PROFIT ANALYSIS

Analyzing the Impact of Marketing, R&D, and Administration Spending on Profit

Introduction

- **Objective:** To analyze and predict how spending on Marketing, R&D, and Administration affects a company’s profit.
- **Scope:** Data from 50 startups in New York, California, and Florida.

Dataset Overview

This particular dataset holds data from 50 startups in New York, California, and Florida. The features in this dataset are R&D spending, Administration Spending, Marketing Spending, location features, and Profit.

Attribute Information:

R&D spending: The amount which startups are spending on Research and development.

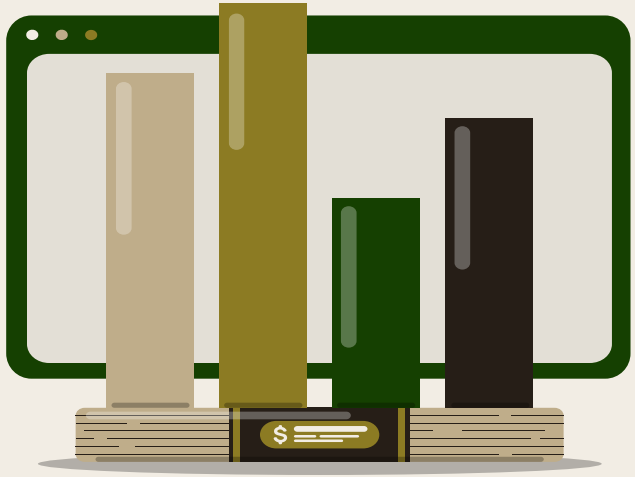
Administration spending: The amount which startups are spending on the admin panel.

Marketing spending: The amount which startups are spending on marketing strategies.

State: To which state that particular startup belongs.

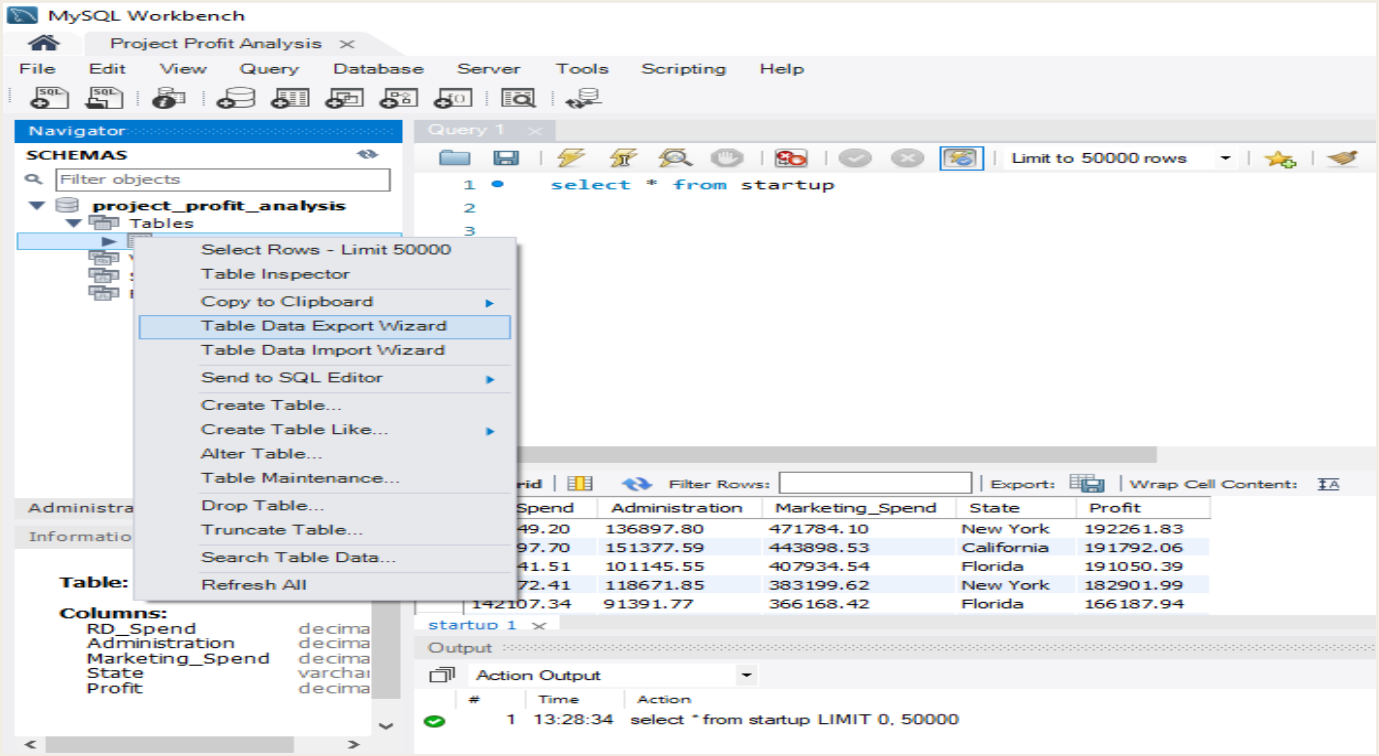
Profit: How much profit that particular startup is making.

Data Extraction

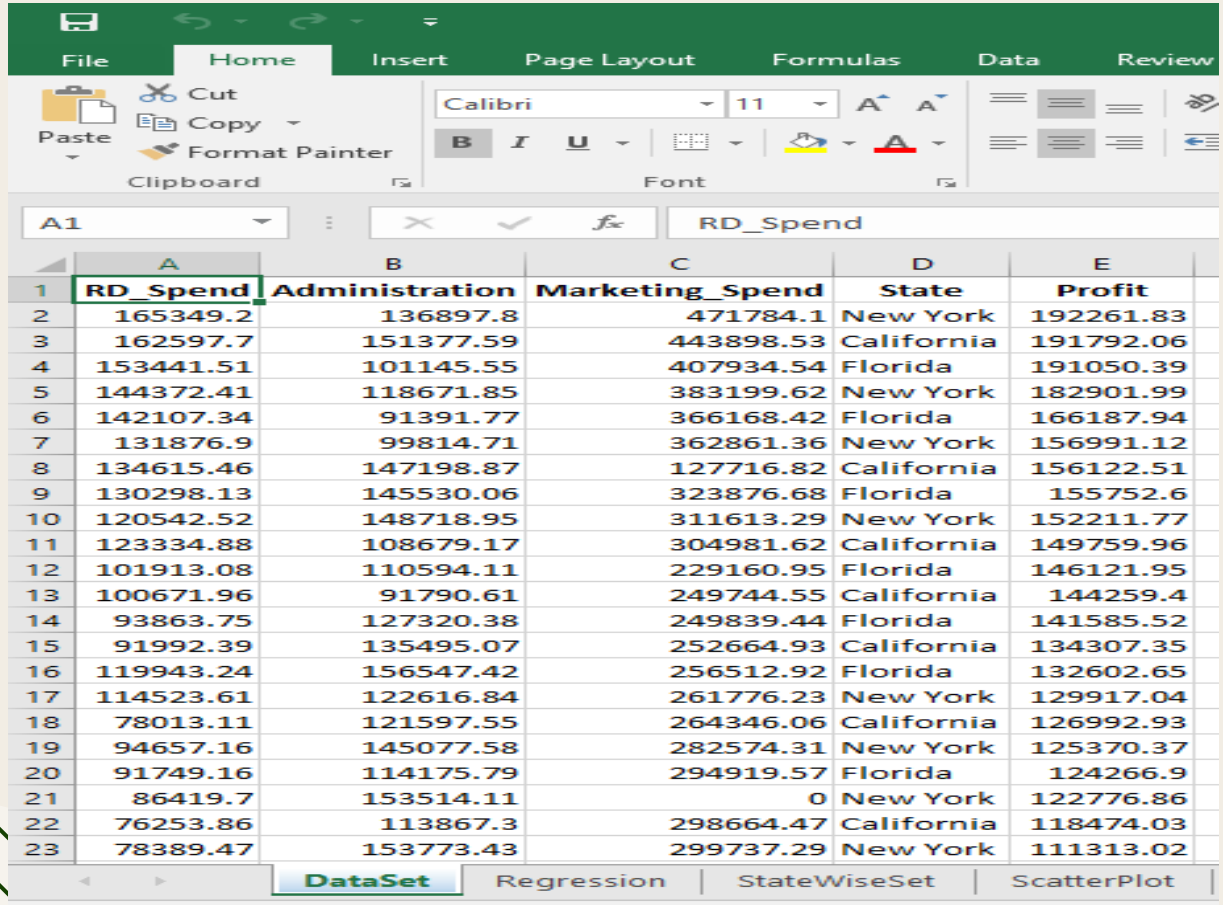


Task : Retrieved data from the database using the provided credentials.

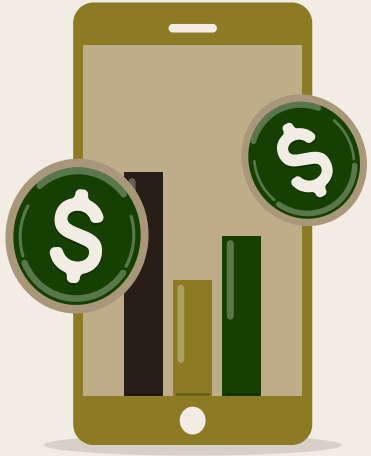
Tools used : MySQL, MS Excel.



As per the task dataset fetched from the MySQL database & the process for the same shown here,



	A	B	C	D	E
1	RD_Spend	Administration	Marketing_Spend	State	Profit
2	165349.2	136897.8	471784.1	New York	192261.83
3	162597.7	151377.59	443898.53	California	191792.06
4	153441.51	101145.55	407934.54	Florida	191050.39
5	144372.41	118671.85	383199.62	New York	182901.99
6	142107.34	91391.77	366168.42	Florida	166187.94
7	131876.9	99814.71	362861.36	New York	156991.12
8	134615.46	147198.87	127716.82	California	156122.51
9	130298.13	145530.06	323876.68	Florida	155752.6
10	120542.52	148718.95	311613.29	New York	152211.77
11	123334.88	108679.17	304981.62	California	149759.96
12	101913.08	110594.11	229160.95	Florida	146121.95
13	100671.96	91790.61	249744.55	California	144259.4
14	93863.75	127320.38	249839.44	Florida	141585.52
15	91992.39	135495.07	252664.93	California	134307.35
16	119943.24	156547.42	256512.92	Florida	132602.65
17	114523.61	122616.84	261776.23	New York	129917.04
18	78013.11	121597.55	264346.06	California	126992.93
19	94657.16	145077.58	282574.31	New York	125370.37
20	91749.16	114175.79	294919.57	Florida	124266.9
21	86419.7	153514.11	0	New York	122776.86
22	76253.86	113867.3	298664.47	California	118474.03
23	78389.47	153773.43	299737.29	New York	111313.02



Here is the dataset for the Profit Analysis Project that we got from database.

Data Analysis

Performed regression analysis to identify the impact of R&D, Marketing, and Administration spending on profit.(Summary Output)

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.975062046
R Square	0.950745994
Adjusted R Square	0.947533776
Standard Error	9232.334837
Observations	50

ANOVA

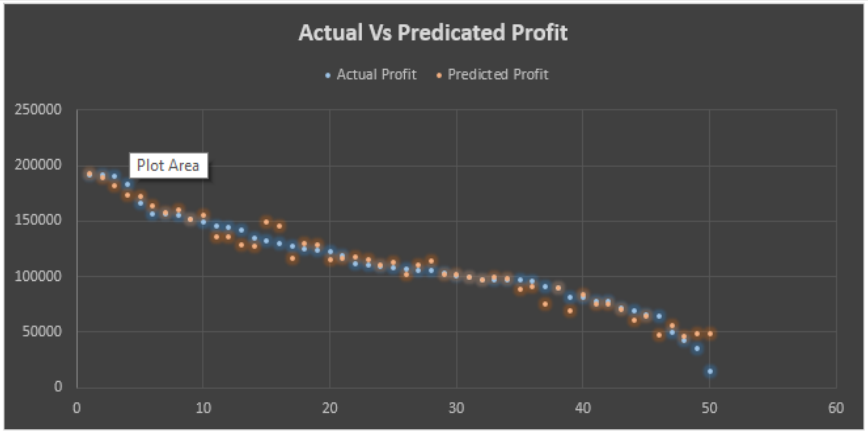
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	75683964196	25227988065	295.9780624	4.52851E-30
Residual	46	3920856301	85236006.54		
Total	49	79604820497			

	Coefficients	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	50122.19299	6572.352622	7.626217867	1.05738E-09	36892.73332	63351.65266	36892.73332	63351.65266
RD_Spend	0.80571505	0.04514727	17.84637376	2.63497E-22	0.714838309	0.89659179	0.714838309	0.89659179
Administration	-0.026815968	0.05102878	-0.525506752	0.601755108	-0.129531575	0.075899638	-0.129531575	0.075899638
Marketing_Spend	0.027228065	0.016451235	1.6550773	0.104716819	-0.005886553	0.060342682	-0.005886553	0.060342682

RESIDUAL OUTPUT

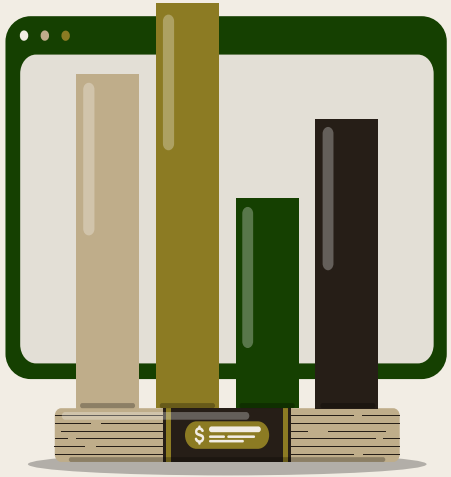
In Below image we can see the Actual Profit vs the Predicated Profit with Scatter Plot (**Residual Output)**

Observation	Actual Profit	Predicted Profit	Residuals	Absolute Error	Absolute Persentage Error
1	192261.83	192521.2529	-259.4228901	-259.4228901	-0.134932082
2	191792.06	189156.7682	2635.291768	2635.291768	1.374035905
3	191050.39	182147.2791	8903.110904	8903.110904	4.660085176
4	182901.99	173696.7	9205.289974	9205.289974	5.032908595
5	166187.94	172139.5142	-5951.574183	-5951.574183	-3.581231095
6	156991.12	163580.7806	-6589.660571	-6589.660571	-4.197473444
7	156122.51	158114.0967	-1991.586669	-1991.586669	-1.275656322
8	155752.6	160021.363	-4268.763048	-4268.763048	-2.740733091
9	152211.77	151741.6997	470.0703013	470.0703013	0.308826513
10	149759.96	154884.6841	-5124.72411	-5124.72411	-3.421958787
11	146121.95	135509.0164	10612.93363	10612.93363	7.263065975
12	144259.4	135573.713	8685.687039	8685.687039	6.020881162
13	141585.52	129138.0542	12447.46582	12447.46582	8.79148222
14	134307.35	127487.9917	6819.358337	6819.358337	5.07742751
15	132602.65	149548.6463	-16945.99633	-16945.99633	-12.77953068
16	129917.04	146235.16	-16318.11999	-16318.11999	-12.56041547
17	126992.93	116915.4054	10077.5246	10077.5246	7.935500503
18	125370.37	130192.4472	-4822.077208	-4822.077208	-3.846265436
19	124266.9	129014.2268	-4747.326806	-4747.326806	-3.820266544
20	122776.86	115635.2164	7141.643633	7141.643633	5.816766802



DataSet | Regression | Regression (2) | StateWiseSet | ScatterPlot

Accuracy and Reliability of Linear Regression



Conclusion:

•The regression model is highly significant ($p < 0.001$), indicating that the predictors significantly explain the variability in the dependent variable.

•A MAPE of 4.31% suggests that linear regression model has reasonably good accuracy in predicting the dependent variable, with predictions typically deviating by about 4.31% from the actual values on average.

•95.07% of the variability in profit is explained by R&D, Administration, and Marketing spending. This indicates a strong model fit.

•Adjusted R-squared (0.94) value accounts for the number of predictors and confirms the model's strong explanatory power with adjustment for the number of predictors.

Profit Prediction

R&D Spend	Administration	Marketing Spend	Profit
21892.92	81910.77	164270.7	
23940.93	96489.63	137001.1	

Here is the output for the predicted profit using the regression analysis method-

H	I	J	L
R&D Spend	**Administration**	**Marketing Spend**	**Profit**
21892.92	81910.77	164270.7	70037.905
23940.93	96489.63	137001.1	70554.573

Data Visualization

Insights and Recommendations

Insights -

- **Total spend** (i.e.20.3M) of all department is higher than the Profit of all department (5.6M).
- **Profit vs. R&D Spending** - A positive correlation would suggest higher R&D spending tends to increase profit.
- **Profit vs. Administration Spending** – no clear pattern is observed & administration spending may not be a significant driver of profit.
- **Profit vs. Marketing Spending** - A positive trend would indicate effective marketing strategies leading to higher profits.
- **Spending by Location –**
    - Marketing Spend is the highest in overall all state i.e. in New York 3.5, California 3.1 & Florida 4.
    - RD Spend is the lowest in overall all state i.e. in New York 1.3, California 1.1 & Florida 1.3.
- **Positive Growth -** RD department had given positive growth/profit in upward way.

Recommendations to company -

- **Optimize R&D Investment -** Encourage higher investment in R&D, as it shows a strong positive correlation with profit.
- **Evaluate Marketing Strategies -** Assess the effectiveness of marketing campaigns to ensure they are generating sufficient returns.
- **Efficiency in Administration -** While necessary, consider optimizing administrative costs to improve overall profitability.
- **Regional Strategy –**
  - Explore differences between states to tailor strategies accordingly. This could involve understanding local market dynamics and consumer behaviors.
  - With a significantly higher ROI of 33%, New York's strategies should be closely examined to identify best practices that can be replicated or adapted in other locations to enhance overall profitability.

Thank You

Profile Links

LinkedIn Profile : https://www.linkedin.com/in/ajay-wadile-994bb7255

GitHub Profile : https://github.com/ajwadile

Mail Id : ajaywadile1406@mail.com

Mobile No.: 9766997101 / 7767085863