QSO 510 Final Project Case Addendum

Vice-president Arun Mittra speculates:

We have always estimated how many transformers will be needed to meet demand. The usual method is to look at the sales figures of the last two to three months and also the sales figures of the last two years in the same month. Next make a guess as to how many transformers will be needed. Either we have too many transformers in stock, or there are times when there are not enough to meet our normal production levels. It is a classic case of both understocking and overstocking.

Ratnaparkhi, operations head, has been given two charges by Mittra. First, to develop an analysis of the data and present a report with recommendations. Second, "to come up with a report that even a lower grade clerk in stores should be able to fathom and follow."

In an effort to develop a report that is understood by all, Ratnaparkhi decides to provide incremental amounts of information to his operations manager, who is assigned the task of developing the complete analyses.

A-Cat Corporation is committed to the pursuit of a robust statistical process control (quality control) program to monitor the quality of its transformers. Ratnaparkhi, aware that the construction of quality control charts depends on means and ranges, provides the following descriptive statistics for 2006 (from Exhibit 1).

	2006
Mean	801.1667
Standard Error	24.18766
Median	793
Mode	708
Standard Deviation	83.78851
Sample Variance	7020.515
Kurtosis	-1.62662
Skewness	0.122258
Range	221
Minimum	695
Maximum	916
Sum	9614
Count	12

The operations manager is assigned the task of developing descriptive statistics for the remaining years, 2007–2010, that are to be submitted to the quality control department.

A-Cat's president asks Mittra, his vice-president of operations, to provide the sales department with an estimate of the mean number of transformers that are required to produce voltage regulators. Mittra,

recalling the product data from 2006, which was the last year he supervised the production line, speculates that the mean number of transformers that are needed is less than 745 transformers. His analysis reveals the following:

$$t = 2.32$$
$$p = .9798$$

This suggests that the mean number of transformers needed is not less than 745 but at least 745 transformers. Given that Mittra uses older (2006) data, his operations manager knows that he substantially underestimates current transformers requirements. She believes that the mean number of transformers required exceeds 1000 transformers and decides to test this using the most recent (2010) data.

Initially, the operations manager possessed only data for years 2006 to 2008. However, she strongly believes that the mean number of transformers needed to produce voltage regulators has increased over the three-year period. She performs a one-way analysis of variance (ANOVA) analysis that follows:

2006	2007	2008
779	845	857
802	739	881
818	871	937
888	927	1159
898	1133	1072
902	1124	1246
916	1056	1198
708	889	922
695	857	798
708	772	879
716	751	945
784	820	990

Anova: Single Factor

SUMMARY

Groups	Count	Sum	Average	Variance
2006	12	9614	801.1667	7020.515
2007	12	10784	898.6667	18750.06
2008	12	11884	990.3333	21117.88

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	214772.2	2	107386.1	6.870739	0.003202	3.284918

Within Groups	515773	33	15629.48
Total	730545.2	35	

The results (F = 6.871 and p = 0.003202) suggest that indeed the mean number of transformers has changed over the period 2006–2008. Mittra has now provided her with the remaining two years of data (2009 and 2010) and would like to know if the mean number of transformers required has changed over the period 2006–2010.

Finally, the operations manager is tasked with developing a model for forecasting transformer requirements based on sales of refrigerators. The table below summarizes sales of refrigerators and transformer requirements by quarter for the period 2006–2010, which are extracted from Exhibits 2 and 1 respectively.

Sales of Refrigerators	Transformer Requirements
3832	2399
5032	2688
3947	2319
3291	2208
4007	2455
5903	3184
4274	2802
3692	2343
4826	2675
6492	3477
4765	2918
4972	2814
5411	2874
7678	3774
5774	3247
6007	3107
6290	2776
8332	3571
6107	3354
6729	3513