Exam marks prediction using Linear Regression-Multiple variable

Import Libraries

In [ ]:
```
import pandas as pd
import numpy as np
from sklearn.linear_model import LinearRegression
import matplotlib.pyplot as plt
```

Load Dataset

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

In [ ]:
```
df.head()
```

Out[ ]:

	hours	age	internet	marks
0	6.83	15	1	78.50
1	6.56	16	0	76.74
2	NaN	17	1	78.68
3	5.67	18	0	71.82
4	8.67	19	1	84.19

In [ ]:
```
df.tail()
```

Out[ ]:

	hours	age	internet	marks
196	8.56	19	1	84.68
197	8.94	20	1	86.75
198	6.60	15	1	78.05
199	8.35	16	1	83.50
200	4.15	15	0	81.45

In [ ]:
```
df.describe()
```

Out[ ]:

	hours	age	internet	marks
count	196.000000	201.000000	201.000000	201.000000
mean	6.981429	17.467662	0.552239	77.951244
std	1.266266	1.720523	0.498505	4.919626
min	4.150000	15.000000	0.000000	68.570000
25%	5.757500	16.000000	0.000000	73.400000
50%	7.110000	17.000000	1.000000	77.770000
75%	8.082500	19.000000	1.000000	82.300000
max	8.990000	20.000000	1.000000	86.990000

In [ ]:
```
df.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 201 entries, 0 to 200
Data columns (total 4 columns):
 #   Column    Non-Null Count  Dtype  
---  ------    --------------  -----  
 0   hours     196 non-null    float64
 1   age       201 non-null    int64  
 2   internet  201 non-null    int64  
 3   marks     201 non-null    float64
dtypes: float64(2), int64(2)
memory usage: 6.4 KB
```

Load Summarize

In [ ]:
```
print(df.shape)
print(df.head(5))
```

```
(201, 4)
   hours  age  internet  marks
0   6.83   15         1  78.50
1   6.56   16         0  76.74
2    NaN   17         1  78.68
3   5.67   18         0  71.82
4   8.67   19         1  84.19
```

FInding & Removing NA values fromour features X

In [ ]:
```
df.columns[df.isna().any()]
```

Out[ ]:
```
Index(['hours'], dtype='object')
```

In [ ]:
```
df.hours=df.hours.fillna(df.hours.mean())
```

Segregate Data into Input X & Ouptut Y

In [ ]:
```
X=df.iloc[:,:-1].values
print(X.shape)
X
```

```
(201, 3)
```

Out[ ]:
```
array([[ 6.83      , 15.        ,  1.        ],
       [ 6.56      , 16.        ,  0.        ],
       [ 6.98142857, 17.        ,  1.        ],
       [ 5.67      , 18.        ,  0.        ],
       [ 8.67      , 19.        ,  1.        ],
       [ 7.55      , 20.        ,  0.        ],
       [ 6.67      , 15.        ,  0.        ],
       [ 8.99      , 16.        ,  0.        ],
       [ 5.19      , 17.        ,  1.        ],
       [ 6.75      , 18.        ,  0.        ],
       [ 6.59      , 19.        ,  0.        ],
       [ 8.56      , 20.        ,  1.        ],
       [ 7.75      , 15.        ,  0.        ],
       [ 7.9       , 16.        ,  1.        ],
       [ 8.19      , 17.        ,  0.        ],
       [ 6.55      , 18.        ,  1.        ],
       [ 6.36      , 19.        ,  0.        ],
       [ 8.44      , 20.        ,  1.        ],
       [ 8.41      , 15.        ,  0.        ],
       [ 7.67      , 16.        ,  1.        ],
       [ 7.42      , 17.        ,  1.        ],
       [ 8.16      , 18.        ,  1.        ],
       [ 5.05      , 19.        ,  1.        ],
       [ 5.85      , 20.        ,  1.        ],
       [ 5.45      , 15.        ,  0.        ],
       [ 7.96      , 16.        ,  0.        ],
       [ 6.51      , 17.        ,  0.        ],
       [ 6.73      , 18.        ,  0.        ],
       [ 5.94      , 19.        ,  1.        ],
       [ 7.48      , 20.        ,  0.        ],
       [ 8.13      , 15.        ,  1.        ],
       [ 6.98142857, 16.        ,  1.        ],
       [ 5.4       , 17.        ,  1.        ],
       [ 8.78      , 18.        ,  0.        ],
       [ 8.72      , 19.        ,  1.        ],
       [ 7.1       , 20.        ,  0.        ],
       [ 7.86      , 15.        ,  1.        ],
       [ 7.19      , 16.        ,  0.        ],
       [ 5.62      , 17.        ,  1.        ],
       [ 7.88      , 18.        ,  0.        ],
       [ 5.28      , 19.        ,  1.        ],
       [ 8.92      , 20.        ,  1.        ],
       [ 5.46      , 15.        ,  0.        ],
       [ 8.3       , 16.        ,  1.        ],
       [ 8.09      , 17.        ,  0.        ],
       [ 6.18      , 18.        ,  1.        ],
       [ 7.01      , 19.        ,  1.        ],
       [ 5.01      , 20.        ,  0.        ],
       [ 5.54      , 15.        ,  1.        ],
       [ 5.09      , 16.        ,  1.        ],
       [ 5.09      , 17.        ,  0.        ],
       [ 7.31      , 18.        ,  1.        ],
       [ 8.71      , 19.        ,  0.        ],
       [ 5.52      , 20.        ,  1.        ],
       [ 8.76      , 15.        ,  0.        ],
       [ 8.69      , 16.        ,  1.        ],
       [ 5.75      , 17.        ,  1.        ],
       [ 8.93      , 18.        ,  1.        ],
       [ 5.39      , 19.        ,  1.        ],
       [ 5.65      , 20.        ,  0.        ],
       [ 5.49      , 15.        ,  1.        ],
       [ 7.26      , 16.        ,  1.        ],
       [ 6.35      , 17.        ,  0.        ],
```

```
[ 7.72      , 18.        ,  1.        ],
[ 8.88      , 19.        ,  0.        ],
[ 5.45      , 20.        ,  1.        ],
[ 7.86      , 15.        ,  1.        ],
[ 8.26      , 16.        ,  0.        ],
[ 5.07      , 17.        ,  1.        ],
[ 8.25      , 18.        ,  0.        ],
[ 5.37      , 19.        ,  1.        ],
[ 5.11      , 20.        ,  1.        ],
[ 6.35      , 15.        ,  0.        ],
[ 7.41      , 16.        ,  1.        ],
[ 7.31      , 17.        ,  0.        ],
[ 6.04      , 18.        ,  1.        ],
[ 5.11      , 19.        ,  1.        ],
[ 6.56      , 20.        ,  0.        ],
[ 5.09      , 15.        ,  1.        ],
[ 5.88      , 16.        ,  0.        ],
[ 8.34      , 17.        ,  1.        ],
[ 7.94      , 18.        ,  0.        ],
[ 6.66      , 19.        ,  1.        ],
[ 6.01      , 20.        ,  1.        ],
[ 6.88      , 15.        ,  0.        ],
[ 5.63      , 16.        ,  1.        ],
[ 5.88      , 17.        ,  0.        ],
[ 8.05      , 18.        ,  1.        ],
[ 5.33      , 19.        ,  0.        ],
[ 8.79      , 20.        ,  0.        ],
[ 7.52      , 15.        ,  1.        ],
[ 8.2       , 16.        ,  0.        ],
[ 5.44      , 17.        ,  1.        ],
[ 7.9       , 18.        ,  0.        ],
[ 7.69      , 19.        ,  1.        ],
[ 6.09      , 20.        ,  0.        ],
[ 6.98142857, 15.        ,  1.        ],
[ 5.2       , 16.        ,  1.        ],
[ 8.88      , 17.        ,  0.        ],
[ 8.07      , 18.        ,  1.        ],
[ 6.24      , 19.        ,  1.        ],
[ 7.95      , 20.        ,  0.        ],
[ 8.26      , 15.        ,  0.        ],
[ 7.31      , 16.        ,  1.        ],
[ 7.23      , 17.        ,  1.        ],
[ 6.46      , 18.        ,  1.        ],
[ 5.34      , 19.        ,  1.        ],
[ 5.72      , 20.        ,  1.        ],
[ 5.84      , 15.        ,  0.        ],
[ 5.02      , 16.        ,  1.        ],
[ 7.98      , 17.        ,  0.        ],
[ 6.37      , 18.        ,  1.        ],
[ 6.92      , 19.        ,  0.        ],
[ 7.95      , 20.        ,  1.        ],
[ 7.12      , 15.        ,  0.        ],
[ 5.79      , 16.        ,  1.        ],
[ 5.4       , 17.        ,  0.        ],
[ 8.83      , 18.        ,  1.        ],
[ 5.69      , 19.        ,  0.        ],
[ 6.6       , 20.        ,  1.        ],
[ 6.52      , 15.        ,  0.        ],
[ 8.31      , 16.        ,  0.        ],
[ 6.98142857, 17.        ,  1.        ],
[ 7.62      , 18.        ,  0.        ],
[ 8.69      , 19.        ,  1.        ],
[ 8.75      , 20.        ,  0.        ],
```

```
[ 6.46      , 15.        ,  1.        ],
[ 7.14      , 16.        ,  1.        ],
[ 6.38      , 17.        ,  0.        ],
[ 6.33      , 18.        ,  1.        ],
[ 5.64      , 19.        ,  0.        ],
[ 5.26      , 20.        ,  1.        ],
[ 6.83      , 15.        ,  1.        ],
[ 5.76      , 16.        ,  0.        ],
[ 6.51      , 17.        ,  1.        ],
[ 8.33      , 18.        ,  0.        ],
[ 8.16      , 19.        ,  1.        ],
[ 5.14      , 20.        ,  0.        ],
[ 8.71      , 15.        ,  0.        ],
[ 8.6       , 16.        ,  1.        ],
[ 8.6       , 17.        ,  0.        ],
[ 7.43      , 18.        ,  1.        ],
[ 7.81      , 19.        ,  1.        ],
[ 6.51      , 20.        ,  0.        ],
[ 8.11      , 15.        ,  1.        ],
[ 8.95      , 16.        ,  0.        ],
[ 7.99      , 17.        ,  1.        ],
[ 5.92      , 18.        ,  0.        ],
[ 8.3       , 19.        ,  1.        ],
[ 8.97      , 20.        ,  0.        ],
[ 5.39      , 15.        ,  0.        ],
[ 6.77      , 16.        ,  0.        ],
[ 8.08      , 17.        ,  1.        ],
[ 5.24      , 18.        ,  0.        ],
[ 6.93      , 19.        ,  1.        ],
[ 5.14      , 20.        ,  0.        ],
[ 8.39      , 15.        ,  1.        ],
[ 6.18      , 16.        ,  0.        ],
[ 7.53      , 17.        ,  1.        ],
[ 7.86      , 18.        ,  0.        ],
[ 7.7       , 19.        ,  1.        ],
[ 7.3       , 20.        ,  0.        ],
[ 7.79      , 15.        ,  1.        ],
[ 6.75      , 16.        ,  0.        ],
[ 7.87      , 17.        ,  1.        ],
[ 5.38      , 18.        ,  0.        ],
[ 7.8       , 19.        ,  1.        ],
[ 5.07      , 20.        ,  0.        ],
[ 7.95      , 15.        ,  1.        ],
[ 8.35      , 16.        ,  0.        ],
[ 5.19      , 17.        ,  0.        ],
[ 7.19      , 18.        ,  0.        ],
[ 7.35      , 19.        ,  1.        ],
[ 5.22      , 20.        ,  1.        ],
[ 5.39      , 15.        ,  1.        ],
[ 5.39      , 16.        ,  1.        ],
[ 8.93      , 17.        ,  1.        ],
[ 5.79      , 18.        ,  0.        ],
[ 8.42      , 19.        ,  1.        ],
[ 7.26      , 20.        ,  0.        ],
[ 6.97      , 15.        ,  1.        ],
[ 5.55      , 16.        ,  1.        ],
[ 8.66      , 17.        ,  0.        ],
[ 8.61      , 18.        ,  1.        ],
[ 5.22      , 19.        ,  1.        ],
[ 8.05      , 20.        ,  0.        ],
[ 8.87      , 15.        ,  1.        ],
[ 5.54      , 16.        ,  0.        ],
[ 6.98142857, 17.        ,  0.        ],
```

```
       [ 7.26      , 18.        ,  1.        ],
       [ 5.79      , 19.        ,  0.        ],
       [ 5.22      , 20.        ,  0.        ],
       [ 8.71      , 15.        ,  1.        ],
       [ 7.55      , 16.        ,  1.        ],
       [ 6.35      , 17.        ,  1.        ],
       [ 7.53      , 18.        ,  0.        ],
       [ 8.56      , 19.        ,  1.        ],
       [ 8.94      , 20.        ,  1.        ],
       [ 6.6       , 15.        ,  1.        ],
       [ 8.35      , 16.        ,  1.        ],
       [ 4.15      , 15.        ,  0.        ]])
```

In [ ]:
```
Y=df.iloc[:,-1].values
Y
```

Out[ ]:
```
array([78.5 , 76.74, 78.68, 71.82, 84.19, 81.18, 76.99, 85.46, 70.66,
       77.82, 75.37, 83.88, 79.5 , 80.76, 83.08, 76.03, 76.04, 85.11,
       82.5 , 80.58, 82.18, 83.36, 70.67, 75.02, 70.96, 83.33, 74.75,
       75.65, 74.15, 80.17, 82.27, 76.14, 71.1 , 84.35, 83.08, 76.76,
       81.24, 78.21, 73.08, 83.23, 70.27, 86.41, 71.1 , 82.84, 82.38,
       72.96, 77.46, 70.11, 72.38, 71.41, 72.22, 77.77, 84.44, 71.45,
       82.21, 85.48, 75.03, 86.65, 70.9 , 71.7 , 73.61, 79.41, 76.19,
       80.43, 85.78, 70.06, 81.25, 81.7 , 69.27, 82.79, 71.8 , 71.79,
       74.97, 78.61, 77.59, 72.33, 72.08, 77.33, 70.05, 73.34, 84.  ,
       82.93, 76.63, 75.36, 77.29, 72.87, 73.4 , 81.74, 71.85, 84.6 ,
       79.56, 82.1 , 72.08, 79.1 , 81.01, 76.48, 75.39, 68.57, 83.64,
       82.3 , 75.18, 82.03, 82.99, 79.26, 77.55, 77.07, 72.1 , 73.25,
       74.25, 70.58, 81.08, 75.04, 76.38, 80.86, 78.42, 74.44, 70.34,
       85.04, 73.61, 75.55, 76.2 , 82.69, 76.83, 79.53, 83.57, 85.95,
       76.02, 77.65, 77.01, 74.49, 73.19, 71.86, 75.8 , 72.46, 78.39,
       83.48, 83.15, 71.22, 85.98, 83.91, 84.58, 80.31, 82.55, 75.52,
       83.82, 85.15, 82.75, 74.34, 82.02, 86.12, 71.87, 76.7 , 81.7 ,
       70.78, 78.45, 70.2 , 83.37, 75.52, 81.57, 80.72, 80.81, 79.49,
       79.17, 77.07, 82.04, 71.94, 81.6 , 70.79, 82.68, 83.08, 71.18,
       77.63, 77.78, 70.4 , 73.02, 71.11, 85.96, 73.64, 84.24, 78.17,
       77.19, 71.83, 86.99, 83.87, 71.5 , 79.63, 85.1 , 72.01, 77.27,
       79.87, 73.14, 70.51, 84.03, 79.64, 74.24, 81.67, 84.68, 86.75,
       78.05, 83.5 , 81.45])
```

Training Dataset using Linear Regression

In [ ]:
```
model=LinearRegression()
model.fit(X,Y)
```

Out[ ]:
```
▾ LinearRegression
LinearRegression()
```

Predicted Marks

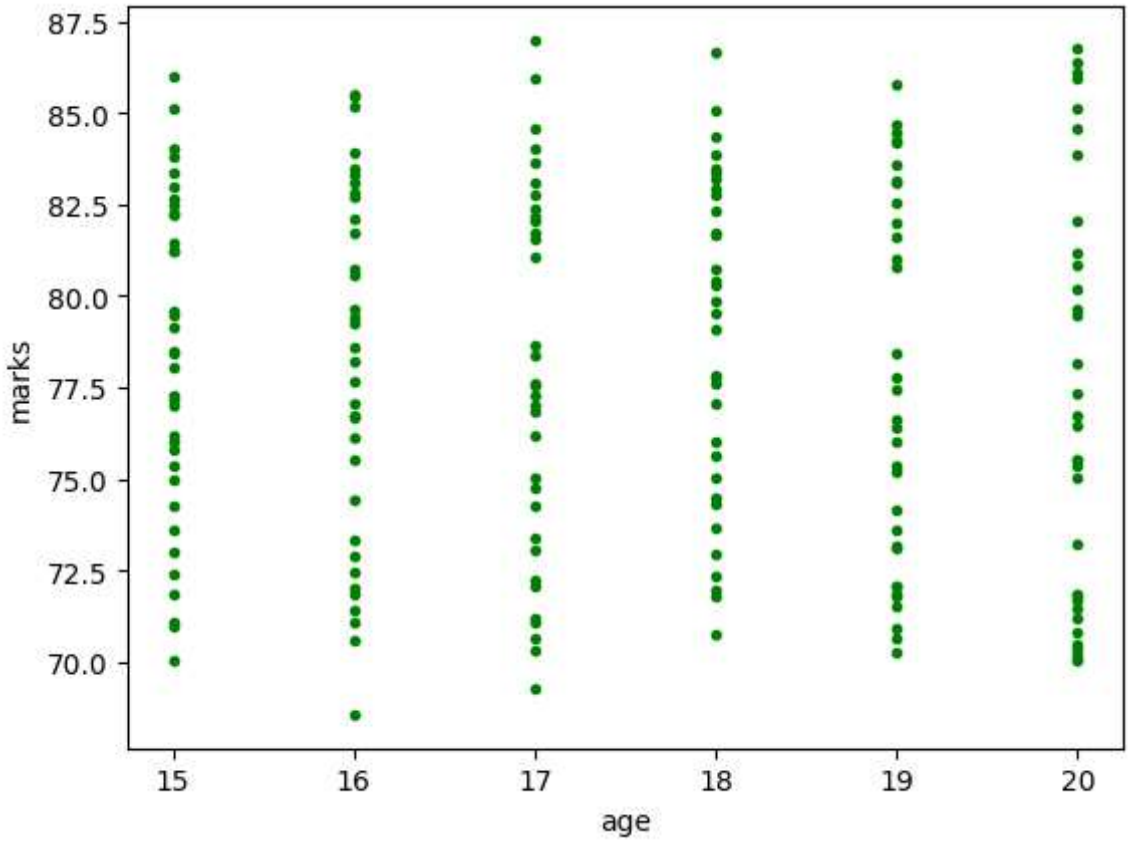
In [ ]:
```
d = int(input("Enter the number of hours studied: "))
b = int(input("Enter the age: "))
c = int(input("Is Internet Available (0 or 1): "))

a=[[d,b,c]]
PredictedmodelResult=model.predict(a)
print(PredictedmodelResult)
```

```
[70.80240294]
```

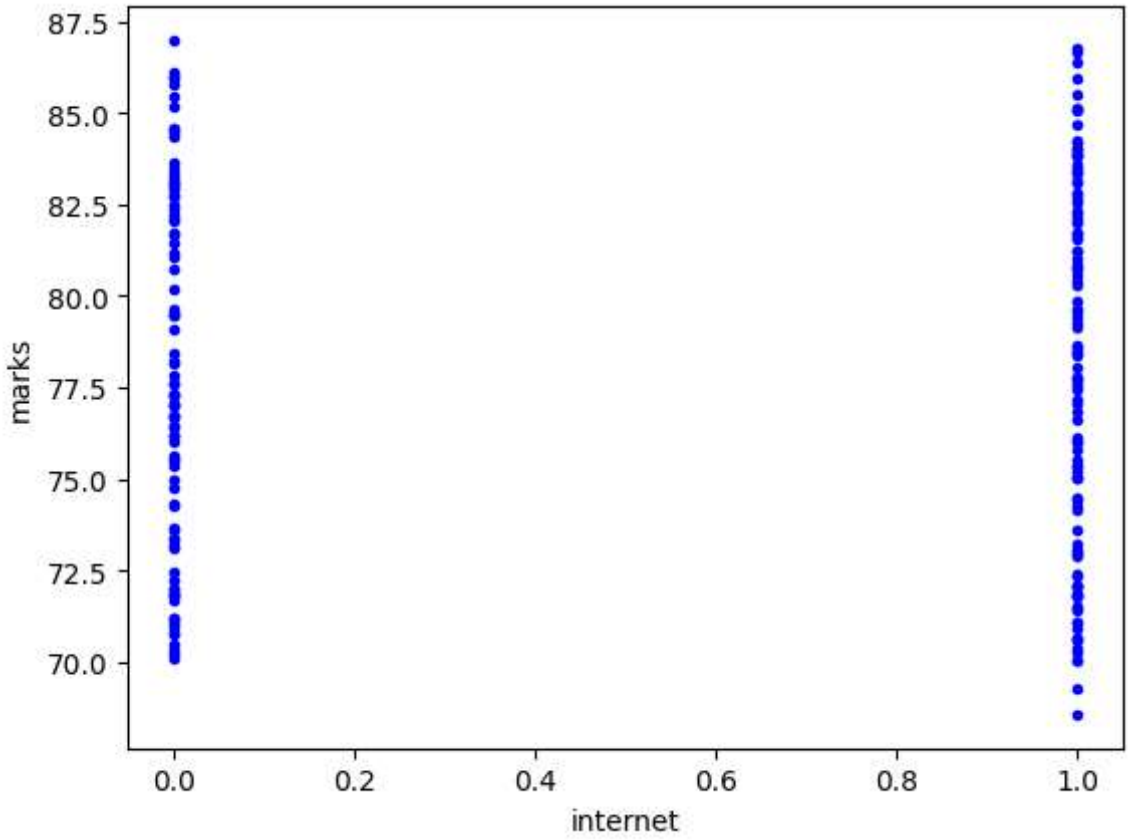
In [ ]:
```
plt.xlabel("age")
plt.ylabel("marks")
plt.scatter(df.age,df.marks,color="green",marker=".")
```

Out[ ]:
```
<matplotlib.collections.PathCollection at 0x1ed26a78450>
```



In [ ]:
```
plt.xlabel("internet")
plt.ylabel("marks")
plt.scatter(df.internet,df.marks,color="blue",marker=".")
```

Out[ ]:
```
<matplotlib.collections.PathCollection at 0x1ed2b64fc90>
```


87.5
85.0
82.5
80.0
77.5
75.0
72.5
70.0
marks
0.0
0.2
0.4
0.6
0.8
1.0
internet