

Cars Analysis & Hypothesis Testing

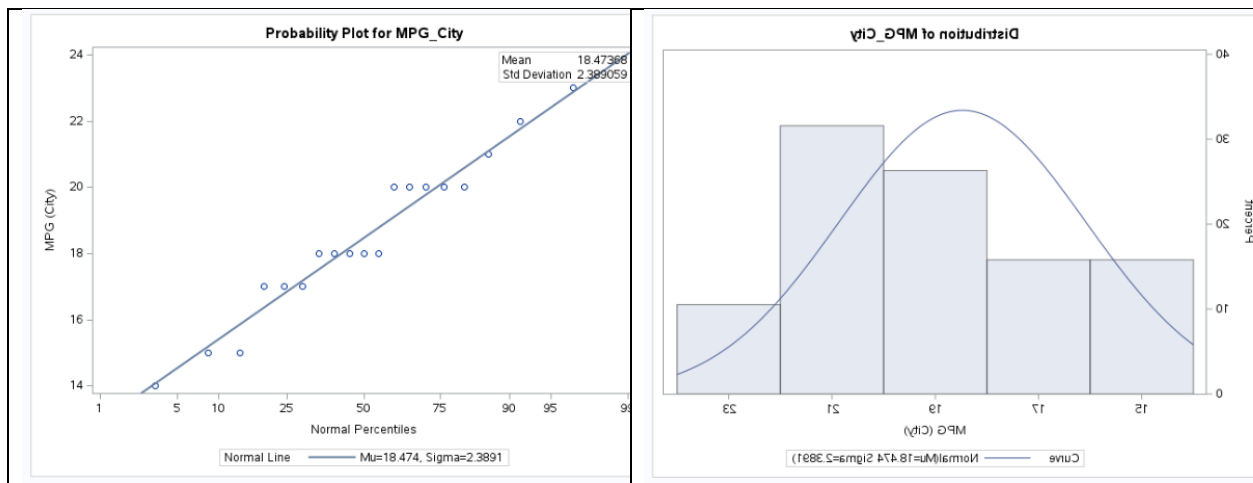
Part A) A luxury car dealership owner is considering restocking their inventory with more luxury cars to meet a perceived increase in demand of luxury car purchases for the holiday season. This car owner has access to

Output:

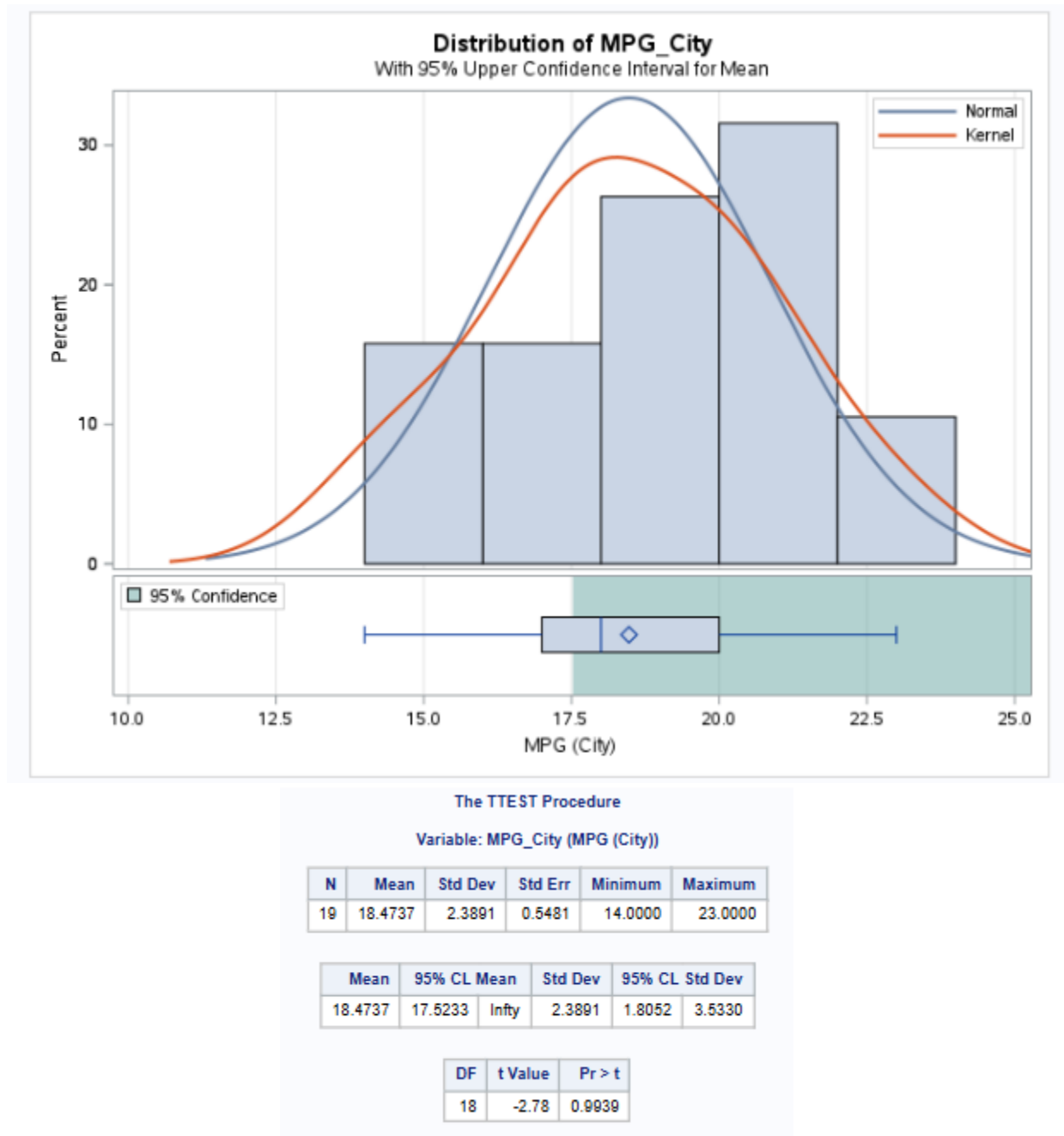
	Make	Avg_MSRP	Avg_City_MPG	Avg_Highway_MPG
1	Audi	\$43,308	18.473684211	25.789473684
2	BMW	\$43,285	18.7	27
3	Infiniti	\$36,070	17.25	23.875

Part B) After careful consideration the dealership owner has decided that he will be purchasing Audis to restock his inventory for the holiday season, believing they will be the more popular option. He is planning on filming a commercial where he is going to make the claim that the Audi vehicles he is purchasing will have an average city mpg of over 20 miles but wants you to run a test to check his claim. Before you run a hypothesis test to check the mpg, he reminds you to check if the assumptions of normality are violated by checking the appropriate analytics. Report the results of the assumptions evaluation as well as your main analysis in context of the scenario, should the dealership owner run the commercial?

Output: Normality test



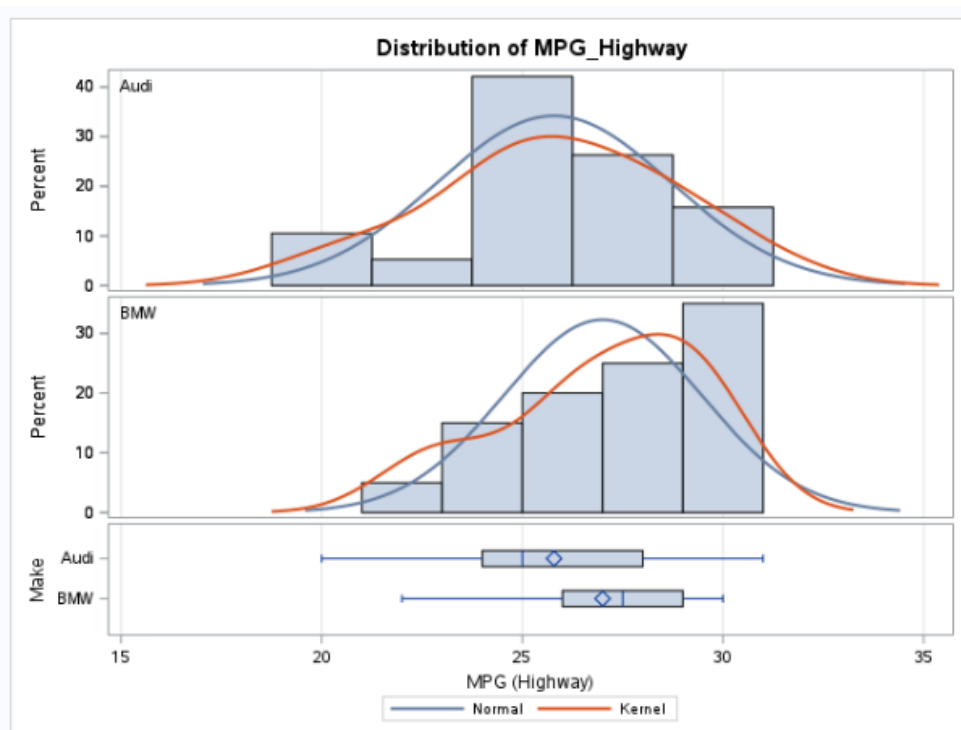
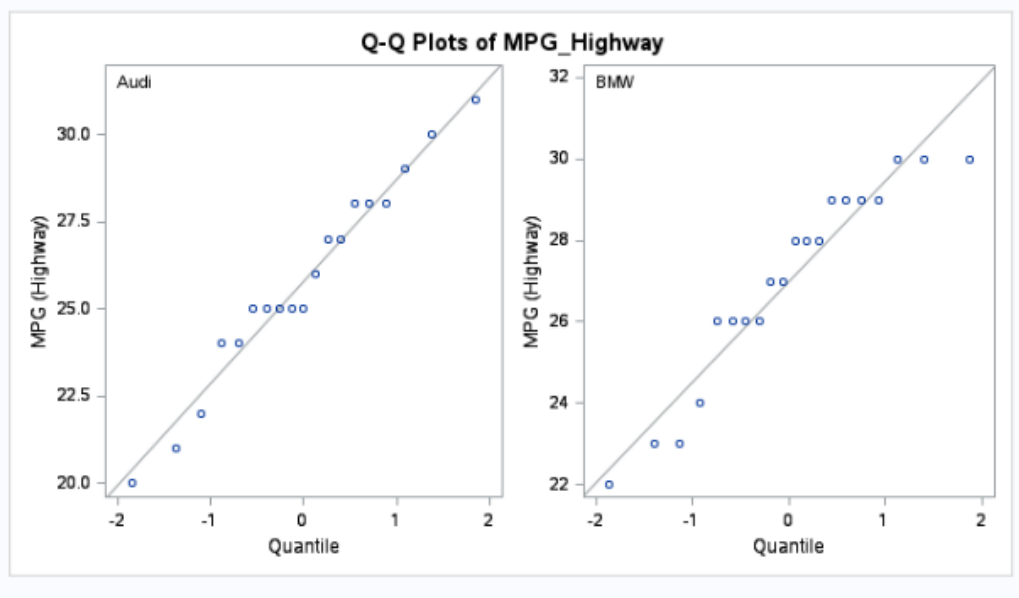
T-test



The assumption of normality for the city MPG of Audi vehicles was evaluated using a Q-Q plot and a histogram with overlaid normal and kernel density curves. The data showed a roughly bell-shaped distribution with points closely aligned along the normal line, indicating that the normality assumption was not violated. Therefore, it is rightly appropriate to proceed with a one-sample t-test to assess the dealership owner's claim that Audi vehicles average more than 20 miles per gallon in the city. The results of the t-test showed a mean city MPG of 18.47, a t-value of -2.78, and a p-value of 0.9939. We fail to reject the null hypothesis. This means there is no statistical evidence to support the claim that Audi vehicles average more than 20 MPG in city driving. Based on these results, the dealership owner should not run the commercial with that specific claim.

Part C) The dealership owner is now second-guessing whether he wants to purchase Audis for his inventory restock as he now hears that the BMW models have significantly better Highway mpg than the Audi models. Once again, he is asking you to run a test to compare if the average Highway mpg of the BMW vehicles are statistically different from that of the Audi's Highway mpg. He is asking you to run this test with an alpha level of .05. Report whether the mpg's are significantly different and if so by how much, and justify your answer with p-values and t-scores (t-values). Assume that if the mpgs are not statistically different that he will still purchase the Audi's and use this information to state which he should purchase.

Output: Normality Test



The TTEST Procedure							
Variable: MPG_Highway (MPG (Highway))							
Make	Method	N	Mean	Std Dev	Std Err	Minimum	Maximum
Audi		19	25.7895	2.9170	0.6692	20.0000	31.0000
BMW		20	27.0000	2.4709	0.5525	22.0000	30.0000
Diff (1-2)	Pooled		-1.2105	2.6971	0.8641		
Diff (1-2)	Satterthwaite		-1.2105		0.8678		

Make	Method	Mean	95% CL Mean	Std Dev	95% CL Std Dev
Audi		25.7895	24.3835 27.1954	2.9170	2.2041 4.3137
BMW		27.0000	25.8436 28.1564	2.4709	1.8791 3.6089
Diff (1-2)	Pooled	-1.2105	-2.9613 0.5402	2.6971	2.1989 3.4894
Diff (1-2)	Satterthwaite	-1.2105	-2.9717 0.5506		

Method	Variances	DF	t Value	Pr > t
Pooled	Equal	37	-1.40	0.1696
Satterthwaite	Unequal	35.345	-1.39	0.1717

Equality of Variances				
Method	Num DF	Den DF	F Value	Pr > F
Folded F	18	19	1.39	0.4791

Average highway MPG between BMW and Audi vehicles, a two-sample *t*-test was conducted at the 0.05 significance level. Prior to testing, normality was assessed using *Q-Q* plots and histograms, which showed that both BMW and Audi highway MPG data followed a roughly linear trend and bell-shaped distribution, indicating that the assumption of normality was met. The test for equality of variances (*F*-test) resulted in a *p*-value of 0.6471, suggesting equal variances could be assumed. Using the pooled method, the *t*-test yielded a *t*-value of -1.40 with a corresponding *p*-value of 0.1765. Since the *p*-value is greater than 0.05, we fail to reject the null hypothesis. Therefore, there is no statistically significant difference in the average highway MPG between BMW and Audi vehicles. This suggests that both brands offer comparable highway fuel efficiency based on the sample data.