Importing Libraries

In [1]:
```
import numpy as np
import pandas as pd
import seaborn as sns
import matplotlib.pyplot as plt
from scipy.stats import norm, t
from scipy.stats import ttest_1samp, ttest_ind
```

Pastries

A french cake shop claims that the average number of pastries they can produce in a day exceeds 500. The average number of pastries produced per day over a 70 day period was found to be 530. Assume that the population standard deviation for the pastries produced per day is 125. Test the claim using a z-test with the critical z-value = 1.64 at the alpha (significance level) = 0.05, and state your interpretation.

In [8]:
```
# Ho : mu = 500
# Ha : mu > 500

z_stat= (530-500)/(125/np.sqrt(70))
print("z_stat : ",z_stat)
alpha = 0.05
print("alpha : ",alpha)

p_value=1-norm.cdf(z_stat)
print("p_value : ",p_value)

if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
z_stat :  2.007984063681781
alpha :  0.05
p_value :  0.022322492581293485
Reject Ho
```

In [10]:
```
observed = 530
z_critical_value = norm.ppf(0.95)
print("z_critical_value : ",z_critical_value)
```

```
z_critical_value :  1.6448536269514722
```

In [ ]:
```
# z= x-mu/(sigma/np.sqrt(n))
```

In [15]:
```
mu = 500
observed_value = 530
critical_value = mu + z_critical_value*(125/np.sqrt(70))
print("critical_value : ",critical_value)
print("observed_value : ",observed_value)
```

```
critical_value :  524.574701413748
observed_value :  530
```

In [16]:
```
# for a right tailed test
if critical_value < observed_value :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
Reject Ho
```

In [17]:
```
norm.ppf(q=0.95,loc=500,scale=(125/np.sqrt(70)))
```

Out[17]:
```
524.574701413748
```

Improve IQ with a pill

Population IQ average = 100

One researcher claims that his pill will improve IQ

In [18]:
```
# The pill is given to a few people and their IQ is tested with following results:
iq_scores = [110, 105, 98, 102, 99, 104, 115, 95]
```

In [19]:
```
np.mean(iq_scores)
```

Out[19]:
```
103.5
```

In [ ]:
```
#Establish with 99% confidence ( alpha = 0.01)
```

In [31]:
```
# Ho : mu = 100 ( pill had not effect)
# Ha : mu > 100 ( pill had an effect)
```

In [35]:
```
t_stat,p_value=ttest_1samp(iq_scores,100,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.01
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  1.5071573172061195
p_value :  0.08774972467925055
Fail to Reject Ho
```

In [39]:
```
t_stat1= (103.5-100)/(( pd.Series(iq_scores).std()/np.sqrt(8)))
print("t_stat1 : ",t_stat1)
```

```
t_stat1 :  1.5071573172061195
```

In [43]:
```
p_value1=1-t.cdf(t_stat1,df=7)
print("p_value1 : ",p_value1)
if p_value1 < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
p_value1 :  0.08774972467925057
Fail to Reject Ho
```

T Distribution

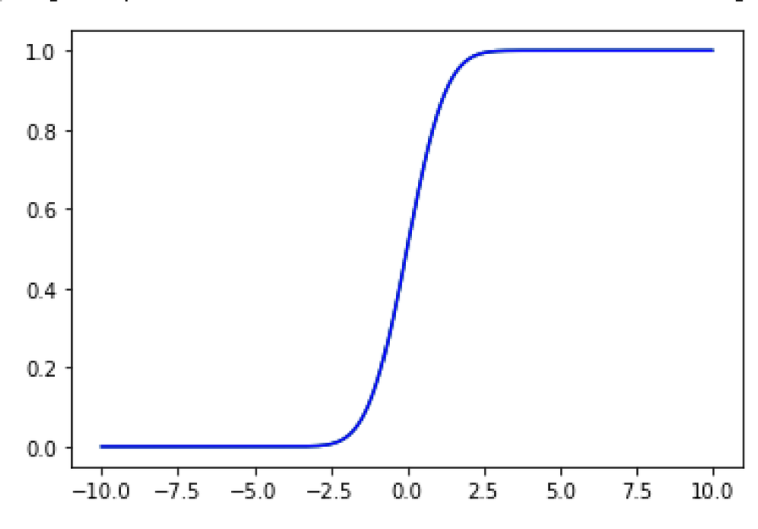
In [30]:
```
x_values= np.linspace(-10,10,1000)
y_values= norm.cdf(x_values)

plt.plot ( x_values, y_values,color= "green")

y_values1= t.cdf(x_values,df=10000)

plt.plot ( x_values, y_values1,color= "blue")
```

Out[30]:
```
[<matplotlib.lines.Line2D at 0x7f96282486d0>]
```



In [ ]:

In [ ]:

In [ ]:

In [ ]:

IQ across 2 schools

In [44]:
```
df_iq = pd.read_csv("iq_two_schools.csv")
```

In [47]:
```
df_iq.head()
```

Out[47]:

	School	iq
0	school_1	91
1	school_1	95
2	school_1	110
3	school_1	112
4	school_1	115

In [52]:
```
iq_1= df_iq.loc[df_iq["School"]=="school_1"]["iq"]
iq_2= df_iq.loc[df_iq["School"]=="school_2"]["iq"]
```

In [53]:
```
iq_1.mean()
```

Out[53]:
```
101.15384615384616
```

In [54]:
```
iq_2.mean()
```

Out[54]:
```
109.41666666666667
```

In [55]:
```
# Ho : mu1 = mu2
# Ha1 : mu1 > mu2
# Ha2 : mu1 < mu2
# Ha3 : mu1 != mu2
```

In [57]:
```
t_stat,p_value=ttest_ind(iq_1,iq_2,alternative="two-sided")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  -2.40564748615127 04
p_value :  0.020045527109 36217
Reject Ho
```

In [58]:
```
t_stat,p_value=ttest_ind(iq_1,iq_2,alternative="less")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  -2.4056474861512704
p_value :  0.010022763554681085
Reject Ho
```

In [59]:
```
t_stat,p_value=ttest_ind(iq_2,iq_1,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  2.4056474861512704
p_value :  0.010022763554681085
Reject Ho
```

In [60]:
```
t_stat,p_value=ttest_ind(iq_1,iq_2,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  -2.4056474861512704
p_value :  0.9899772364453189
Fail to Reject Ho
```

In [ ]:

In [ ]:

In [ ]:

In [ ]:

Cricket

In [61]:
```
df = pd.read_csv("Sachin_ODI.csv")
```

In [4]:
```
df
```

Out[4]:

	runs	NotOut	mins	bf	fours	sixes	sr	Inns	Opp	Ground	Date	Winner	Won	century
0	13	0	30	15	3	0	86.66	1	New Zealand	Napier	1995-02-16	New Zealand	False	False
1	37	0	75	51	3	1	72.54	2	South Africa	Hamilton	1995-02-18	South Africa	False	False
2	47	0	65	40	7	0	117.50	2	Australia	Dunedin	1995-02-22	India	True	False
3	48	0	37	30	9	1	160.00	2	Bangladesh	Sharjah	1995-04-05	India	True	False
4	4	0	13	9	1	0	44.44	2	Pakistan	Sharjah	1995-04-07	Pakistan	False	False
...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
355	14	0	34	15	2	0	93.33	2	Australia	Sydney	2012-02-26	Australia	False	False
356	39	0	45	30	5	0	130.00	2	Sri Lanka	Hobart	2012-02-28	India	True	False
357	6	0	25	19	1	0	31.57	1	Sri Lanka	Dhaka	2012-03-13	India	True	False
358	114	0	205	147	12	1	77.55	1	Bangladesh	Dhaka	2012-03-16	Bangladesh	False	True
359	52	0	93	48	5	1	108.33	2	Pakistan	Dhaka	2012-03-18	India	True	False

360 rows × 14 columns

In [ ]:

Batting pattern in first and second innings

In [62]:
```
df.groupby("Inns")["runs"].mean()
```

Out[62]:
```
Inns
1    46.670588
2    40.173684
Name: runs, dtype: float64
```

In [63]:
```
df_first_innings = df.loc[df["Inns"]==1]["runs"]
df_second_innings = df.loc[df["Inns"]==2]["runs"]
```

In [64]:
```
# Ho : mu1 = mu2 ( first inning's performace is similar to second inning's performance)
# Ha1 : mu1 > mu2 ( first inning's performace is significantly better than second inning's performance)
```

In [65]:
```
t_stat,p_value=ttest_ind(df_first_innings,df_second_innings,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  1.4612016295532178
p_value :  0.07241862097379981
Fail to Reject Ho
```

In [66]:
```
t_stat,p_value=ttest_ind(df_first_innings,df_second_innings,alternative="two-sided")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  1.4612016295532178
p_value :  0.14483724194759962
Fail to Reject Ho
```

Victory Vs Defeat

In [67]:
```
df.groupby("Won")["runs"].mean()
```

Out[67]:
```
Won
False    35.130682
True     51.000000
Name: runs, dtype: float64
```

In [68]:
```
df_won = df[df["Won"]==True]["runs"]
df_lost = df[df["Won"]==False]["runs"]
```

In [69]:
```
# Ho : mu_won = mu_lost (India Winning or losing, in both the conditions, Sachin's performance is same/similar )
# Ha1 : mu_won > mu_lost ( Sachin's performance is significantly better when India Wins in comparison to when India loses)
```

In [70]:
```
t_stat,p_value=ttest_ind(df_won,df_lost,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  3.628068563969343
p_value :  0.00016353077486826558
Reject Ho
```

In [72]:
```
t_stat,p_value=ttest_ind(df_won,df_lost,alternative="two-sided")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  3.628068563969343
p_value :  0.00032706154973653116
Reject Ho
```

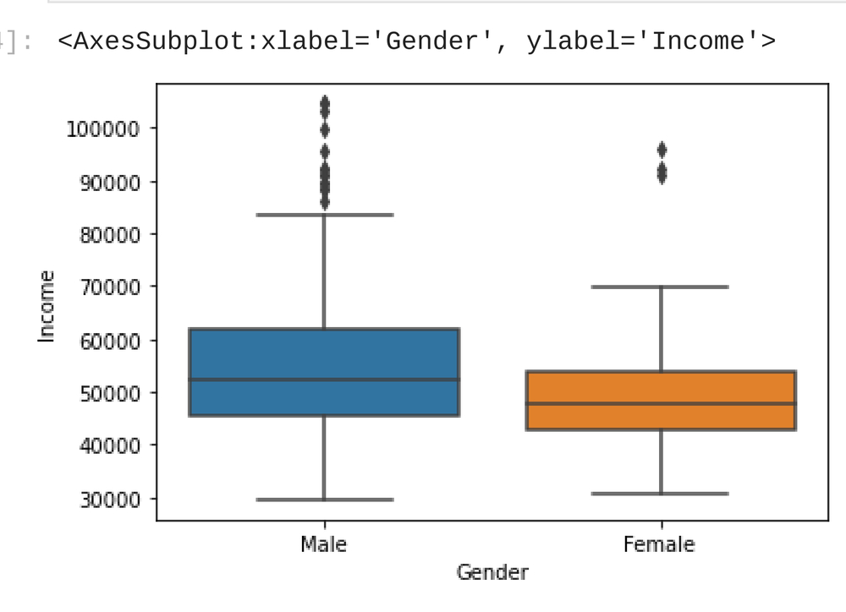
Aerofit

In [73]:
```
df_aerofit = pd.read_csv("aerofit.csv")
```

Gender vs Income

In [74]:
```
sns.boxplot(x='Gender', y='Income', data=df_aerofit)
```

Out[74]:
```
<AxesSubplot:xlabel='Gender', ylabel='Income'>
```



In [75]:
```
income_male = df_aerofit[df_aerofit["Gender"]=="Male"]["Income"]
income_female = df_aerofit[df_aerofit["Gender"]=="Female"]["Income"]
```

In [76]:
```
income_male.mean()
```

Out[76]:
```
56562.75961538462
```

In [77]:
```
income_female.mean()
```

Out[77]:
```
49828.90789473684
```

In [78]:
```
# Ho : mu_male = mu_female( Income of both males and females are similar)
# Ha1 : mu_male > mu_female ( Income of males are significantly better than females)

t_stat,p_value=ttest_ind(income_male,income_female,alternative="greater")
print("t_stat : ",t_stat)
print("p_value : ",p_value)
alpha= 0.05
if p_value < alpha :
    print("Reject Ho")
else :
    print("Fail to Reject Ho")
```

```
t_stat :  2.7524886375402 57
p_value :  0.003263631548607129
Reject Ho
```

In [ ]:

In [ ]:

In [ ]: