'Denmark', 'Djibouti',
       'Dominica', 'Dominican Republic', 'East Timor', 'Ecuador', 'Egypt',
       'El Salvador', 'Equatorial Guinea', 'Eritrea', 'Estonia',
       'Ethiopia', 'Fiji', 'Finland', 'France', 'Gabon', 'Gambia',
       'Georgia', 'Germany', 'Ghana', 'Greece', 'Grenada', 'Guatemala',
       'Guinea', 'Guinea-Bissau', 'Guyana', 'Haiti', 'Honduras',
       'Hungary', 'Iceland', 'India', 'Indonesia',
       'Iran (Islamic Republic of)', 'Iraq', 'Ireland', 'Israel', 'Italy',
       'Jamaica', 'Japan', 'Jordan', 'Kazakhstan', 'Kenya', 'Kiribati',
       'Kuwait', 'Kyrgyzstan', 'Laos', 'Latvia', 'Lebanon', 'Lesotho',
       'Liberia', 'Libya', 'Lithuania', 'Luxembourg', 'Madagascar',
       'Malawi', 'Malaysia', 'Maldives', 'Mali', 'Malta',
       'Marshall Islands', 'Mauritania', 'Mauritius', 'Mexico',
       'Micronesia (Federated States of)', 'Monaco', 'Mongolia',
       'Montenegro', 'Morocco', 'Mozambique', 'Myanmar', 'Namibia',
       'Nauru', 'Nepal', 'Netherlands', 'New Zealand', 'Nicaragua',
       'Niger', 'Nigeria', 'Niue', 'Norway', 'Oman', 'Pakistan', 'Palau',
       'Panama', 'Papua New Guinea', 'Paraguay', 'Peru', 'Philippines',
       'Poland', 'Portugal', 'Qatar', 'Republic of Korea',
       'Republic of Moldova', 'Romania', 'Russian Federation', 'Rwanda',
       'Saint Kitts and Nevis', 'Saint Lucia',
       'Saint Vincent and the Grenadines', 'Samoa', 'San Marino',
       'Sao Tome and Principe', 'Saudi Arabia', 'Senegal', 'Serbia',
       'Seychelles', 'Sierra Leone', 'Singapore', 'Slovakia', 'Slovenia',
       'Solomon Islands', 'Somalia', 'South Africa', 'South Sudan',
```

```
       'Spain', 'Sri Lanka', 'Sudan', 'Suriname', 'Swaziland', 'Sweden',
       'Switzerland', 'Syrian Arab Republic', 'Tajikistan', 'Thailand',
       'The former Yugoslav republic of Macedonia', 'Togo', 'Tonga',
       'Trinidad and Tobago', 'Tunisia', 'Turkey', 'Turkmenistan',
       'Tuvalu', 'Uganda', 'Ukraine', 'United Arab Emirates',
       'United Kingdom of Great Britain and Northern Ireland',
       'United Republic of Tanzania', 'United States of America',
       'Uruguay', 'Uzbekistan', 'Vanuatu',
       'Venezuela (Bolivarian Republic of)', 'Vietnam', 'Yemen', 'Zambia',
       'Zimbabwe'], dtype=object)
```

In [10]:

```
SEA = ('Brunei Darussalam', 'Cambodia', 'East Timor', 'Indonesia', 'Laos', 'Malaysia
Life_Expectancy_SEA = Life_Expectancy[Life_Expectancy['country'].isin(SEA)]
Life_Expectancy_SEA
```

Out[10]:

| | country | Status | Mean Life Expectancy | Max Life Expectancy | Mean Adult Mortality | Mean BMI | Mean Income Composition of Resources | Mean Schooling |
|---|---|---|---|---|---|---|---|---|
| **23** | Brunei Darussalam | Developing | 78.3 | 76.48750 | 67.0625 | 29.71875 | 0.839375 | 14.10625 |
| **28** | Cambodia | Developing | 68.7 | 64.34375 | 196.3750 | 15.36250 | 0.491938 | 9.87500 |
| **51** | East Timor | Developing | 68.3 | 64.75625 | 170.3750 | 14.55000 | 0.517625 | 10.70000 |
| **78** | Indonesia | Developing | 69.1 | 67.55625 | 166.5625 | 19.95625 | 0.641437 | 11.61250 |
| **92** | Laos | Developing | 65.7 | 62.38125 | 197.1875 | 14.36250 | 0.515625 | 9.23125 |
| **102** | Malaysia | Developing | 75.0 | 73.75625 | 118.5625 | 29.16875 | 0.749125 | 12.56250 |
| **116** | Myanmar | Developing | 66.6 | 64.20000 | 154.3125 | 17.12500 | 0.488250 | 8.32500 |
| **134** | Philippines | Developing | 68.5 | 67.57500 | 217.9375 | 19.18750 | 0.650438 | 11.54375 |
| **154** | Singapore | Developed | 87.0 | 81.47500 | 62.0000 | 25.90625 | 0.866875 | 13.98125 |
| **170** | Thailand | Developing | 74.9 | 73.08125 | 160.3750 | 21.59375 | 0.694688 | 12.55000 |
| **189** | Vietnam | Developing | 76.0 | 74.77500 | 126.5625 | 11.18750 | 0.627062 | 11.51250 |

# Manage any data type issues or data issues

In [11]:

```
Life_Expectancy_SEA.dtypes
```

Out[11]:

```
country                                object
Status                                 object
Mean Life Expectancy                  float64
Max Life Expectancy                   float64
Mean Adult Mortality                  float64
Mean BMI                              float64
Mean Income Composition of Resources  float64
Mean Schooling                        float64
dtype: object
```

The data types are correct, nothing to change

# Reading the GDP data file and Wrangling the useful data

Using the panda library, we read the csv file and store them as a data frame We also use the function to output the dataframe to check if the file has been read correctly

In [12]:
```
gdp = pd.read_csv('data/2019-GDP.csv')
gdp.shape
```

Out[12]:
```
(244, 6)
```

In [13]:
```
gdp.sample(5)
```

Out[13]:

| | Unnamed: 0 | Gross domestic product 2019 | Unnamed: 2 | Unnamed: 3 | Unnamed: 4 | Unnamed: 5 |
|---|---|---|---|---|---|---|
| **215** | SXM | NaN | NaN | Sint Maarten (Dutch part) | - | NaN |
| **216** | SSD | NaN | NaN | South Sudan | - | NaN |
| **45** | CHL | 42 | NaN | Chile | 282,318 | NaN |
| **188** | GNB | 185 | NaN | Guinea-Bissau | 1,340 | NaN |
| **33** | NOR | 30 | NaN | Norway | 403,336 | NaN |

# Cleaning the data

Changing name 'Timor-Leste' to 'East Timor'

In [14]:
```
gdp['Unnamed: 3'].unique()
```

Out[14]:
```
array([nan, 'Economy', 'United States', 'China', 'Japan', 'Germany',
       'India', 'United Kingdom', 'France', 'Italy', 'Brazil', 'Canada',
       'Russian Federation', 'Korea, Rep.', 'Spain', 'Australia',
       'Mexico', 'Indonesia', 'Netherlands', 'Saudi Arabia', 'Turkey',
       'Switzerland', 'Poland', 'Thailand', 'Sweden', 'Belgium',
       'Argentina', 'Nigeria', 'Austria', 'Iran, Islamic Rep.',
       'United Arab Emirates', 'Norway', 'Israel', 'Ireland',
       'Philippines', 'Singapore', 'Hong Kong SAR, China', 'Malaysia',
       'South Africa', 'Denmark', 'Colombia', 'Egypt, Arab Rep.',
       'Bangladesh', 'Chile', 'Pakistan', 'Finland', 'Vietnam', 'Romania',
       'Czech Republic', 'Portugal', 'Iraq', 'Peru', 'Greece',
       'New Zealand', 'Qatar', 'Kazakhstan', 'Algeria', 'Hungary',
       'Ukraine', 'Kuwait', 'Morocco', 'Ecuador', 'Slovak Republic',
       'Puerto Rico', 'Cuba', 'Ethiopia', 'Kenya', 'Angola',
       'Dominican Republic', 'Sri Lanka', 'Oman', 'Guatemala', 'Myanmar',
       'Luxembourg', 'Bulgaria', 'Ghana', 'Panama', 'Tanzania', 'Belarus',
       'Costa Rica', 'Croatia', "Côte d'Ivoire", 'Uzbekistan', 'Uruguay',
       'Lithuania', 'Macao SAR, China', 'Slovenia', 'Lebanon', 'Libya',
       'Serbia', 'Azerbaijan', 'Congo, Dem. Rep.', 'Jordan', 'Bolivia',
       'Turkmenistan', 'Tunisia', 'Cameroon', 'Bahrain', 'Paraguay',
       'Uganda', 'Latvia', 'Estonia', 'Nepal', 'Yemen, Rep.', 'Cambodia',
       'El Salvador', 'Honduras', 'Papua New Guinea', 'Cyprus', 'Iceland',
       'Trinidad and Tobago', 'Senegal', 'Zambia', 'Zimbabwe',
       'Bosnia and Herzegovina', 'Afghanistan', 'Sudan', 'Botswana',
       'Lao PDR', 'Georgia', 'Mali', 'Gabon', 'Jamaica', 'Burkina Faso',
       'Albania', 'Mozambique', 'Malta', 'West Bank and Gaza', 'Benin',
       'Mauritius', 'Madagascar', 'Mongolia', 'Armenia', 'Guinea',
       'Brunei Darussalam', 'Niger', 'Bahamas, The', 'North Macedonia',
```

```
       'Nicaragua', 'Namibia', 'Moldova', 'Chad', 'Equatorial Guinea',
       'Congo, Rep.', 'Rwanda', 'Haiti', 'Kyrgyz Republic', 'Tajikistan',
       'Kosovo', 'Malawi', 'Mauritania', 'Monaco', 'Isle of Man',
       'Liechtenstein', 'Guam', 'Maldives', 'Fiji', 'Montenegro',
       'Cayman Islands', 'Togo', 'Barbados', 'Eswatini', 'Guyana',
       'Suriname', 'Sierra Leone', 'Virgin Islands (U.S.)', 'Djibouti',
       'Andorra', 'Curaçao', 'Liberia', 'Aruba', 'Greenland', 'Burundi',
       'Faroe Islands', 'Lesotho', 'Bhutan', 'Central African Republic',
       'St. Lucia', 'Cabo Verde', 'Belize', 'Gambia, The',
       'Antigua and Barbuda', 'Seychelles', 'Timor-Leste', 'San Marino',
       'Solomon Islands', 'Guinea-Bissau', 'Northern Mariana Islands',
       'Grenada', 'Comoros', 'St. Kitts and Nevis',
       'Turks and Caicos Islands', 'Vanuatu', 'Samoa',
       'St. Vincent and the Grenadines', 'American Samoa', 'Dominica',
       'Tonga', 'São Tomé and Principe', 'Micronesia, Fed. Sts.', 'Palau',
       'Marshall Islands', 'Kiribati', 'Nauru', 'Tuvalu', 'Bermuda',
       'British Virgin Islands', 'Channel Islands', 'Eritrea',
       'French Polynesia', 'Gibraltar', "Korea, Dem. People's Rep.",
       'New Caledonia', 'Sint Maarten (Dutch part)', 'South Sudan',
       'St. Martin (French part)', 'Syrian Arab Republic',
       'Venezuela, RB', 'Somalia', 'World', 'East Asia & Pacific',
       'Europe & Central Asia', 'Latin America & Caribbean',
       'Middle East & North Africa', 'North America', 'South Asia',
       'Sub-Saharan Africa', 'Low income', 'Lower middle income',
       'Upper middle income', 'High income'], dtype=object)
```

In [15]:

```
gdp.loc[gdp['Unnamed: 3'] == 'Timor-Leste','Unnamed: 3'] = 'East Timor'
gdp.loc[gdp['Unnamed: 3'] == 'Lao PDR','Unnamed: 3'] = 'Laos'
```

# Filtering out South East Asian Countries for the GDP DataFrame

We create a tuple of South East Asian Countries as SEA because it is faster as compared to lists and requires less memory

In [16]:

```
SEA = ('Brunei Darussalam', 'Cambodia', 'East Timor', 'Indonesia', 'Laos', 'Malaysia
GDP_SEA = gdp[gdp['Unnamed: 3'].isin(SEA)]
GDP_SEA_1 = GDP_SEA.drop(['Unnamed: 0','Unnamed: 2', 'Unnamed: 5', 'Gross domestic p
GDP_SEA_Final = GDP_SEA_1.rename(columns = {'Unnamed: 3': 'country','Unnamed: 4': 'G
GDP_SEA_Final
```

Out[16]:

| | country | GDP (Millions US Dollars) |
|---|---|---|
| 19 | Indonesia | 1,119,191 |
| 25 | Thailand | 543,650 |
| 36 | Philippines | 376,796 |
| 37 | Singapore | 372,063 |
| 39 | Malaysia | 364,702 |
| 48 | Vietnam | 261,921 |
| 74 | Myanmar | 76,086 |
| 106 | Cambodia | 27,089 |
| 120 | Laos | 18,174 |

| | country | GDP (Millions US Dollars) |
|---|---|---|
| **136** | Brunei Darussalam | 13,469 |
| **185** | East Timor | 1,674 |

# Reading The population.csv file

## and checking if it is read correctly

In [18]:
```
population = pd.read_csv('data/2020-Population.csv')
population.shape
```

Out[18]: (305, 78)

In [19]:
```
population.sample(5)
```

Out[19]:

| | Unnamed: 0 | Unnamed: 1 | Unnamed: 2 | Unnamed: 3 | Unnamed: 4 | Unnamed: 5 | Unnamed: 6 | Unnamed: 7 |
|---|---|---|---|---|---|---|---|---|
| **136** | 121 | Estimates | Iran (Islamic Republic of) | NaN | 364 | Country/Area | 5501 | 17 119 |
| **116** | 101 | Estimates | Oman | NaN | 512 | Country/Area | 922 | 456 |
| **11** | © August 2019 by United Nations, made availabl... | NaN | NaN | NaN | NaN | NaN | NaN | NaN |
| **101** | 86 | Estimates | Morocco | NaN | 504 | Country/Area | 912 | 8 986 |
| **289** | 274 | Estimates | Western Europe | NaN | 926 | Subregion | 917 | 142 414 |

5 rows × 78 columns

# Cleaning the Population Dataframe and producing only the relevant Data

In [20]:
```
population = population.rename(columns = {'Unnamed: 2': 'country', 'Unnamed: 76': '2
population.loc[population['country'] == 'Viet Nam','country'] = 'Vietnam'
population.loc[population['country'] == 'Timor-Leste','country'] = 'East Timor'
population.loc[population['country'] == 'Lao People\'s Democratic Republic','country
```

In [21]:
```
SEA = ('Brunei Darussalam', 'Cambodia', 'East Timor', 'Indonesia', 'Laos', 'Malaysia
population_SEA = population[population['country'].isin(SEA)]
population_SEA_Final = population_SEA[['country', '2019 Population (Thousands)']]
population_SEA_Final
```

Out[21]:

| | country | 2019 Population (Thousands) |
|---|---|---|
| **152** | Brunei Darussalam | 433 |
| **153** | Cambodia | 16 487 |
| **154** | Indonesia | 270 626 |
| **155** | Laos | 7 169 |
| **156** | Malaysia | 31 950 |
| **157** | Myanmar | 54 045 |
| **158** | Philippines | 108 117 |
| **159** | Singapore | 5 804 |
| **160** | Thailand | 69 626 |
| **161** | East Timor | 1 293 |
| **162** | Vietnam | 96 462 |

# Creating a dataframe for perCapitaGDP

GDP per capita shows a country's GDP divided by its total population.

In [22]:

```
perCapitaGDP = pd.merge(GDP_SEA_Final, population_SEA_Final, on = 'country')
perCapitaGDP.dtypes
```

Out[22]:

```
country                        object
GDP (Millions US Dollars)      object
2019 Population (Thousands)    object
dtype: object
```

# Change the data types

We need to change data tpes of gdp and population to int so we can perform mathematical operations

In [23]:

```
import locale
from locale import atof
```

In [24]:

```
locale.setlocale(locale.LC_NUMERIC, '')
perCapitaGDP['GDP (Millions US Dollars)'] = perCapitaGDP['GDP (Millions US Dollars)'
perCapitaGDP['2019 Population (Thousands)'] = perCapitaGDP['2019 Population (Thousan
perCapitaGDP['2019 Population (Thousands)'] = perCapitaGDP['2019 Population (Thousan
perCapitaGDP.dtypes
```

Out[24]:

```
country                         object
GDP (Millions US Dollars)      float64
2019 Population (Thousands)    float64
dtype: object
```

# Converting the population as a whole

Multiplying by 1000 to make it easier to understand

In [25]:
```
#perCapitaGDP['GDP'] = perCapitaGDP['GDP (Millions US Dollars)'].mul(1000000)
#perCapitaGDP['2019 Population'] = perCapitaGDP['2019 Population (Thousands)'].mul(1
perCapitaGDP = perCapitaGDP[['country', 'GDP (Millions US Dollars)', '2019 Populatio
perCapitaGDP
```

Out[25]:

| | country | GDP (Millions US Dollars) | 2019 Population (Thousands) |
|---|---|---|---|
| **0** | Indonesia | 1119191.0 | 270626.0 |
| **1** | Thailand | 543650.0 | 69626.0 |
| **2** | Philippines | 376796.0 | 108117.0 |
| **3** | Singapore | 372063.0 | 5804.0 |
| **4** | Malaysia | 364702.0 | 31950.0 |
| **5** | Vietnam | 261921.0 | 96462.0 |
| **6** | Myanmar | 76086.0 | 54045.0 |
| **7** | Cambodia | 27089.0 | 16487.0 |
| **8** | Laos | 18174.0 | 7169.0 |
| **9** | Brunei Darussalam | 13469.0 | 433.0 |
| **10** | East Timor | 1674.0 | 1293.0 |

# Find perCapitaGDP

In [26]:
```
perCapitaGDP['perCapitaGDP (Millions of USD per 1000 people)'] = perCapitaGDP['GDP (
perCapitaGDP
```

Out[26]:

| | country | GDP (Millions US Dollars) | 2019 Population (Thousands) | perCapitaGDP (Millions of USD per 1000 people) |
|---|---|---|---|---|
| **0** | Indonesia | 1119191.0 | 270626.0 | 4.135563 |
| **1** | Thailand | 543650.0 | 69626.0 | 7.808146 |
| **2** | Philippines | 376796.0 | 108117.0 | 3.485076 |
| **3** | Singapore | 372063.0 | 5804.0 | 64.104583 |
| **4** | Malaysia | 364702.0 | 31950.0 | 11.414773 |
| **5** | Vietnam | 261921.0 | 96462.0 | 2.715276 |
| **6** | Myanmar | 76086.0 | 54045.0 | 1.407827 |
| **7** | Cambodia | 27089.0 | 16487.0 | 1.643052 |
| **8** | Laos | 18174.0 | 7169.0 | 2.535082 |
| **9** | Brunei Darussalam | 13469.0 | 433.0 | 31.106236 |
| **10** | East Timor | 1674.0 | 1293.0 | 1.294664 |

# Merging the Data

and verifying that it has been merged correctly

In [27]:
```
final_df = pd.merge(Life_Expectancy_SEA,perCapitaGDP, on = 'country')
final_df.shape
```

Out[27]:
```
(11, 11)
```

In [28]:
```
final_df
```

Out[28]:

| | country | Status | Mean Life Expectancy | Max Life Expectancy | Mean Adult Mortality | Mean BMI | Mean Income Composition of Resources | Mean Schooling |
|---|---|---|---|---|---|---|---|---|
| **0** | Brunei Darussalam | Developing | 78.3 | 76.48750 | 67.0625 | 29.71875 | 0.839375 | 14.10625 |
| **1** | Cambodia | Developing | 68.7 | 64.34375 | 196.3750 | 15.36250 | 0.491938 | 9.87500 |
| **2** | East Timor | Developing | 68.3 | 64.75625 | 170.3750 | 14.55000 | 0.517625 | 10.70000 |
| **3** | Indonesia | Developing | 69.1 | 67.55625 | 166.5625 | 19.95625 | 0.641437 | 11.61250 |
| **4** | Laos | Developing | 65.7 | 62.38125 | 197.1875 | 14.36250 | 0.515625 | 9.23125 |
| **5** | Malaysia | Developing | 75.0 | 73.75625 | 118.5625 | 29.16875 | 0.749125 | 12.56250 |
| **6** | Myanmar | Developing | 66.6 | 64.20000 | 154.3125 | 17.12500 | 0.488250 | 8.32500 |
| **7** | Philippines | Developing | 68.5 | 67.57500 | 217.9375 | 19.18750 | 0.650438 | 11.54375 |
| **8** | Singapore | Developed | 87.0 | 81.47500 | 62.0000 | 25.90625 | 0.866875 | 13.98125 |
| **9** | Thailand | Developing | 74.9 | 73.08125 | 160.3750 | 21.59375 | 0.694688 | 12.55000 |
| **10** | Vietnam | Developing | 76.0 | 74.77500 | 126.5625 | 11.18750 | 0.627062 | 11.51250 |

# Q1

### 1. Each country will be classified as developing or developed. With this in mind, how would you visualise the expected life expectancy for the South East Asian population for developed or developing countries? Give some kind of insight (although it may be straight forward and easily understood from the visualisation).

Create a dataframe using groupby function to visualise the relevant data

In [29]:
```
fun2 = {'Mean Life Expectancy':'mean'}
groupby_status = final_df.groupby('Status').agg(fun2)
```

Reset the index of the dataframe and output the data

In [30]:
```
groupby_status = groupby_status.reset_index()
groupby_status
```

Out[30]:

| | Status | Mean Life Expectancy |
|---|---|---|
| 0 | Developed | 87.00 |
| 1 | Developing | 71.11 |

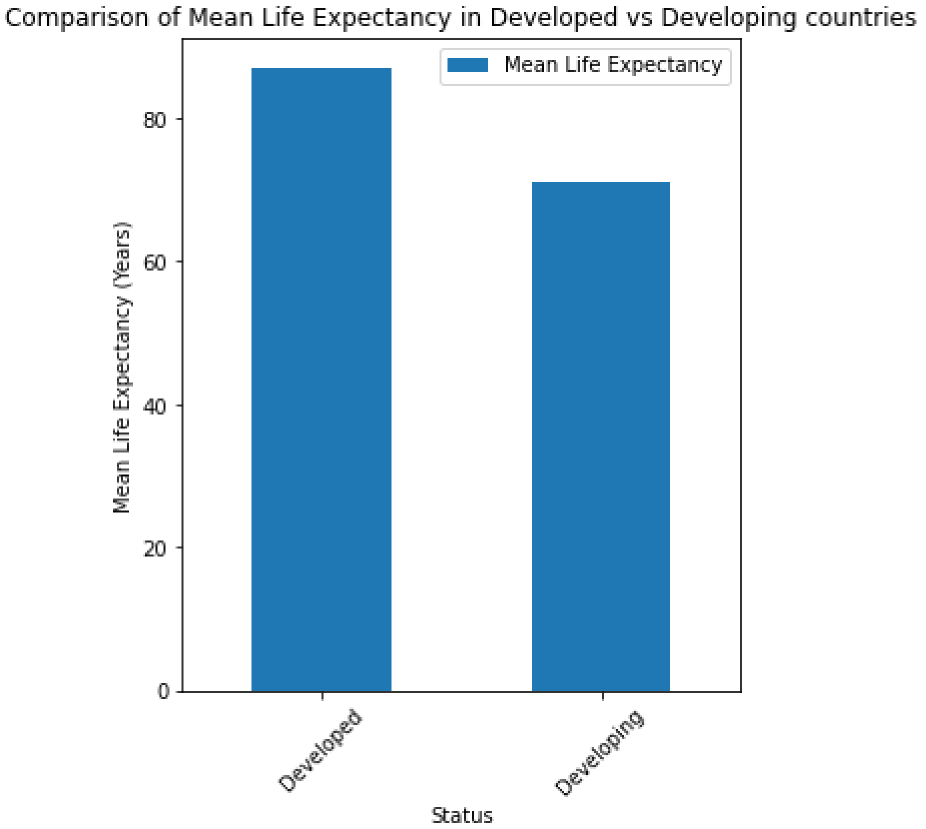
## Visualise as a bar chart

In [31]:

```
bar = groupby_status.plot.bar(figsize = (5,6))
# figsize sets size of plot
bar.set_xticklabels(groupby_status['Status'],rotation = 45)
# use values of column 'class' as the x axis labels.
plt.xlabel('Status')
# setting a label for x axis
plt.ylabel('Mean Life Expectancy (Years)')
# Setting a label for y axis
plt.title('Comparison of Mean Life Expectancy in Developed vs Developing countries')
# Setting the title of chart
```

Out[31]:

```
Text(0.5, 1.0, 'Comparison of Mean Life Expectancy in Developed vs Developing countr
ies')
```




# Answer 1

### We use a graph to visualize the data as it is between only 2 variables and one of them being a value. Hence the most suitable option being a bar chart.

### As visualised in the bar chart produced above, the average life expectancy in already developed countries is significantly larger as compared to the presently developing countries.

### In comparison, the mean life expectancy in developed countries is approximately 87 years as seen in the bar chart whereas the mean life expectancy in developing countries is in the range of 70-72 years. This could suggest that developed countries produce a safer lifestyle, hence improving the average life expectancy as compared to developing countries

# Q2.

#### Create a bar graph for each country, with side-by-side bars for population, mean life expectancy, and adult mortality. There are two difficulties here: first, the default graph will be difficult to visualise due to big disparities in the numbers, and second, this information may not provide a decent visualisation. These two challenges need you to figure out, create the necessary code adjustments for the visualisation, and explainwhy the data used for the graph may be misleading (some general knowledge / domain expertise required).

Create a dataframe using groupby function to visualise the relevant data

In [32]:
```
fun3 = {'Mean Life Expectancy':'mean', 'Mean Adult Mortality': 'mean', '2019 Populat
groupby_country = final_df.groupby('country').agg(fun3)
```

In [33]:
```
groupby_country = groupby_country.reset_index()
groupby_country
```

Out[33]:

| | country | Mean Life Expectancy | Mean Adult Mortality | 2019 Population (Thousands) |
|---|---|---|---|---|
| **0** | Brunei Darussalam | 78.3 | 67.0625 | 433.0 |
| **1** | Cambodia | 68.7 | 196.3750 | 16487.0 |
| **2** | East Timor | 68.3 | 170.3750 | 1293.0 |
| **3** | Indonesia | 69.1 | 166.5625 | 270626.0 |
| **4** | Laos | 65.7 | 197.1875 | 7169.0 |
| **5** | Malaysia | 75.0 | 118.5625 | 31950.0 |
| **6** | Myanmar | 66.6 | 154.3125 | 54045.0 |
| **7** | Philippines | 68.5 | 217.9375 | 108117.0 |
| **8** | Singapore | 87.0 | 62.0000 | 5804.0 |
| **9** | Thailand | 74.9 | 160.3750 | 69626.0 |
| **10** | Vietnam | 76.0 | 126.5625 | 96462.0 |

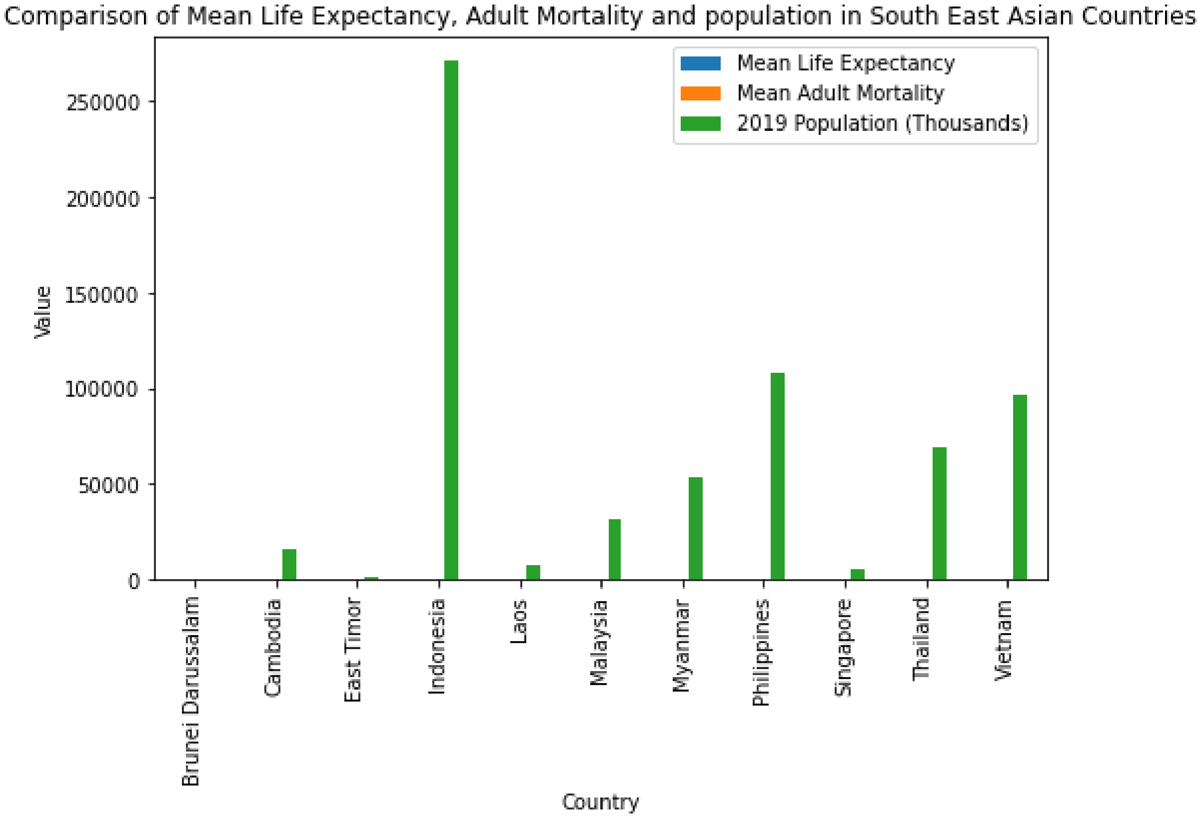
# Original Graph

In [34]:
```
bar = groupby_country.plot.bar(figsize = (8,5))
# figsize sets size of plot
bar.set_xticklabels(groupby_country['country'],rotation = 90)
# use values of column 'class' as the x axis labels.
plt.xlabel('Country')
# setting a label for x axis
```

```
plt.ylabel('Value')
# Setting a label for y axis
plt.title('Comparison of Mean Life Expectancy, Adult Mortality and population in Sou
# Setting the title of chart
```

Out[34]:

```
Text(0.5, 1.0, 'Comparison of Mean Life Expectancy, Adult Mortality and population i
n South East Asian Countries')
```




As we can see, its difficult to visualise the relevant data, hence we improve the graph

# Improving the graph

In [35]:

```
groupby_country['2019 Population (Millions)'] = groupby_country['2019 Population (Th
groupby_country.drop('2019 Population (Thousands)', axis = 1, inplace = True)
groupby_country
```

Out[35]:

| | country | Mean Life Expectancy | Mean Adult Mortality | 2019 Population (Millions) |
|---|---|---|---|---|
| **0** | Brunei Darussalam | 78.3 | 67.0625 | 0.433 |
| **1** | Cambodia | 68.7 | 196.3750 | 16.487 |
| **2** | East Timor | 68.3 | 170.3750 | 1.293 |
| **3** | Indonesia | 69.1 | 166.5625 | 270.626 |
| **4** | Laos | 65.7 | 197.1875 | 7.169 |
| **5** | Malaysia | 75.0 | 118.5625 | 31.950 |
| **6** | Myanmar | 66.6 | 154.3125 | 54.045 |
| **7** | Philippines | 68.5 | 217.9375 | 108.117 |
| **8** | Singapore | 87.0 | 62.0000 | 5.804 |
| **9** | Thailand | 74.9 | 160.3750 | 69.626 |

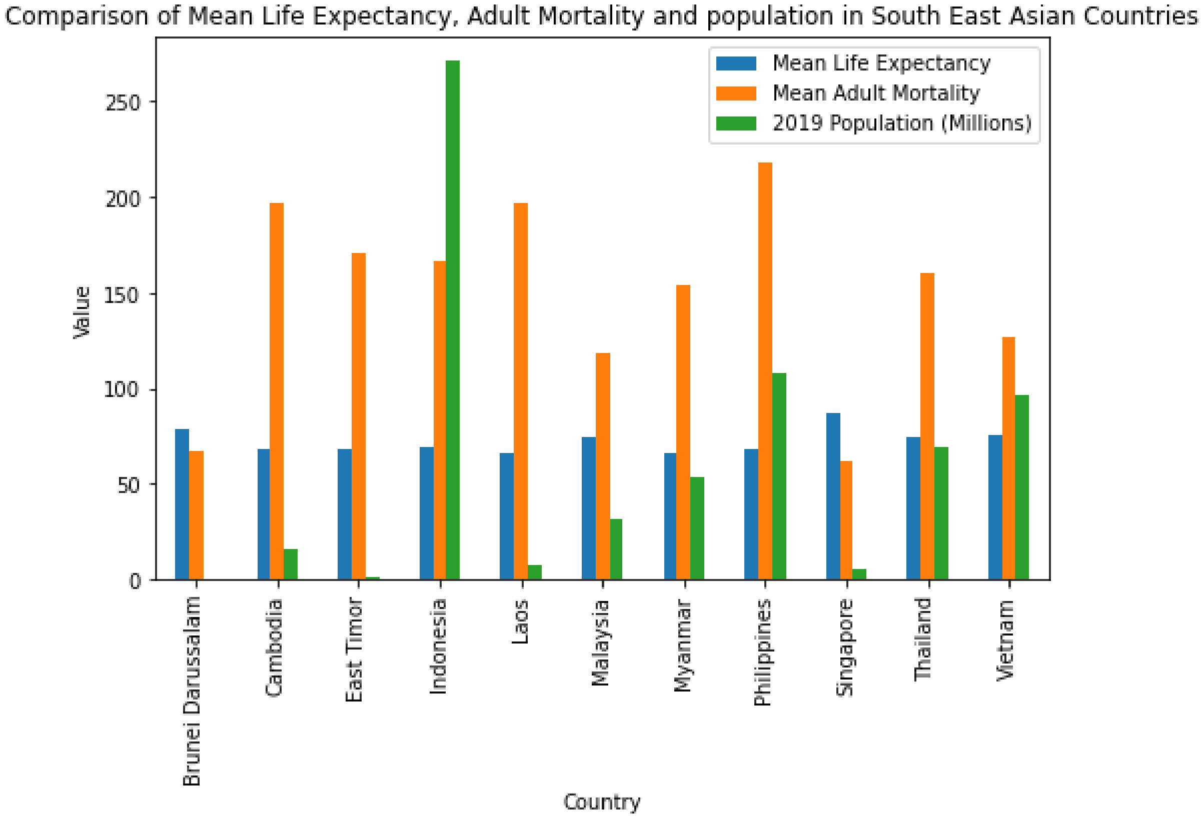
| | country | Mean Life Expectancy | Mean Adult Mortality | 2019 Population (Millions) |
|---|---|---|---|---|
| **10** | Vietnam | 76.0 | 126.5625 | 96.462 |

In [36]:

```
bar = groupby_country.plot.bar(figsize = (8,5))
# figsize sets size of plot
bar.set_xticklabels(groupby_country['country'],rotation = 90)
# use values of column 'class' as the x axis labels.
plt.xlabel('Country')
# setting a label for x axis
plt.ylabel('Value')
# Setting a label for y axis
plt.title('Comparison of Mean Life Expectancy, Adult Mortality and population in Sou
# Setting the title of chart
```

Out[36]:

```
Text(0.5, 1.0, 'Comparison of Mean Life Expectancy, Adult Mortality and population i
n South East Asian Countries')
```




We can convert the population into millions and display the graph, but it still doesn't clearly visualise the smaller population as there is a massive disparity between the populations of the countries (ex: Brunei, East Timor and Singapore)

# Solution

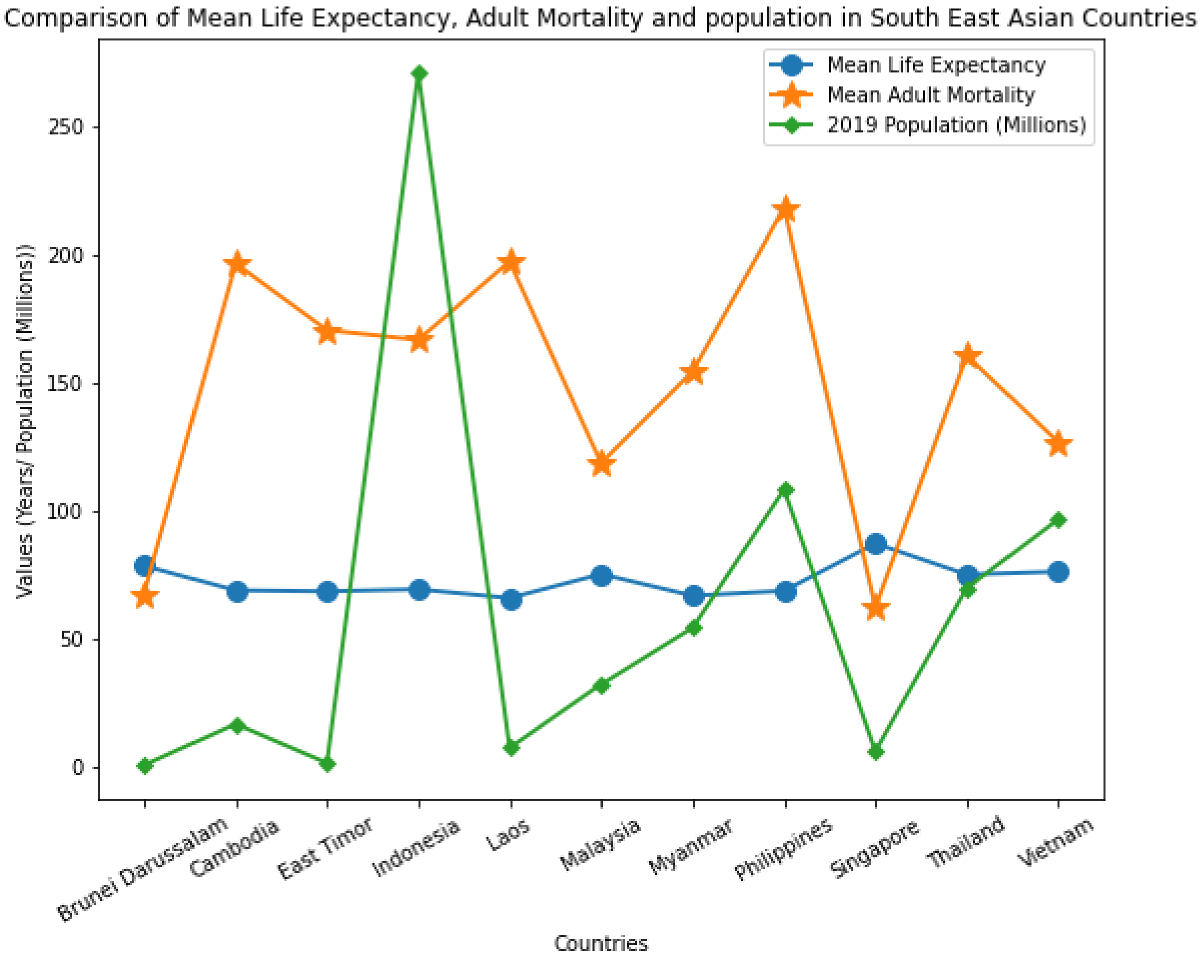
We can create a multiline graph with different markers and adjusted marker size to make the value pop out. This gives a more understandable visualization for the comparison of Mean Life Expectancy, Adult Mortality and population in South East Asian Countries

In [37]:

```
fig, ax = plt.subplots(figsize=[9, 7])

ax.plot(groupby_country['country'], groupby_country['Mean Life Expectancy'], marker=
ax.plot(groupby_country['country'], groupby_country['Mean Adult Mortality'], marker=
```

```
ax.plot(groupby_country['country'], groupby_country['2019 Population (Millions)'], m
plt.xticks(rotation=30)
ax.set_xlabel('Countries')
ax.set_ylabel('Values (Years/ Population (Millions))')
plt.legend()
plt.title('Comparison of Mean Life Expectancy, Adult Mortality and population in Sou
plt.show()
```




# Q3.

For the final question, you will probably need the non-aggregated data from "LifeExpectancyData-v2.csv". You are to extract the data that's related only to Singapore and then plot a line graph on the Life expectancy over time. Again, plot another line graph to visualise the Adult mortality and infant deaths over time. Explain in what circumstances would the first line graph be useful (if at all) and What effect will infant and adult mortality rates have on life expectancy?

The Original Life Expectancy dataframe is saved as Life_Expectancy

In [38]:
```
life.sample(5)
```

Out[38]:

| | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B |
|---|---|---|---|---|---|---|---|---|---|
| 752 | Denmark | 2000 | Developed | 76.9 | 0 | 12.0 | 52.2 | 11.69 | NaN |

| | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B |
|---|---|---|---|---|---|---|---|---|---|
| **318** | Bolivia (Plurinational State of) | 2001 | Developing | 63.3 | 14 | 238.0 | 43.3 | 2.20 | 77.0 |
| **745** | Denmark | 2007 | Developed | 78.4 | 0 | 93.0 | 55.9 | 10.99 | NaN |
| **1313** | Jamaica | 2000 | Developing | 72.6 | 1 | 171.0 | 41.6 | 3.46 | NaN |
| **32** | Algeria | 2015 | Developing | 75.6 | 21 | 19.0 | 59.5 | NaN | 95.0 |

In [39]:

```
singapore = life.loc[life['country'] == 'Singapore']
```

In [40]:

```
singapore.reset_index()
```

Out[40]:

| | index | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B |
|---|---|---|---|---|---|---|---|---|---|---|
| **0** | 2313 | Singapore | 2015 | Developed | 83.1 | 0 | 55.0 | 33.2 | 1.79 | 96.( |
| **1** | 2314 | Singapore | 2014 | Developed | 82.9 | 0 | 56.0 | 32.9 | 1.83 | 96.( |
| **2** | 2315 | Singapore | 2013 | Developed | 82.7 | 0 | 57.0 | 32.7 | 1.83 | 97.( |
| **3** | 2316 | Singapore | 2012 | Developed | 82.5 | 0 | 59.0 | 32.4 | 1.89 | 97.( |
| **4** | 2317 | Singapore | 2011 | Developed | 82.2 | 0 | 6.0 | 32.1 | 1.80 | 96.( |
| **5** | 2318 | Singapore | 2010 | Developed | 82.0 | 0 | 61.0 | 31.8 | 1.84 | 96.( |
| **6** | 2319 | Singapore | 2009 | Developed | 81.7 | 0 | 62.0 | 31.5 | 1.73 | 96.( |
| **7** | 2320 | Singapore | 2008 | Developed | 81.4 | 0 | 64.0 | 31.2 | 1.70 | 97.( |
| **8** | 2321 | Singapore | 2007 | Developed | 81.1 | 0 | 65.0 | 3.9 | 1.60 | 96.( |
| **9** | 2322 | Singapore | 2006 | Developed | 87.0 | 0 | 66.0 | 3.5 | 1.55 | 95.( |
| **10** | 2323 | Singapore | 2005 | Developed | 82.0 | 0 | 69.0 | 3.2 | 1.49 | 96.( |
| **11** | 2324 | Singapore | 2004 | Developed | 79.7 | 0 | 71.0 | 29.9 | 1.45 | 94.( |
| **12** | 2325 | Singapore | 2003 | Developed | 79.3 | 0 | 73.0 | 29.6 | 1.43 | 95.( |
| **13** | 2326 | Singapore | 2002 | Developed | 79.0 | 0 | 74.0 | 29.2 | 2.16 | 95.( |
| **14** | 2327 | Singapore | 2001 | Developed | 78.7 | 0 | 76.0 | 28.9 | 2.08 | 95.( |
| **15** | 2328 | Singapore | 2000 | Developed | 78.3 | 0 | 78.0 | 28.5 | 2.03 | 97.( |

## Arrange the data in ascending order of year

In [41]:

```
singapore.sort_values('Year')
```

Out[41]:

| | country | Year | Status | Life expectancy | infant deaths | Adult Mortality | BMI | Alcohol consumption | Hepatitis B | Mo |
|---|---|---|---|---|---|---|---|---|---|---|
| **2328** | Singapore | 2000 | Developed | 78.3 | 0 | 78.0 | 28.5 | 2.03 | 97.0 | |
| **2327** | Singapore | 2001 | Developed | 78.7 | 0 | 76.0 | 28.9 | 2.08 | 95.0 | |
| **2326** | Singapore | 2002 | Developed | 79.0 | 0 | 74.0 | 29.2 | 2.16 | 95.0 | |
| **2325** | Singapore | 2003 | Developed | 79.3 | 0 | 73.0 | 29.6 | 1.43 | 95.0 | |
| **2324** | Singapore | 2004 | Developed | 79.7 | 0 | 71.0 | 29.9 | 1.45 | 94.0 | |
| **2323** | Singapore | 2005 | Developed | 82.0 | 0 | 69.0 | 3.2 | 1.49 | 96.0 | |
| **2322** | Singapore | 2006 | Developed | 87.0 | 0 | 66.0 | 3.5 | 1.55 | 95.0 | |
| **2321** | Singapore | 2007 | Developed | 81.1 | 0 | 65.0 | 3.9 | 1.60 | 96.0 | |
| **2320** | Singapore | 2008 | Developed | 81.4 | 0 | 64.0 | 31.2 | 1.70 | 97.0 | |
| **2319** | Singapore | 2009 | Developed | 81.7 | 0 | 62.0 | 31.5 | 1.73 | 96.0 | |
| **2318** | Singapore | 2010 | Developed | 82.0 | 0 | 61.0 | 31.8 | 1.84 | 96.0 | |
| **2317** | Singapore | 2011 | Developed | 82.2 | 0 | 6.0 | 32.1 | 1.80 | 96.0 | |
| **2316** | Singapore | 2012 | Developed | 82.5 | 0 | 59.0 | 32.4 | 1.89 | 97.0 | |
| **2315** | Singapore | 2013 | Developed | 82.7 | 0 | 57.0 | 32.7 | 1.83 | 97.0 | |
| **2314** | Singapore | 2014 | Developed | 82.9 | 0 | 56.0 | 32.9 | 1.83 | 96.0 | |
| **2313** | Singapore | 2015 | Developed | 83.1 | 0 | 55.0 | 33.2 | 1.79 | 96.0 | |

## Group by Year for life expectancy

In [42]:
```
fun4 = {'Life expectancy ':'mean'}
groupby_year = singapore.groupby('Year').agg(fun4)
```

Arrange the dataframe

In [43]:
```
groupby_year = groupby_year.reset_index()
groupby_year
```

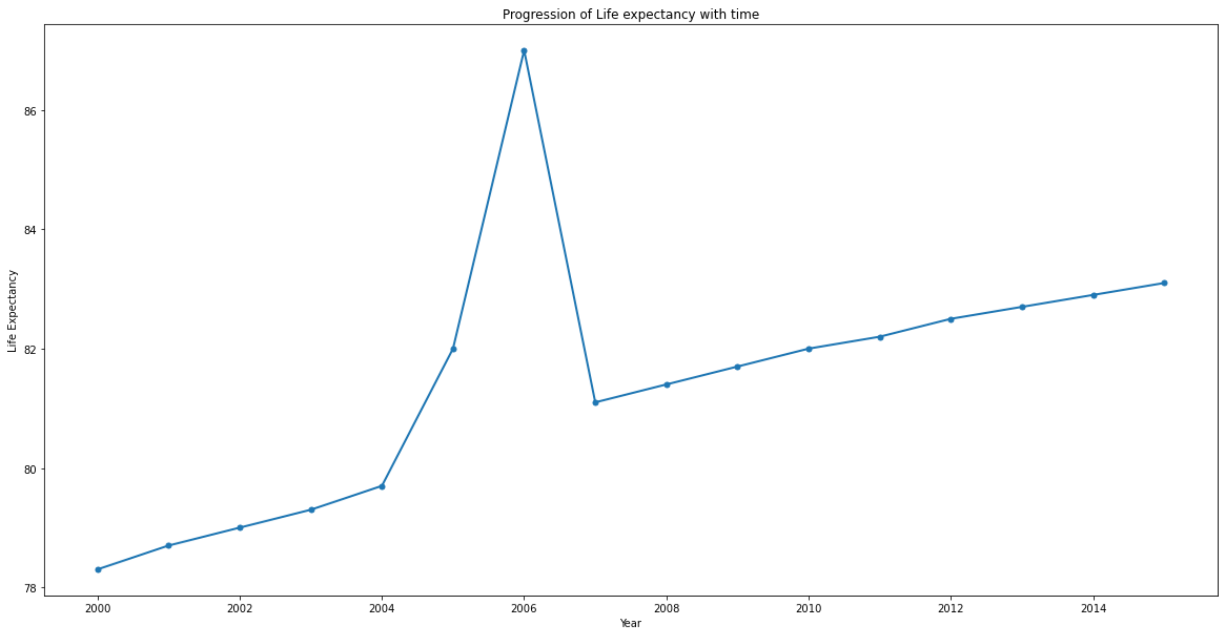
Out[43]:

| | Year | Life expectancy |
|---|---|---|
| **0** | 2000 | 78.3 |
| **1** | 2001 | 78.7 |
| **2** | 2002 | 79.0 |
| **3** | 2003 | 79.3 |
| **4** | 2004 | 79.7 |
| **5** | 2005 | 82.0 |
| **6** | 2006 | 87.0 |
| **7** | 2007 | 81.1 |
| **8** | 2008 | 81.4 |

| | Year | Life expectancy |
|---|---|---|
| 9 | 2009 | 81.7 |
| 10 | 2010 | 82.0 |
| 11 | 2011 | 82.2 |
| 12 | 2012 | 82.5 |
| 13 | 2013 | 82.7 |
| 14 | 2014 | 82.9 |
| 15 | 2015 | 83.1 |

In [44]:

```
fig, ax = plt.subplots(figsize=[20, 10])
ax.plot(groupby_year['Year'], groupby_year['Life expectancy '], marker='o', markersi
ax.set_xlabel('Year')
ax.set_ylabel('Life Expectancy')
plt.title('Progression of Life expectancy with time')
plt.show()
```




# Removing obvious anomaly

In [45]:

```
filt1 = groupby_year['Life expectancy '] < 85
groupby_year = groupby_year[filt1]
groupby_year
```

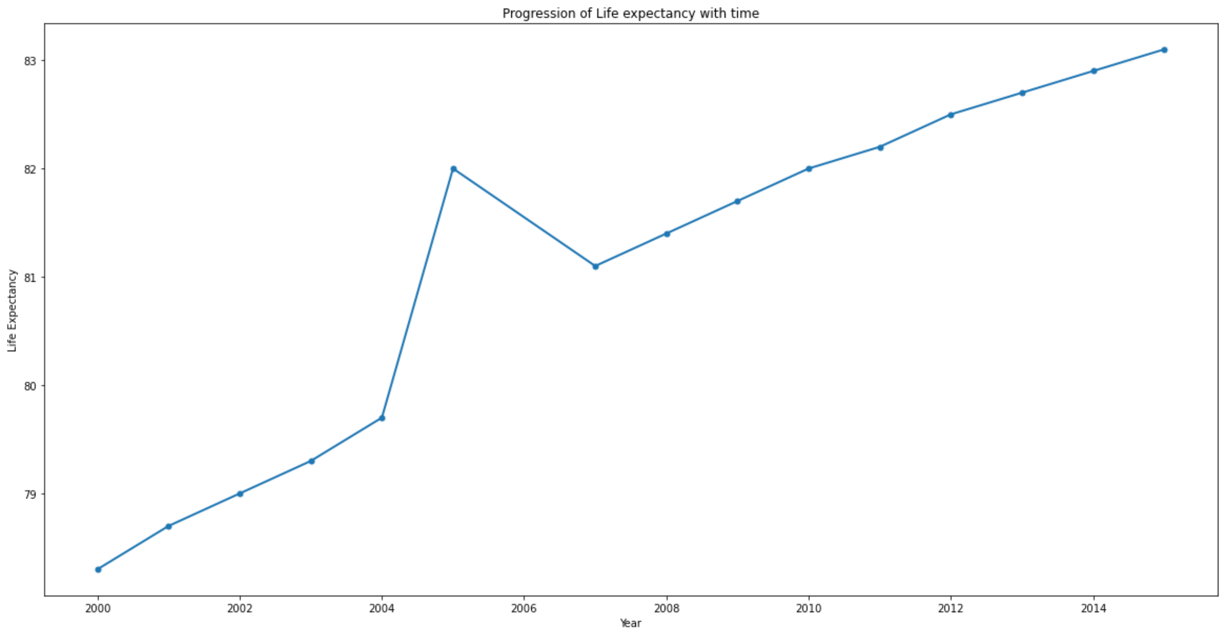
Out[45]:

| | Year | Life expectancy |
|---|---|---|
| 0 | 2000 | 78.3 |
| 1 | 2001 | 78.7 |
| 2 | 2002 | 79.0 |
| 3 | 2003 | 79.3 |
| 4 | 2004 | 79.7 |
| 5 | 2005 | 82.0 |

| | Year | Life expectancy |
|---|---|---|
| 7 | 2007 | 81.1 |
| 8 | 2008 | 81.4 |
| 9 | 2009 | 81.7 |
| 10 | 2010 | 82.0 |
| 11 | 2011 | 82.2 |
| 12 | 2012 | 82.5 |
| 13 | 2013 | 82.7 |
| 14 | 2014 | 82.9 |
| 15 | 2015 | 83.1 |

In [46]:

```
fig, ax = plt.subplots(figsize=[20, 10])
ax.plot(groupby_year['Year'], groupby_year['Life expectancy '], marker='o', markersi
ax.set_xlabel('Year')
ax.set_ylabel('Life Expectancy')
plt.title('Progression of Life expectancy with time')
plt.show()
```




## Group by year for Adult Mortality and Infant Deaths

In [47]:

```
fun5 = {'Adult Mortality':'mean', 'infant deaths': 'mean'}
groupby_year2 = singapore.groupby('Year').agg(fun5)
groupby_year2 = groupby_year2.reset_index()
groupby_year2
```

Out[47]:

| | Year | Adult Mortality | infant deaths |
|---|---|---|---|
| 0 | 2000 | 78.0 | 0.0 |
| 1 | 2001 | 76.0 | 0.0 |
| 2 | 2002 | 74.0 | 0.0 |
| 3 | 2003 | 73.0 | 0.0 |

| | Year | Adult Mortality | infant deaths |
|---|---|---|---|
| **4** | 2004 | 71.0 | 0.0 |
| **5** | 2005 | 69.0 | 0.0 |
| **6** | 2006 | 66.0 | 0.0 |
| **7** | 2007 | 65.0 | 0.0 |
| **8** | 2008 | 64.0 | 0.0 |
| **9** | 2009 | 62.0 | 0.0 |
| **10** | 2010 | 61.0 | 0.0 |
| **11** | 2011 | 6.0 | 0.0 |
| **12** | 2012 | 59.0 | 0.0 |
| **13** | 2013 | 57.0 | 0.0 |
| **14** | 2014 | 56.0 | 0.0 |
| **15** | 2015 | 55.0 | 0.0 |

## Removing outliers

In [48]:

```
filt2 = groupby_year2['Adult Mortality'] > 50.0
groupby_year2 = groupby_year2[filt2]
groupby_year2
```

Out[48]:

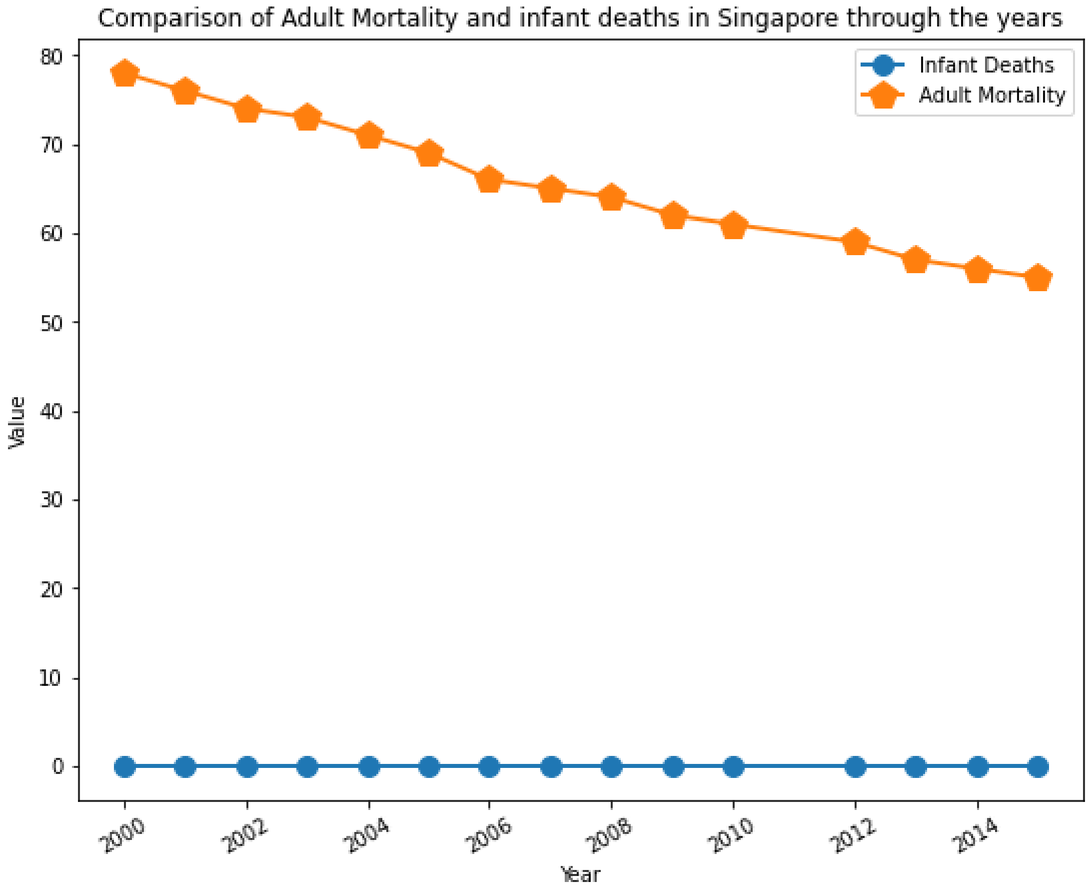
| | Year | Adult Mortality | infant deaths |
|---|---|---|---|
| **0** | 2000 | 78.0 | 0.0 |
| **1** | 2001 | 76.0 | 0.0 |
| **2** | 2002 | 74.0 | 0.0 |
| **3** | 2003 | 73.0 | 0.0 |
| **4** | 2004 | 71.0 | 0.0 |
| **5** | 2005 | 69.0 | 0.0 |
| **6** | 2006 | 66.0 | 0.0 |
| **7** | 2007 | 65.0 | 0.0 |
| **8** | 2008 | 64.0 | 0.0 |
| **9** | 2009 | 62.0 | 0.0 |
| **10** | 2010 | 61.0 | 0.0 |
| **12** | 2012 | 59.0 | 0.0 |
| **13** | 2013 | 57.0 | 0.0 |
| **14** | 2014 | 56.0 | 0.0 |
| **15** | 2015 | 55.0 | 0.0 |

In [49]:

```
fig, ax = plt.subplots(figsize=[9, 7])

ax.plot(groupby_year2['Year'], groupby_year2['infant deaths'], marker='o', markersiz
```

```
ax.plot(groupby_year2['Year'], groupby_year2['Adult Mortality'], marker='p', markers
plt.xticks(rotation=30)
ax.set_xlabel('Year')
ax.set_ylabel('Value')
plt.legend()
plt.title('Comparison of Adult Mortality and infant deaths in Singapore through the
plt.show()
```




# Answer 3

The first line graph will be useful when analyzing the average life expectancy of Singapore over time, this might be able to help us figure out what factors can affect the average life expectancy in the country by comparing other data

As we can see from the 2nd graph, the mean adult mortality gradually decreases with time, we can compare it to the 1st graph, which depicts the life expectancy increasing through the years, hence we can conclude that the decline in adult mortality results in a rise in life expectancy over the years.

The comparison between infant deaths and life expectancy is inconclusive as there is no valuable data as the infant deaths is 0 throughout the period analyzed

# Conclusion

**In conclusion, We used tools of python and various libraries such as pandas and matplotlib to wrangle, analyze and visualize data to compare the Populations of South East Asian Countries with the Life Expectancies and GDP for each country.**