In [59]:
```
import numpy as np
import matplotlib.pyplot as plt
import pandas as pd
from sklearn.linear_model import LinearRegression
import requests
%matplotlib inline
import os
os.chdir(r"C:\Users\camiu\M336\MATH 336 FOLDER(shen)\MATH336 (SHEN)")
```

Q4

In [60]:
```
lifeExpectancy = pd.read_csv('LifeExpectancy19602020.csv')
lifeExpectancy.head()
```

Out[60]:

	Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1
0	Aruba	ABW	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	65.662000	66.074000	66.444000	66.787000	67.11
1	Africa Eastern and Southern	AFE	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	42.716053	43.166935	43.603990	44.025617	44.43
2	Afghanistan	AFG	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	32.446000	32.962000	33.471000	33.971000	34.46
3	Africa Western and Central	AFW	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	37.205380	37.632546	38.052612	38.463746	38.86
4	Angola	AGO	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	37.524000	37.811000	38.113000	38.430000	38.76

5 rows × 66 columns

In [61]:
```
jap = lifeExpectancy[lifeExpectancy['Country Name'] == 'Japan']
jap
```

Out[61]:

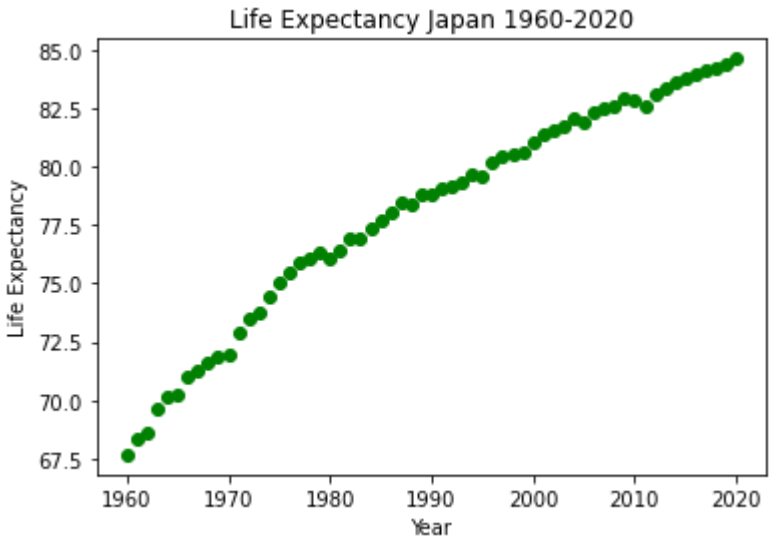
	Country Name	Country Code	Indicator Name	Indicator Code	1960	1961	1962	1963	1964
119	Japan	JPN	Life expectancy at birth, total (years)	SP.DYN.LE00.IN	67.666098	68.31	68.594878	69.658049	70.132439

1 rows × 66 columns

In [73]:
```
japArr = np.array(lifeExpectancy.iloc[119,4:-1])
print(len(japArr))
year = np.arange(1960,2021)
print(len(year))


x = year
y = japArr
plt.xlabel('Year')
plt.ylabel('Life Expectancy')
plt.title('Life Expectancy Japan 1960-2020')
plt.scatter(x,y,color = 'green')
plt.show()
```

```
61
61
```



(b)

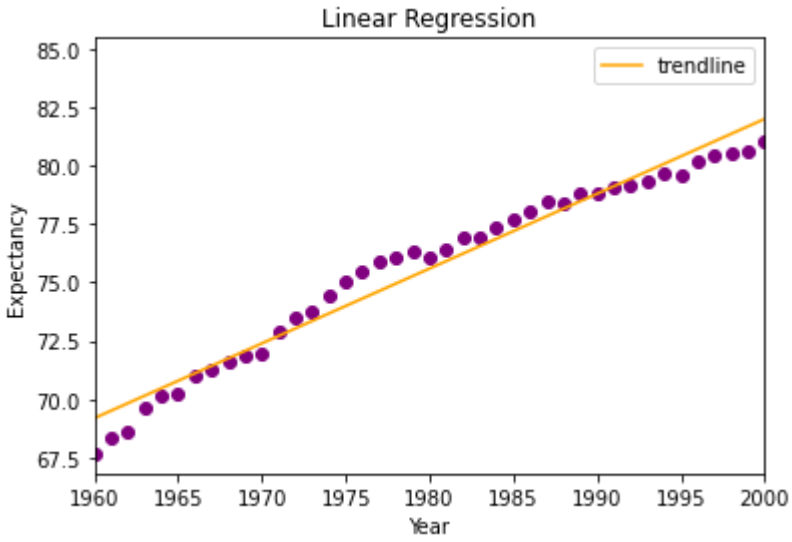
In [63]:
```
ja = np.array(lifeExpectancy.iloc[119,4:45])
sequence = np.arange(1960,2000+1)

trend = np.polyfit(sequence,ja.astype(float),1)
trend
print(f"Slope: {trend[0]:5.4f},"
      f"y-int trend: {trend[1]:5.2f}")

def linModel(x,t):
    return x[0]*t + x[1]
```

```
japan = linModel(trend, sequence)
plt.plot(sequence, japan, color = 'orange', label = 'trendline')
plt.xlim(1960,2000)
plt.xlabel('Year')
plt.ylabel('Expectancy')
plt.title('Linear Regression')
plt.legend()
plt.scatter(x,y, color = 'purple', label = 'part a')
plt.show()
```

```
Slope: 0.3202,y-int trend: -558.49
```



(ii)

In [64]:
```
# Load the data
df = pd.read_table("/Users/camiu/M336/MATH 336 FOLDER(shen)/MATH336 (SHEN)/EarthTemper
df
```

Out[64]:

	YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
0	1850	-0.702	-0.284	-0.732	-0.570	-0.325	-0.213	-0.128	-0.233	-0.444	-0.452	-0.190	-0.268
1	1851	-0.303	-0.362	-0.485	-0.445	-0.302	-0.189	-0.215	-0.153	-0.108	-0.063	-0.030	-0.067
2	1852	-0.308	-0.477	-0.505	-0.559	-0.209	-0.038	-0.016	-0.195	-0.125	-0.216	-0.187	0.083
3	1853	-0.177	-0.330	-0.318	-0.352	-0.268	-0.179	-0.059	-0.148	-0.409	-0.359	-0.256	-0.444
4	1854	-0.360	-0.280	-0.284	-0.349	-0.230	-0.215	-0.228	-0.163	-0.115	-0.188	-0.369	-0.232
...	...	...	...	...	...	...	...	...	...	...	...	...	...
161	2011	0.313	0.327	0.425	0.480	0.384	0.489	0.510	0.488	0.454	0.453	0.347	0.401
162	2012	0.306	0.302	0.358	0.575	0.574	0.557	0.510	0.536	0.553	0.556	0.554	0.275
163	2013	0.450	0.486	0.401	0.439	0.520	0.487	0.514	0.533	0.535	0.497	0.639	0.508
164	2014	0.523	0.313	0.561	0.657	0.599	0.618	0.541	0.666	0.589	0.626	0.489	0.634
165	2015	0.688	0.660	0.681	0.656	0.696	0.730	0.696	0.732	0.784	0.820	0.810	1.010

166 rows × 14 columns

In [65]:
```
print(df.shape)
```

```
(166, 14)
```

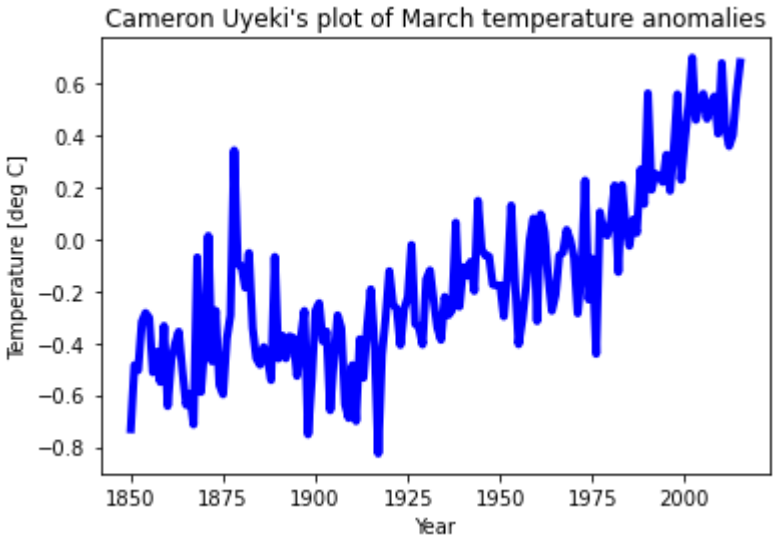
In [66]:
```
print(df.head(3))

time = df['YEAR']
temp = df['MAR']
```

```
   YEAR    JAN    FEB    MAR    APR    MAY    JUN    JUL    AUG    SEP    OCT  \
0  1850 -0.702 -0.284 -0.732 -0.570 -0.325 -0.213 -0.128 -0.233 -0.444 -0.452
1  1851 -0.303 -0.362 -0.485 -0.445 -0.302 -0.189 -0.215 -0.153 -0.108 -0.063
2  1852 -0.308 -0.477 -0.505 -0.559 -0.209 -0.038 -0.016 -0.195 -0.125 -0.216

     NOV    DEC  ANNUAL
0 -0.190 -0.268  -0.375
1 -0.030 -0.067  -0.223
2 -0.187  0.083  -0.224
```

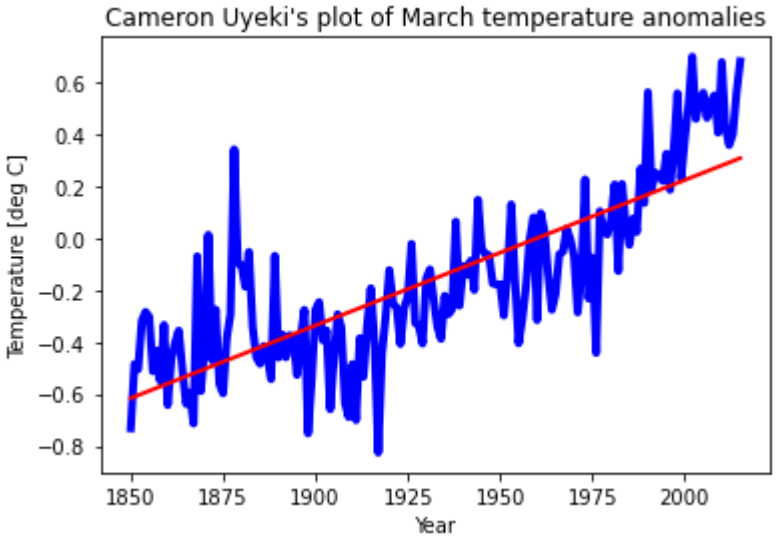
In [67]:
```
plt.plot(time, temp, 'blue', linewidth=4)
plt.title("Cameron Uyeki's plot of March temperature anomalies")
plt.xlabel('Year')
plt.ylabel('Temperature [deg C]')
plt.show()
```



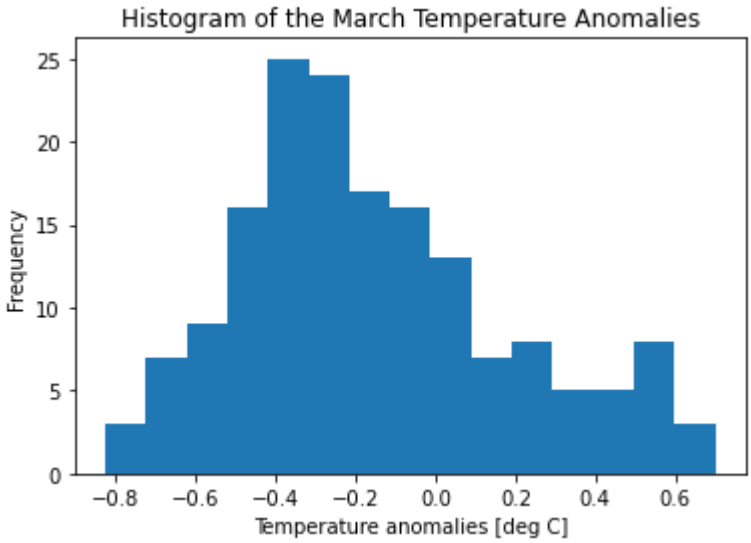
In [68]:
```
trend = np.polyfit(time, temp, 1)
print("March trend = {:.2f} deg C/century".format(trend[0] * 100))
```

```
March trend = 0.56 deg C/century
```

In [71]:
```
plt.plot(time, temp, 'blue', linewidth=4)
plt.plot(time, np.polyval(trend, time), 'red', linewidth=2)
plt.title("Cameron Uyeki's plot of March temperature anomalies")
plt.xlabel('Year')
plt.ylabel('Temperature [deg C]')
plt.show()
```



In [70]:
```
# Plot histogram
plt.hist(temp, bins=15)
plt.title("Histogram of the March Temperature Anomalies")
plt.xlabel("Temperature anomalies [deg C]")
plt.ylabel("Frequency")
plt.show()
```


Histogram of the March Temperature Anomalies
Frequency
25
20
15
10
5
0
−0.8
−0.6
−0.4
−0.2
0.0
0.2
0.4
0.6
Temperature anomalies [deg C]

In [ ]: