Random Motors Project Submission

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Q-1a) Formulate the null hypotheses to check whether the new models are performing as per the desired design specifications.

For Rocinante36:	For Marengo32:
Mileage H_O : $\mu=22$ km/ltr	Mileage H_O : $\mu=15$ km/ltr
Top speed H_O : $\mu=140$ km/hr	Top speed H_O : $\mu=210$ km/hr

Q-1b) Formulate the alternate hypotheses to check whether the new models are performing as per the desired design specifications.

For Rocinante36:

Mileage H_1 : $\mu \neq 22$ km/ltr

Top speed H_1 : $\mu \neq 140$ km/hr

For Marengo32:

Mileage H_1 : $\mu \neq 15$ km/ltr

Top speed H_1 : $\mu \neq 210$ km/hr

Q-2) In order to comment on whether the design specifications are being matched or not, perform relevant hypothesis tests and calculate the p-value for each. What will you conclude? Assume you are performing the tests at 95% confidence level.

For Rocinante36:

p-value for mileage = 0.0822

p-value for top speed = 0.4316

For Marengo32:

p-value for mileage = 0.1342

p-value for top speed = 0.373

Conclusion

At 95% confidence level the significance level(alpha α) is 0.05 and we derived below for all 4 scenarios:

p-value > α for all four scenarios.
So ,we fail to reject the null hypothesis.

Hence the chief engineers claim on models Rocinante36 and Marengo32 specification cannot be challenged.

Q-3) You have learnt about the possible errors that might result from the hypothesis tests. What type of error is more expensive for Random motors based on the hypothesis they are testing? Why? Assume that you need to refund all your customers if your cars deviate from specifications.

The type of error which is more expensive:	Reason:
TYPE II ERROR is more expensive.	TYPE I ERROR occurs if we reject null when Ho=true, in this case Random Motors have to invest more in R&D.
	TYPE II ERROR occurs if we fail to reject the null when Ho=False .
	So based on assumption to refund money to all our customers if designed specification is not delivered and based on the table TYPE II ERROR will be more expensive for Random Motors.

Q-4) Develop a regression equation for each model at 95 percent confidence level. From the regression equation predict the sales of the two models.

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Develop the regression equation for the Rocinante models and Predict the number of unit sales of Rocinante36 model?

Regression coefficients

Price: **-0.79503**

Mileage: **8.306331**

Top speed: **-0.01857**

Equation: **Sales Y=50.7231-0.79502*Price+8.3063*Mileage**

Predicted Sales(in units):**227889.96**

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Develop the regression equation for the Marengo models and Predict the number of unit sales of Marengo32 model?

Regression coefficients

Price: **-0.186728172**

Mileage: **0.041301187**

Top speed: **0.220801682**

Equation: **Sales=-13.4476-0.1867*Price+0.2208*Top Speed**

Predicted Sales(in units): **25265.7**

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Q-5) Based on sales prediction, what is the overall predicted profit for Rocinante36 model and Marengo32 model ?

Overall predicted profit

Rocinante36 Model: Rs   **22,788,996,000.00**
Marengo32 Model: Rs   **20,212,560,000.00**

Q-6) As a CEO, you wish to invest only in the model which is predicted to be more profitable. Which model among Rocinante36 and Marengo32 will you invest in?

Which model you will invest in?

The overall profit for Rocinante36 is Rs **22,788,996,000** and Marengo32 is Rs **20,212,560,000**.
When we compare both, profit for Rocinante36 is higher than Marengo32.Hence as a CEO,I would like to invest on Rocinante36 model.

Q-7) Now you must have derived the regression equation for both models, Rocinante and Marengo. Now if you increase the price of Rocinante36 and Marengo32 by 1 lac rupees each, which car will have a higher impact on the sales due to increase in price? Give proper logic for your answer. You can consider that all other specifications such as mileage and top speed remain the same for both models.

Which car is most affected by a price increase? Why?

Impact on sales if price is increased by 1 Lakh

Rocinante36
Previous Sales(in 1000 units):   227889.96
New Sales (in 1000 units):   227094.94
Difference in Sales(in 1000 units):   -795.02

Marengo32
Previous Sales (in 1000 units):   25265.7
New Sales (in 1000 units):   25079
Difference in Sales(in 1000 units): -186.7

Rocinante36 will have higher impact on sales when price is increased by 1 Lakh.
This is because the regression coefficient of variable price of rocinante36 is higher than the marengo32.

Q-8) After developing the regression equation for both models (Rocinante and Marengo), if you analyse the p values for coefficients in the regression results, you will notice that some of the regression variables (top speed, mileage and price) are insignificant. Remove the insignificant regression variables from your selection and rebuild the regression model using only significant variables. Compare the Adjusted R square value for the new and old regression model. Do you notice any change in Adjusted R square value? If yes, explain the reason for the change.

Is there a change on Adjusted R square Value? If so, Why?

Rocinante36
Building new regression model based on equation with significant variables:
Sales=Bo+B1*Price+B2*Mileage

Old Adjusted R Square: 0.995356039
New Adjusted R Square: 0.995447556

Marengo32
Building new regression model based on equation with significant variables:
Sales=Bo+B1*Price+B3*Top Speed

Old Adjusted R Square: 0.84787522
New Adjusted R Square: 0.853091209

In both models the Adjusted R square increases from the previous models.This is because we removed insignificant variables top speed from Rocinante36 model and mileage from Marengo32 model and rebuilded the new regression model with only significant variables.