In [1]:

```
import pandas as pd
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import scipy.stats as stats
from scipy.stats import ttest_1samp
from statsmodels.stats.power import tt_ind_solve_power


```

In [2]:

```
ages=[10,20,35,50,28,40,55,18,16,55,30,25,43,18,30,28,14,24,16,17,32,35,26,27,65,18,43,
ages_mean=np.mean(ages)
print(ages_mean)
```

```
30.34375
```

In [3]:

```
sample_size=10
age_sample=np.random.choice(ages,sample_size)
age_sample
```

Out[3]:

```
array([35, 10, 19, 28, 27, 20, 17, 40, 18, 35])
```

In [4]:

```
from scipy.stats import ttest_1samp
```

In [5]:

```
ttest,p_values=ttest_1samp(age_sample,10)
```

In [6]:

```
print(p_values)
```

```
0.0008639553346146867
```

In [7]:

```
if p_values <0.05:
    print("We are rejecting null hypothesis")
else:
    print("We are accepting null hypothesis")
```

```
We are rejecting null hypothesis
```

In [12]:

```
df=pd.read_excel('C:/Users/MSCIT/Desktop/datasets/Result.xlsx')
df
```

Out[12]:

	Roll No	Name	Sub1	Sub2	Sub3	Total	Result
0	101	Akash	45	45	45	135	P
1	102	Manoj	35	45	42	122	P
2	103	Mrunal	29	26	30	85	P
3	104	Saurabh	38	35	29	102	P
4	105	Ashish	41	40	34	115	P
5	106	Sudhir	46	62	41	149	P
6	107	Ria	29	48	27	104	P
7	108	Prathana	43	33	33	109	P
8	109	Mihika	37	30	38	105	P
9	110	Shaurya	33	31	41	105	P

In [13]:

```
df.describe()
```

Out[13]:

	Roll No	Sub1	Sub2	Sub3	Total
count	10.00000	10.000000	10.000000	10.000000	10.000000
mean	105.50000	37.600000	39.500000	36.000000	113.100000
std	3.02765	6.168018	10.783217	6.236096	18.241893
min	101.00000	29.000000	26.000000	27.000000	85.000000
25%	103.25000	33.500000	31.500000	30.750000	104.250000
50%	105.50000	37.500000	37.500000	36.000000	107.000000
75%	107.75000	42.500000	45.000000	41.000000	120.250000
max	110.00000	46.000000	62.000000	45.000000	149.000000

In [14]:

```
Ho = "mu <= 113"
Ha = "mu > 113"
al = 0.05
mu = 113
tt = 1
marks = df['Total'].values
print("Ho:",Ho)
print("Ha:",Ha)
print("al:",al)
print("mu:",mu)
print(marks)
print("")
```

```
Ho: mu <= 113
Ha: mu > 113
al: 0.05
mu: 113
[135 122  85 102 115 149 104 109 105 105]
```

In [22]:

```
ts, pv = ttest_1samp(marks,mu)
print("t-stat",ts)
print("p-vals",pv)
t2pv = pv
t1pv = pv*2
print("1t pv",t1pv)
print("2t pv",t2pv)
```

```
t-stat 0.01733524930528476
p-vals 0.9865473848679749
1t pv 1.9730947697359498
2t pv 0.9865473848679749
```

In [18]:

```
if tt == 1:
    if t1pv < al:
        print("Null Hypothesis: Rejected")
        print("Conclusion:",Ha)
    else:
        print("Null Hypothesis: Not Rejected")
        print("Conclusion:",Ho)
else:
    if t2pv < al/2:
        print("Null Hypothesis: Rejected")
        print("Conclusion:",Ha)
    else:
        print("Null Hypothesis:Not Rejected")
        print("Conclusion:",Ho)
```

```
Null Hypothesis: Not Rejected
Conclusion: mu <= 113
```

Two Way Hypothesis

In [19]:

```
Ho = "mu <= 113"
Ha = "mu > 113"
al = 0.05
mu = 113
tt = 2
marks = df['Total'].values
print("Ho:",Ho)
print("Ha:",Ha)
print("al:",al)
print("mu:",mu)
print(marks)
print("")
```

```
Ho: mu <= 113
Ha: mu > 113
al: 0.05
mu: 113
[135 122  85 102 115 149 104 109 105 105]
```

In [20]:

```
ts, pv = ttest_1samp(marks,mu)
print("t-stat",ts)
print("p-vals",pv)
t2pv = pv
t1pv = pv*2
print("1t pv",t1pv)
print("2t pv",t2pv)
```

```
t-stat 0.01733524930528476
p-vals 0.9865473848679749
1t pv 1.9730947697359498
2t pv 0.9865473848679749
```

In [21]:

```
if tt == 1:
    if t1pv < al:
        print("Null Hypothesis: Rejected")
        print("Conclusion:",Ha)
    else:
        print("Null Hypothesis: Not Rejected")
        print("Conclusion:",Ho)
else:
    if t2pv < al/2:
        print("Null Hypothesis: Rejected")
        print("Conclusion:",Ha)
    else:
        print("Null Hypothesis:Not Rejected")
        print("Conclusion:",Ho)
```

```
Null Hypothesis:Not Rejected
Conclusion: mu <= 113
```

AB Testing

In [23]:

```
subj1 = np.array([45,36,29,40,46,37,43,39,28,33])
subj2 = np.array([40,20,30,35,29,43,40,39,28,31])

```

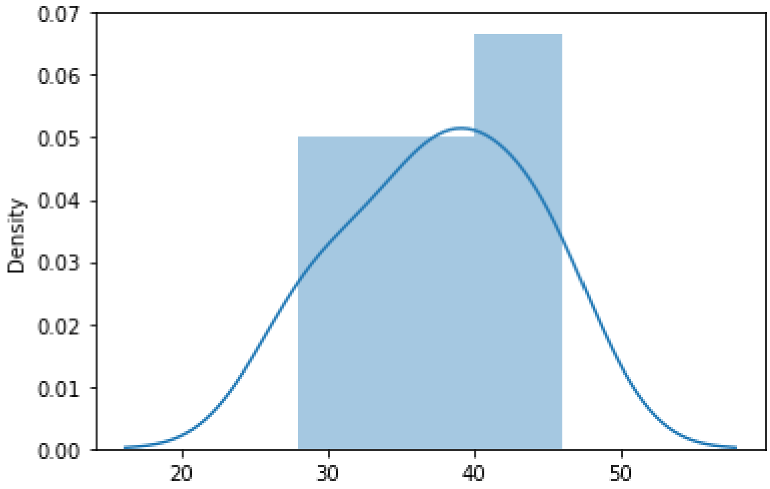
In [25]:

```
sns.distplot(subj1)
```

```
C:\Users\MSCIT\anaconda3\lib\site-packages\seaborn\distributions.py:2619: Fu
tureWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-level
function with similar flexibility) or `histplot` (an axes-level function for
histograms).
  warnings.warn(msg, FutureWarning)
```

Out[25]:

```
<AxesSubplot:ylabel='Density'>
```



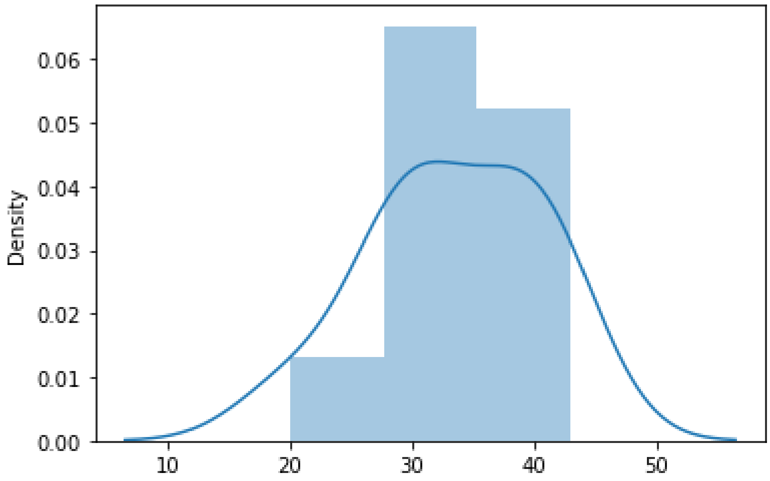
In [26]:

```
sns.distplot(subj2)
```

```
C:\Users\MSCIT\anaconda3\lib\site-packages\seaborn\distributions.py:2619: Fu
tureWarning: `distplot` is a deprecated function and will be removed in a fu
ture version. Please adapt your code to use either `displot` (a figure-level
function with similar flexibility) or `histplot` (an axes-level function for
histograms).
  warnings.warn(msg, FutureWarning)
```

Out[26]:

```
<AxesSubplot:ylabel='Density'>
```



In [27]:

```
t_stat, p_val = stats.ttest_ind(subj1,subj2)
t_stat, p_val
```

Out[27]:

```
(1.365908039538178, 0.18879292981719703)
```

In [28]:

```
stats.ttest_ind(subj1,subj2,equal_var=True)
```

Out[28]:

```
Ttest_indResult(statistic=1.365908039538178, pvalue=0.18879292981719703)
```

Type 1 And Type 2 Error

In [29]:

```
effect_size = abs((subj1.mean()-subj2.mean())/(subj1.std()-subj2.std()))
sample_size=10
alpha=0.05
ratiio=1.0

statistical_power = tt_ind_solve_power(effect_size=effect_size,nobs1=sample_size,alpha=
print(statistical_power)
```

```
1.0
```

In [30]:

```
type_2_error= 1-statistical_power
type_2_error
```

Out[30]:

```
0.0
```

In [ ]:

```


```