

1020818

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Handy Hydraulics Industries Assessment 2

Background: HH Industries has been a family business since 1960. As with all family business, it is quite inefficient.

Aims: The aim of this document is to identify areas of improvements.

Methods: They include measures of central tendency, variation, position, exploratory data analysis, probability and shapes / pictures of data.

Results: We have Statistics summaries, histograms, graphs, Q-Q plots, box plots and bar charts.

Conclusions: Something has to be done urgently, so as not to waste company resources. 80% of the company's resources are used on unprofitable goods and service which bring in only 20% revenue.

Recommendations: Appoint a marketing executive so as to realize the company's objectives the company's objectives.



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1.0 Introduction

HH Industries was established by Mr Douglas in the 1960s. It was a family owned distributor involved in selling spares and repair parts for a variety of hydraulic equipment. Sales were mainly in Florida in the beginning and then spread northward to Alabama and Georgia.

In 1985 due to increasing competition and inefficiency of the company Handy Hydraulics was sold to BMP enterprises. Mr Douglas was given a 3 year contract to remain as president. With additional capital from BMP warehouses were opened in Arizona (1985) and Ohio (1986).

However with Mr Douglas still in charge the company had no marketing strategy to recognise the importance of the changing business environment: that is increased competition, new technologies and management strategies. The result was a business out of control, suffocating itself by once-proven, but now too inflexible policies and procedures. While averaging over \$ 900 000 in sales per quarter the outrageously high payroll and operating expenses were causing net losses.

Mr Douglas retired in 1998 and BMP enterprises brought in Hal Rogers to try to save Handy Hydraulics. For the next 3 years, significant changes were introduced, a walk-in parts counter, Toll-free customer order numbers and payroll was trimmed down. The Ohio warehouse was closed down and a streamline version was opened in Pennsylvania, the company's catalogue was downsized and updated. Finally, to publicise the company's new image, the name was changed to HH Industries.

With a rapid changing business environment the company wants to do internal marketing analysis, so as to enable them to compete. They had to recruit some people from outside to help them analyse their data.

Laurel McRae is an expert in data analysis and strategic planning and she has joined the team to analyse and interpret data in a more statistical way. This will enable them to realize where they are now and where they hope to be in a few years. The corporate fiscal year is December to November and Quarterly sales average \$ 1.4 million.

We have sales figures for different Quarters, third, fourth quarters in 1990 and first, second quarters in 1991. With this data we are assigned to find out where HH Industries stands, and recommend appropriate solutions.

The methods used include making assumptions and testing the assumptions, histograms, central tendency, probability and variation. Recommendations to improve HH Industries business will be made at the end of the report.

2.0 Methods

Question	Method
Question 1a	Graphical methods for describing data (Frequency histograms, bar charts)
Question 1b	Graphical methods for describing data (Relative frequency histograms, bar charts)
Question 1c	Exploratory data analysis, measures of central tendency
Question 2a	Measures of central tendency, Descriptive summaries
Question 2b	Measures of central tendency
Question 3	Measures of position, Measures of central tendency
Question 3b	Measures of variation, Measures of central tendency
Question 3c	Inferential statistics
Question 4	Tests of Probability
Question 5	Tests of Probability, Inferential statistics, forecasting and prediction
Question 6	Tests of Probability, Inferential statistics
Question 7	Descriptive statistics
Question 8	Measures of central tendency, Tests of Probability, Graphs

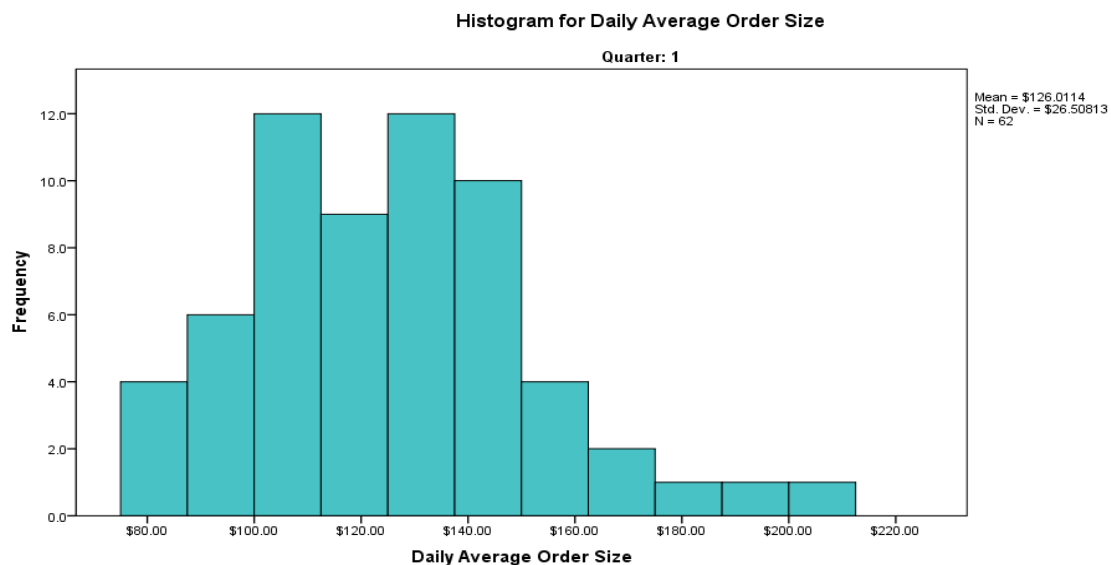
Computer printouts from SPSS and Excel are used throughout. On pasting SPSS graphs and results the small print from SPSS is hardly visible because Word interprets it as pictures

3.0 Results

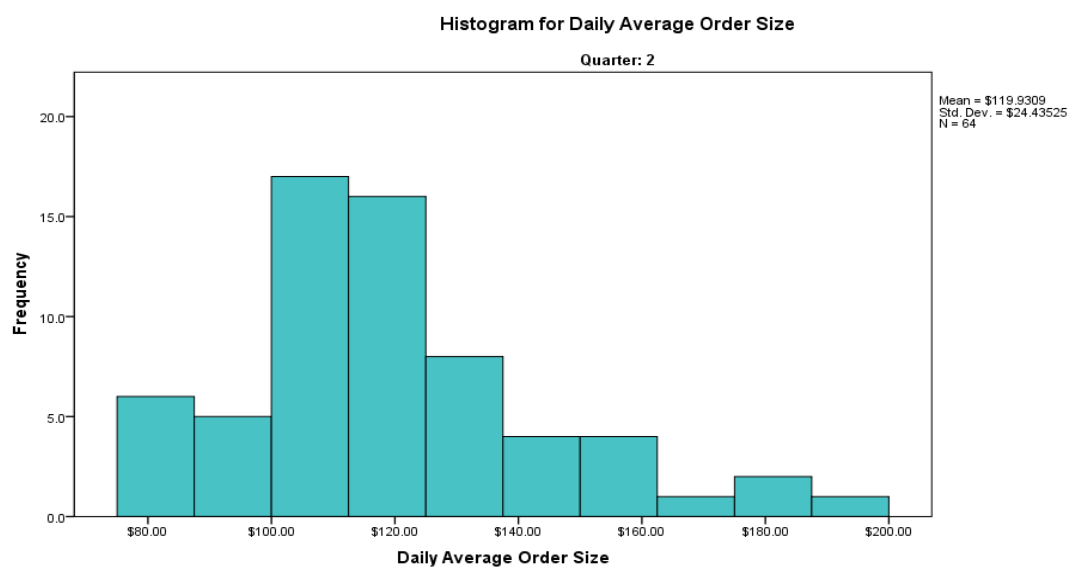
3.1 Question 1 :

3.1.1 Question 1a

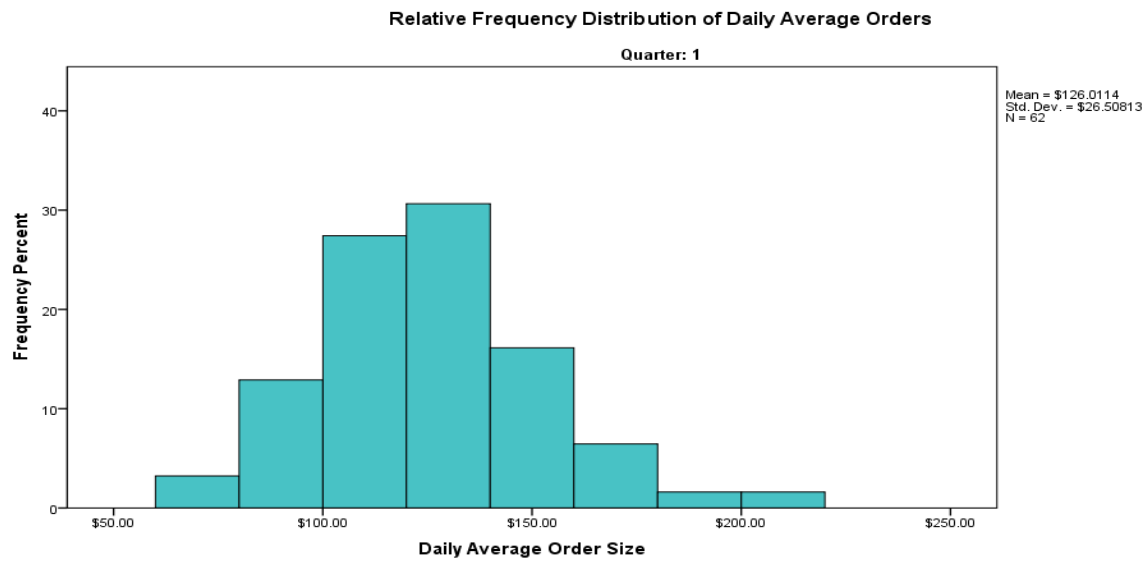
Histograms are used to spot obvious problems.



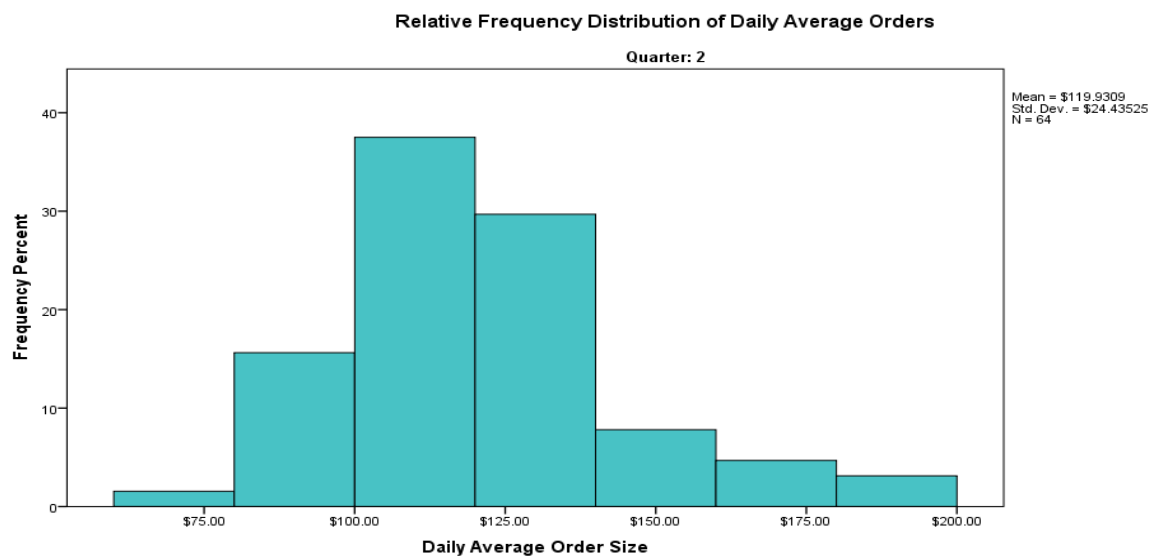
The mean is \$126 and there are a few orders between \$175 and 210. It looks suspiciously positively skewed and bimodal (There are two peaks)



The mean has gone down to \$ 120 and is still positively skewed and bimodal.



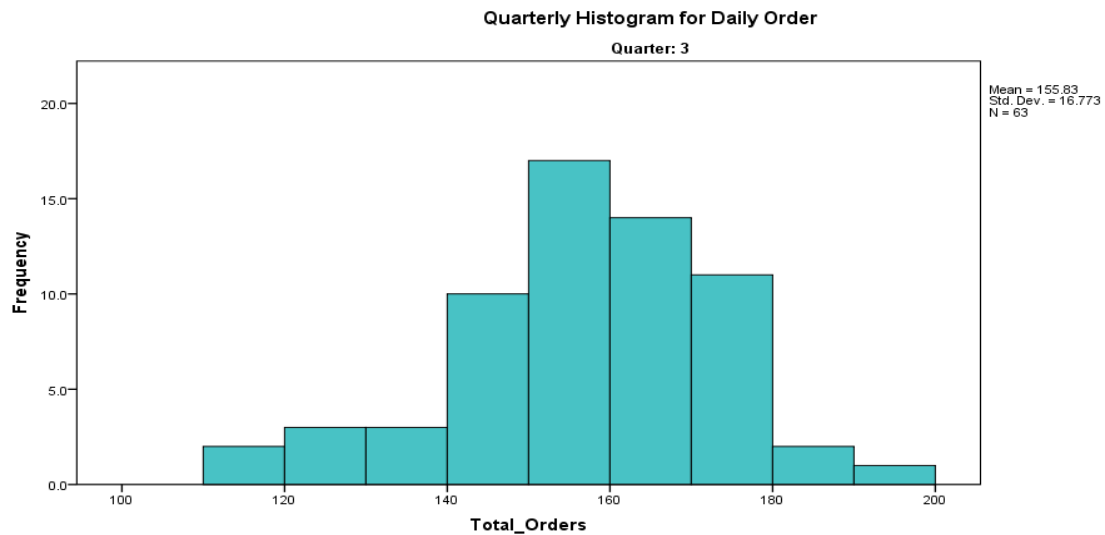
Most orders are between \$80 and \$160 and it shows a small positive skew.



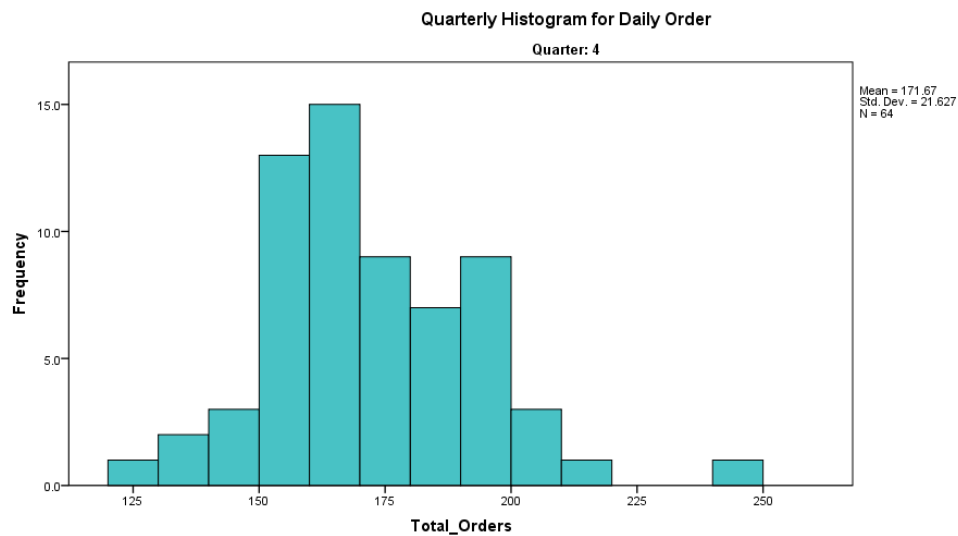
In the 2nd quarter most orders are between \$100 and \$130.

3.1.2 Question 1.B

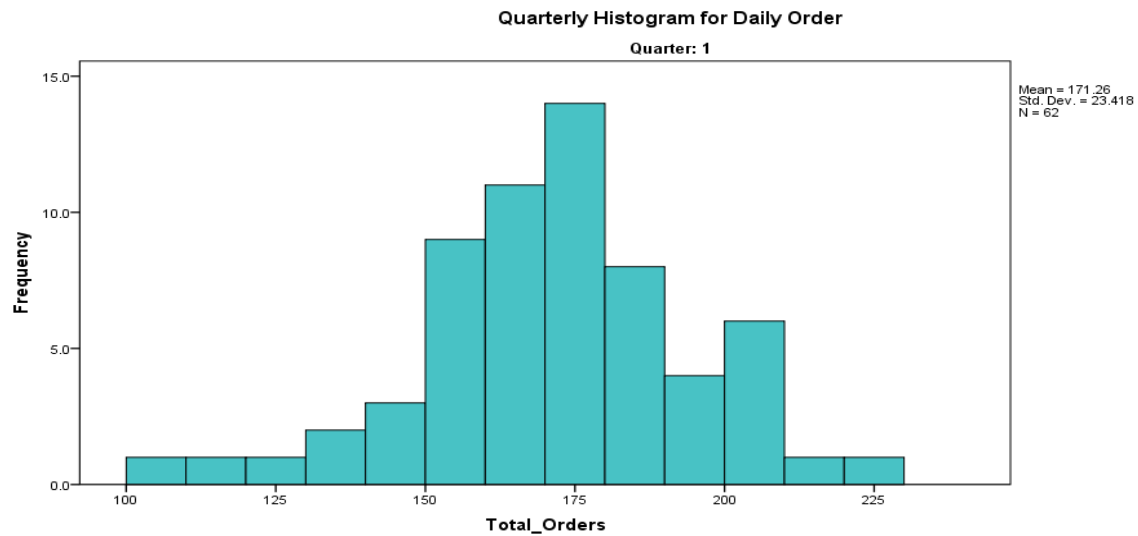
- Quarterly charts for the Company's Total Number of Orders per day.



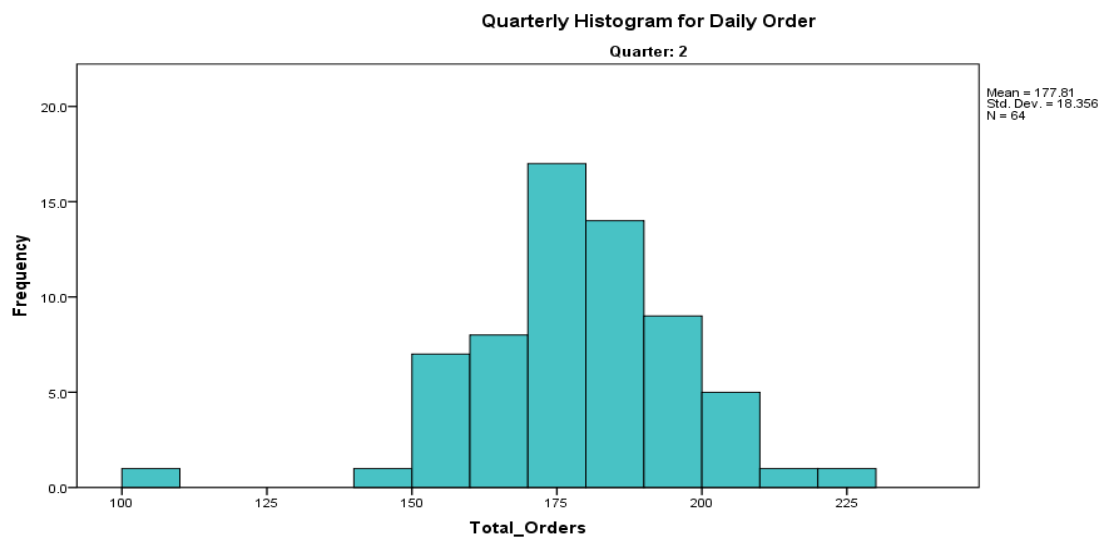
For the 3rd quarter most orders are between 140 and 180, mean is 155, standard deviation is 17 and the highest frequency is approximately 17.



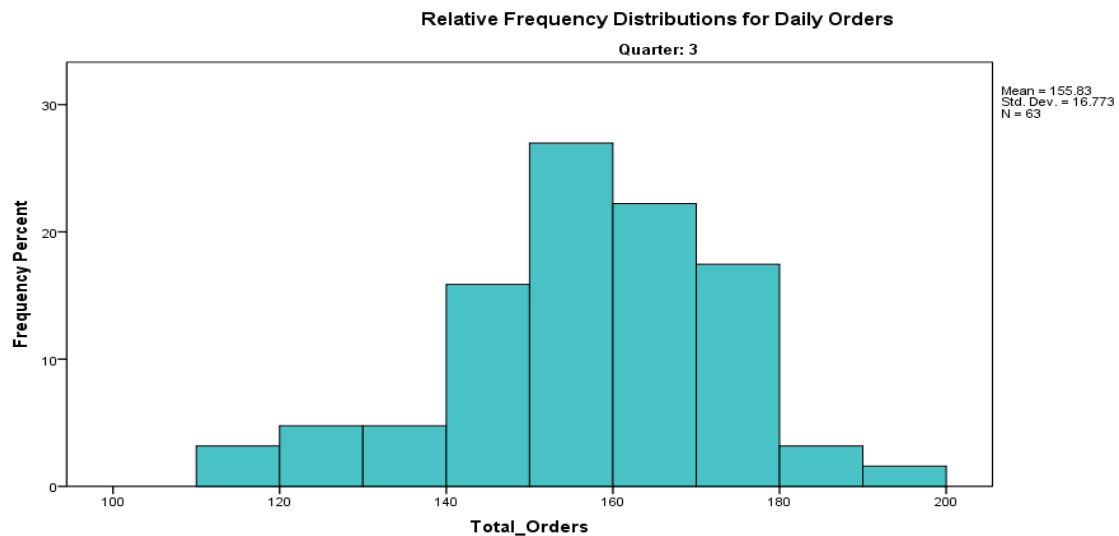
For the 4th quarter most orders are between 150 and 200, mean is 171, standard deviation is 21 and the highest frequency is approximately 15. No orders are between 220 and 240.



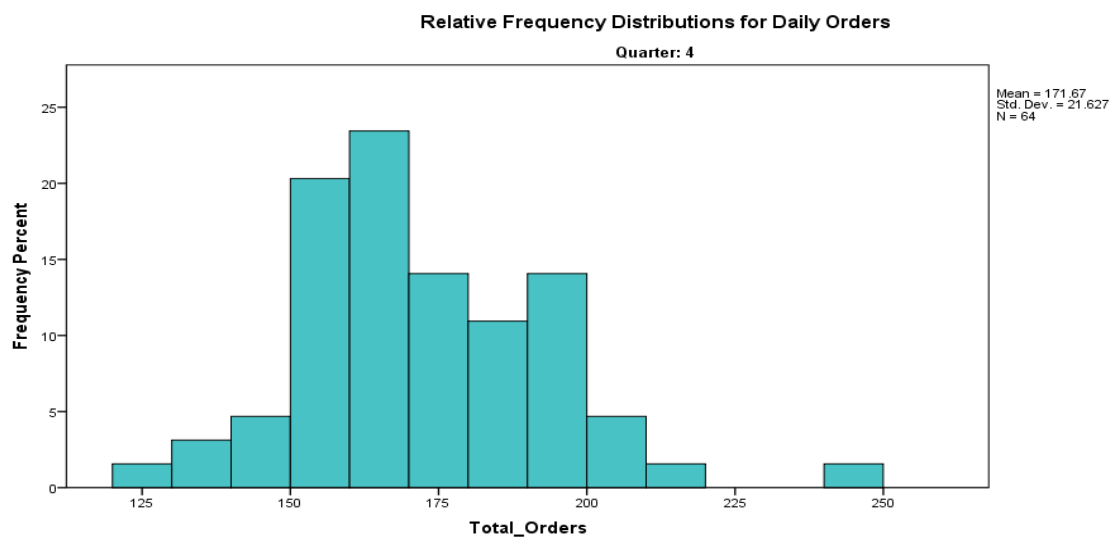
For the 1st quarter most orders are between 150 and 210, mean is 171, standard deviation is 23 and the highest frequency is approximately 14.



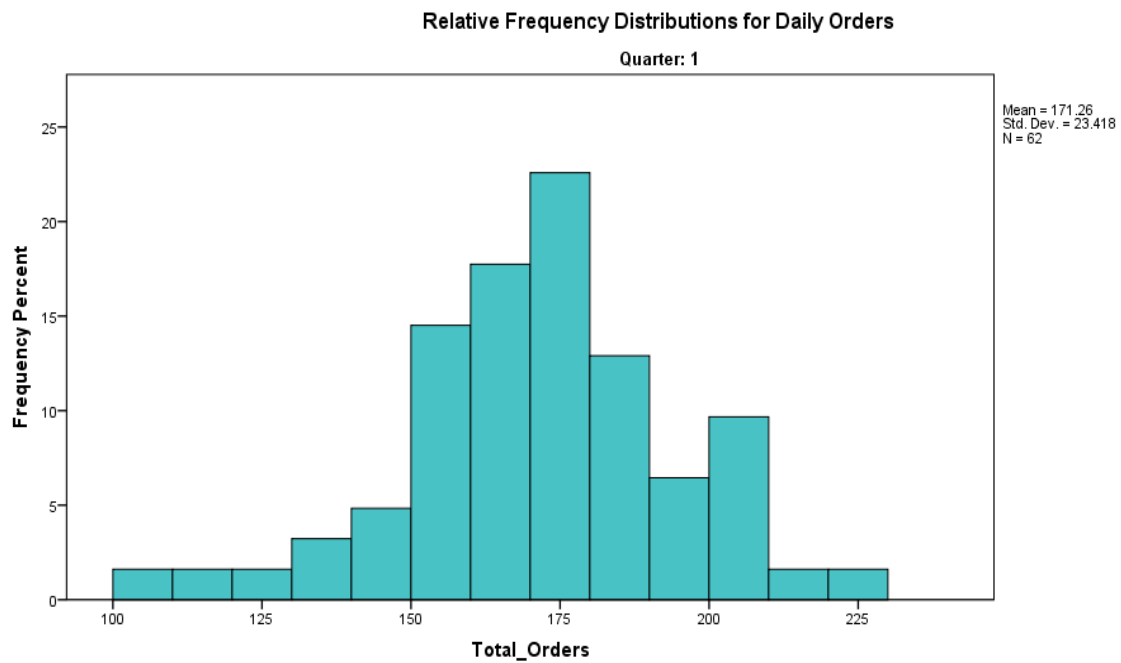
For the 2nd quarter most orders are between 150 and 210, mean is 171, standard deviation is 18 and the highest frequency is approximately 17. No orders between 110 and 130.



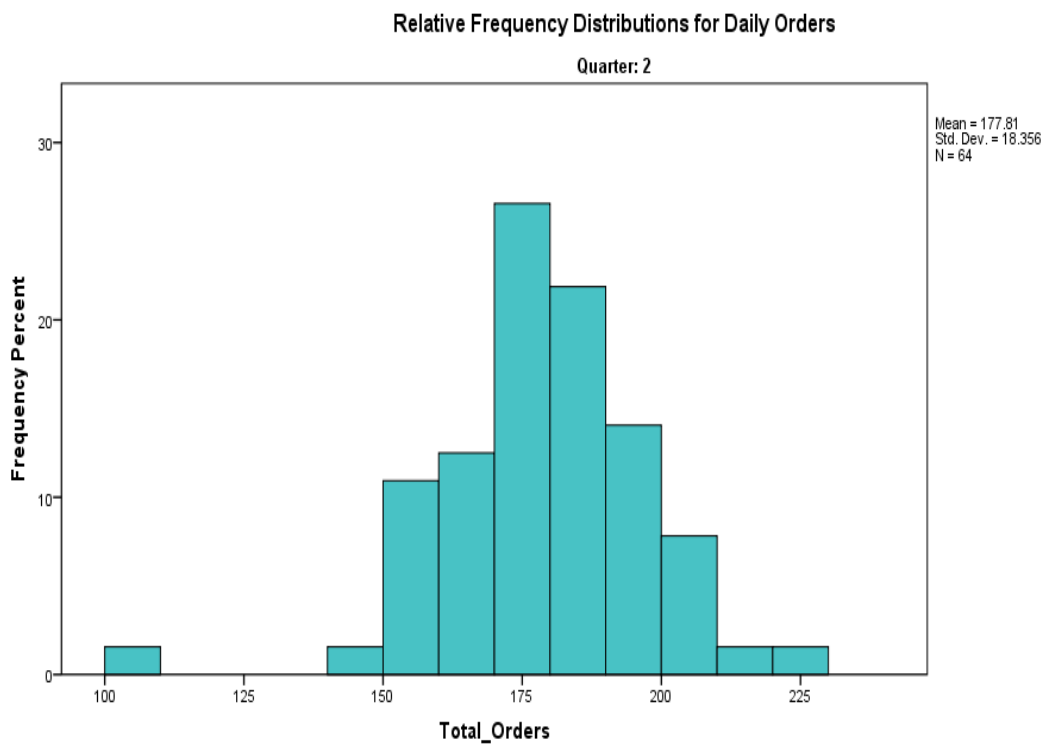
68% of orders lie between 138 and 172 and the distribution looks normal.



Approximately 68% of orders lie between 150 and 192 and there are no orders between 220 and 240.



Approximately 68% of orders lie between 150 and 195 and there are a few orders below 150.



There are no orders between 115 and 135 and approximately 68% of orders lie between 150 and 200.

3.1.3 Question 1.C

-Case Summaries of Total Orders from 3rd quarter through to 2nd quarter.

Case Summaries

	Total Orders 3	Total Orders 4	Total Orders 1	Total Orders 2
Mean	155.83	171.67	171.26	177.81
Median	156.00	168.50	171.50	177.00
Std. Error of Mean	2.113	2.703	2.974	2.295
Sum	9817	10987	10618	11380
Minimum	110	127	106	108
Maximum	195	249	228	229
Range	85	122	122	121
Std. Deviation	16.773	21.627	23.418	18.356
Variance	281.340	467.716	548.391	336.948
Kurtosis	.375	1.398	.546	2.755
Std. Error of Kurtosis	.595	.590	.599	.590
Skewness	-.481	.650	-.270	-.483
Std. Error of Skewness	.302	.299	.304	.299
Harmonic Mean	153.91	169.09	167.82	175.74
Geometric Mean	154.89	170.37	169.60	176.82
% of Total Sum	100.0%	100.0%	100.0%	100.0%
% of Total N	100.0%	100.0%	100.0%	100.0%

The mean has increased from 155 in the 3rd Quarter to 171 in the 4th quarter and then stayed almost the same until the 2nd quarter. This 10% increase has also happened to the median and sum.

The minimum goes up by 15% and then falls down 20 %. The maximum increases and falls.

3rd Quarter looks like there is an outlier.

The data set is skewed to the right for the 3rd and 4th quarter since the median is less than the mean. For the first and second quarter the distributions are normal since mean is equal to median.

Except for the 3rd quarter the range is the same.

The Standard errors of Kurtosis and Skewness are almost constant for all the four periods.

The orders increase by about 10% and then stabilise and the increase again by 7% again.

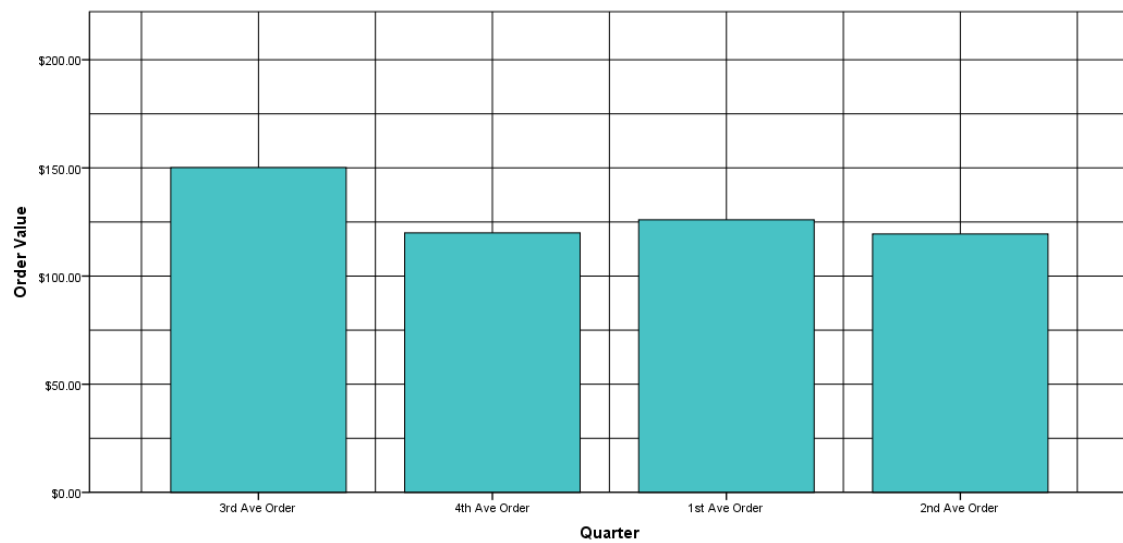
Case Summaries of Average Order sizes from 3rd quarter through to 2nd quarter.

Case Summaries

	3rd Ave Order	4th Ave Order	1st Ave Order	2nd Ave Order
Mean	\$149.5126	\$120.6767	\$126.0114	\$119.9309
Median	\$132.9831	\$120.0882	\$125.7397	\$116.7149
Std. Error of Mean	\$15.94010	\$3.01664	\$3.36654	\$3.05441
Sum	\$9,419.30	\$7,723.31	\$7,812.71	\$7,675.57
Minimum	\$66.18	\$69.96	\$76.42	\$76.77
Maximum	\$1,113.61	\$190.81	\$202.07	\$197.01
Range	\$1,047.44	\$120.85	\$125.65	\$120.23
Std. Deviation	\$126.52065	\$24.13314	\$26.50813	\$24.43525
Variance	16007.475	582.408	702.681	597.081
Kurtosis	56.769	.799	.278	1.175
Std. Error of Kurtosis	.595	.590	.599	.590
Skewness	7.352	.533	.525	.918
Std. Error of Skewness	.302	.299	.304	.299
Harmonic Mean	\$129.6904	\$115.9786	\$120.6812	\$115.4679
Geometric Mean	\$135.5099	\$118.3320	\$123.3257	\$117.6380
% of Total Sum	100.0%	100.0%	100.0%	100.0%
% of Total N	100.0%	100.0%	100.0%	100.0%

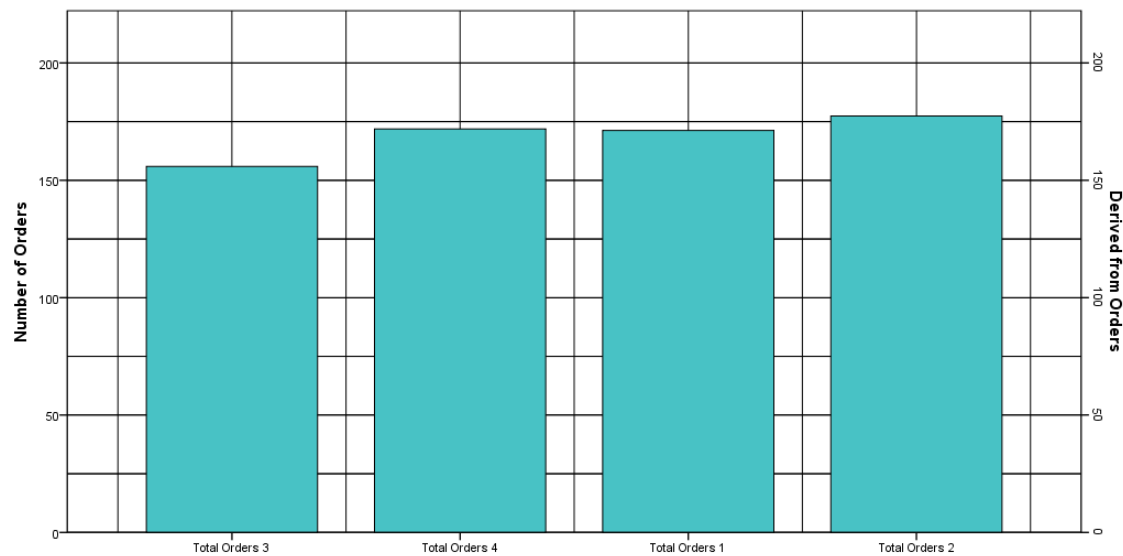
There is a big order of \$ 1 100 in 3rd quarter and the other quarters have maximum orders of about \$ 200. This big order has distorted all the other figures.

Bar charts for Order Values



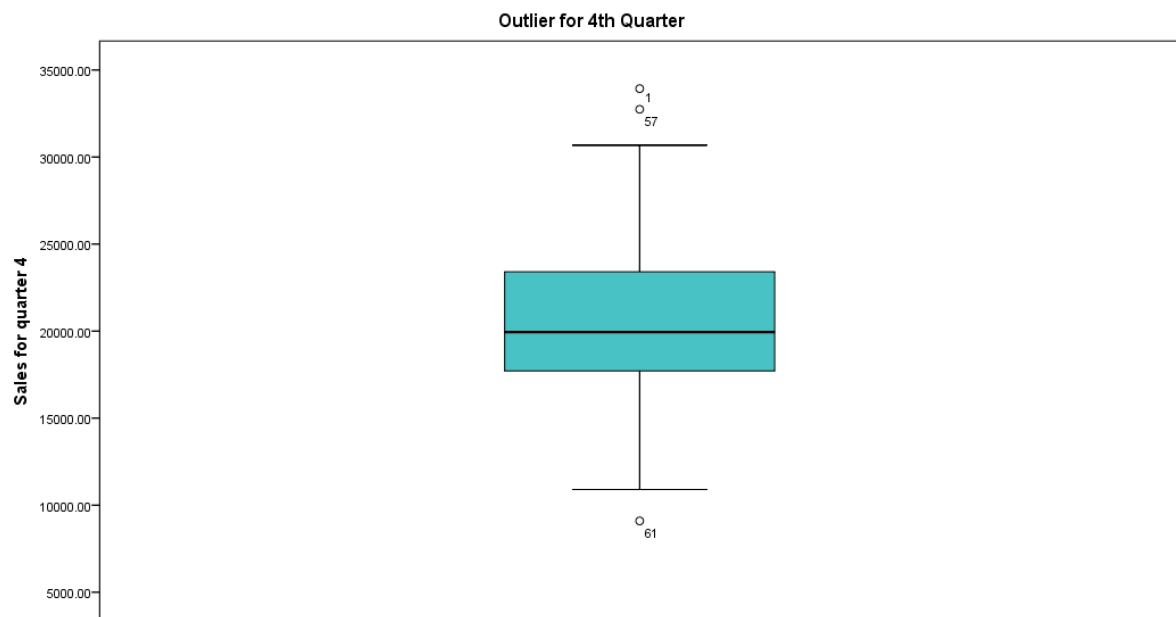
The order value is initially high and then remains constant over the 3 quarters.

Bar charts for Number of Orders

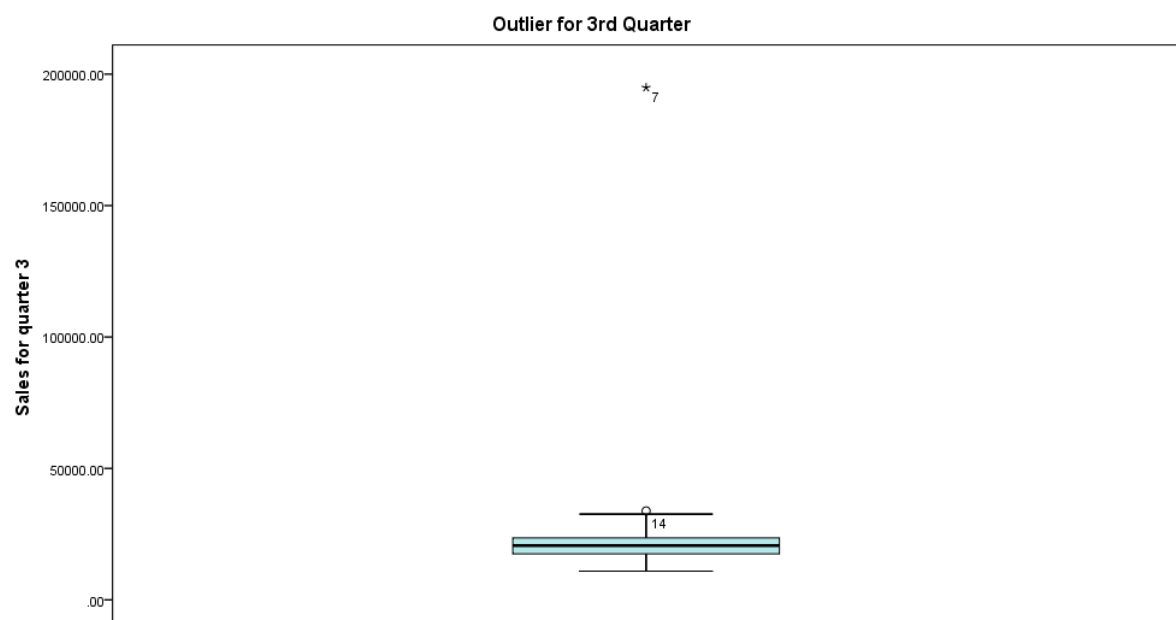


The number of orders per quarter seems to be increasing steadily.

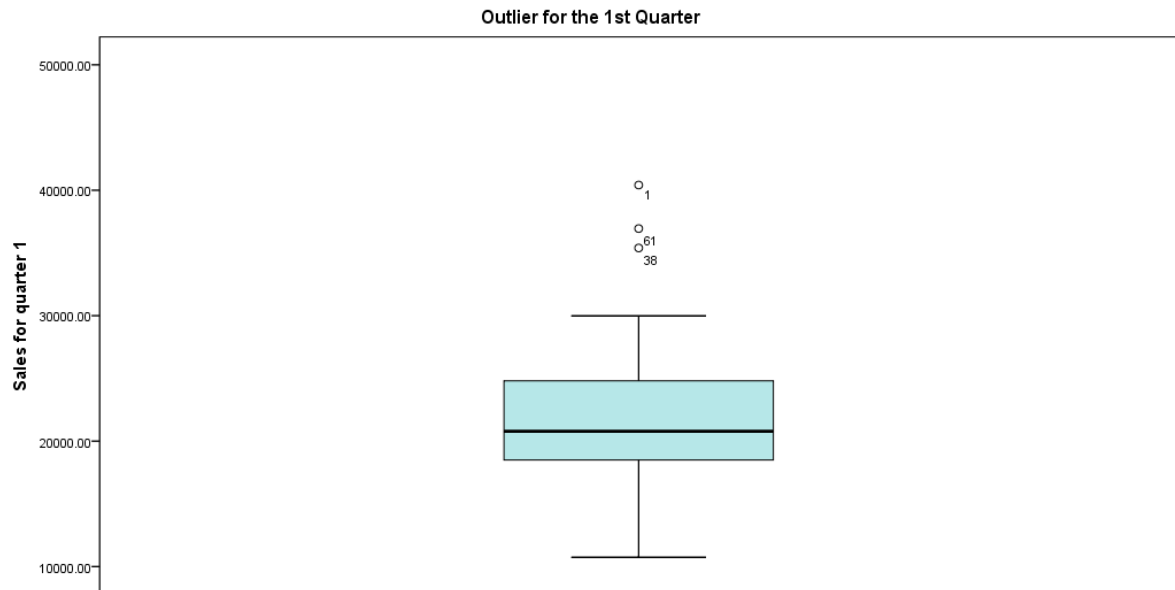
- Checking for outliers with boxplots.
- **Sales Outliers**



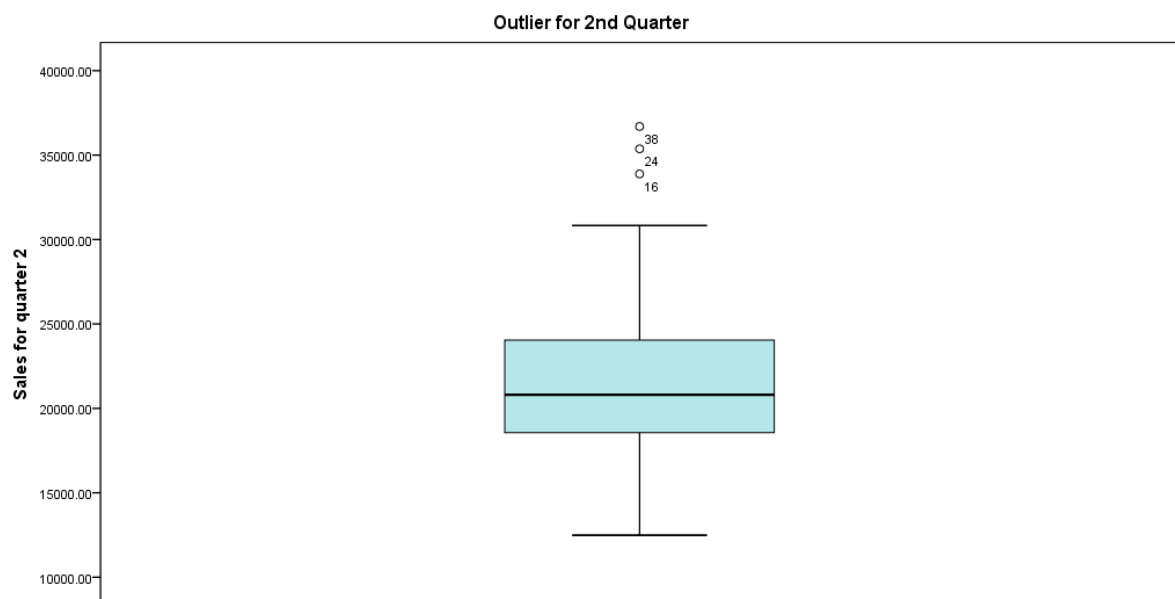
3 Outliers for the 4th quarter are \$30 678.00, \$32 741.00, \$33 931.00



There is one outlier in the 3rd quarter which is \$ 194 882.00

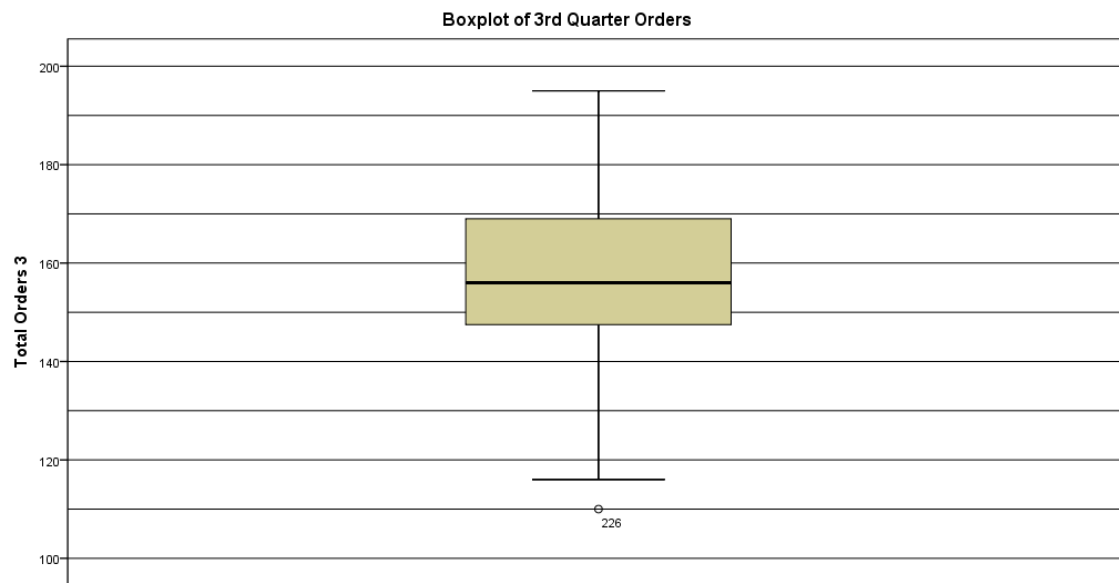


There are 3 outliers in the 1st quarter which are \$40 413.00, \$36 944.00 and \$35 398

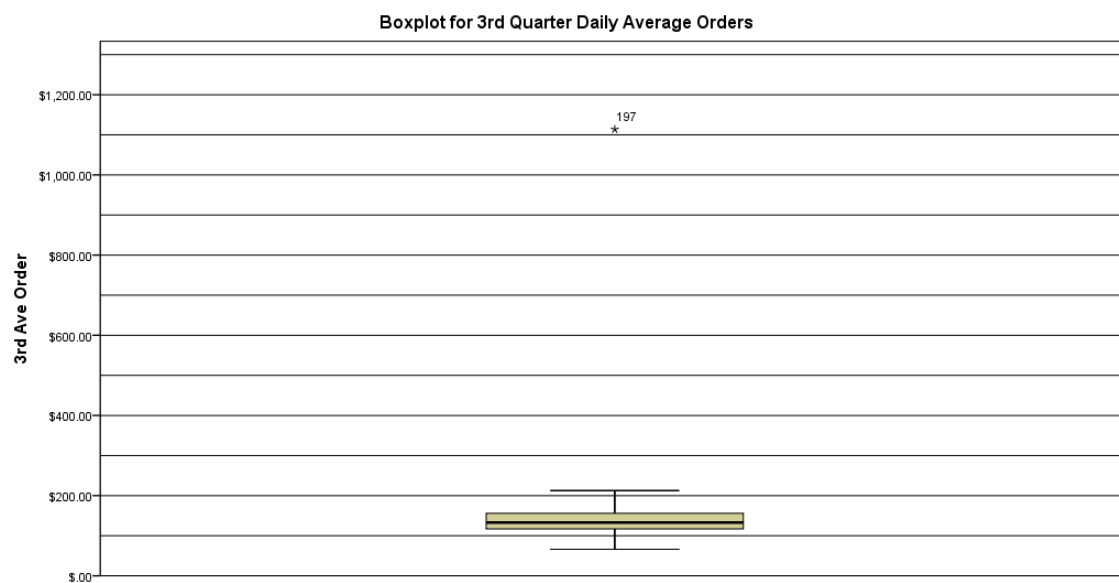


There are 3 outliers in the 2nd quarter which are \$ 36 692.00, \$35 371.00 and \$ 33 885.00

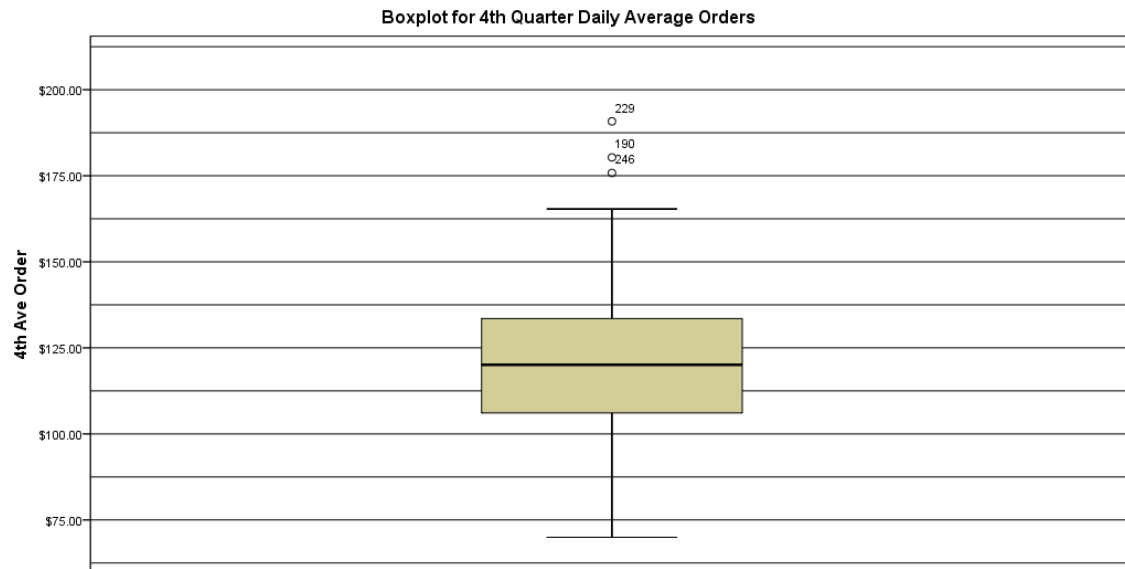
Outliers for Orders



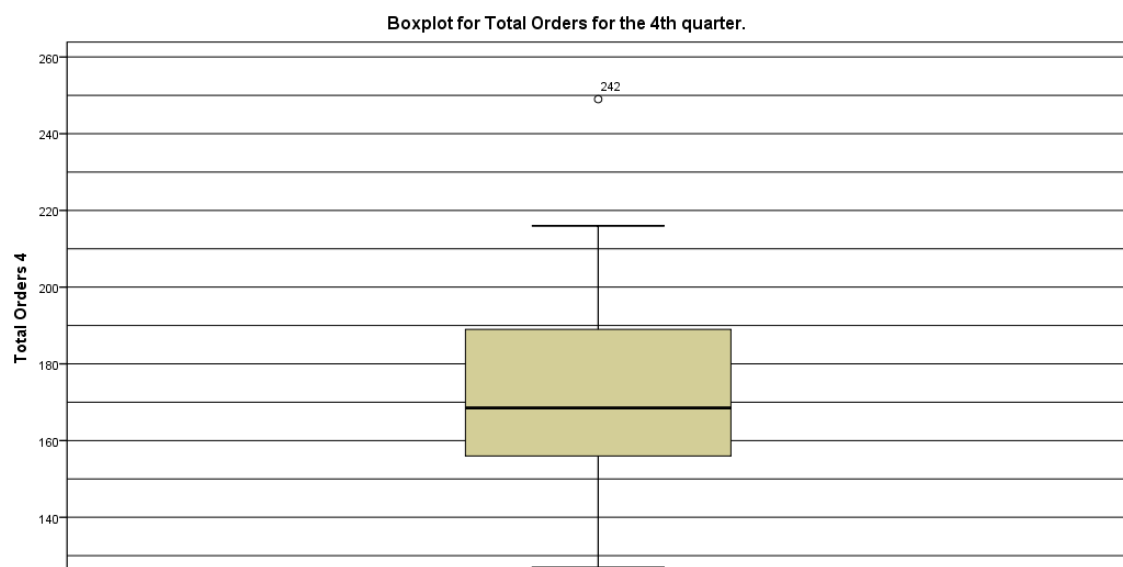
The outlier is 1100, median = 133, 25% of data lies within 150 - 200 & 0 – 50 and 50% lies within 100 – 150.



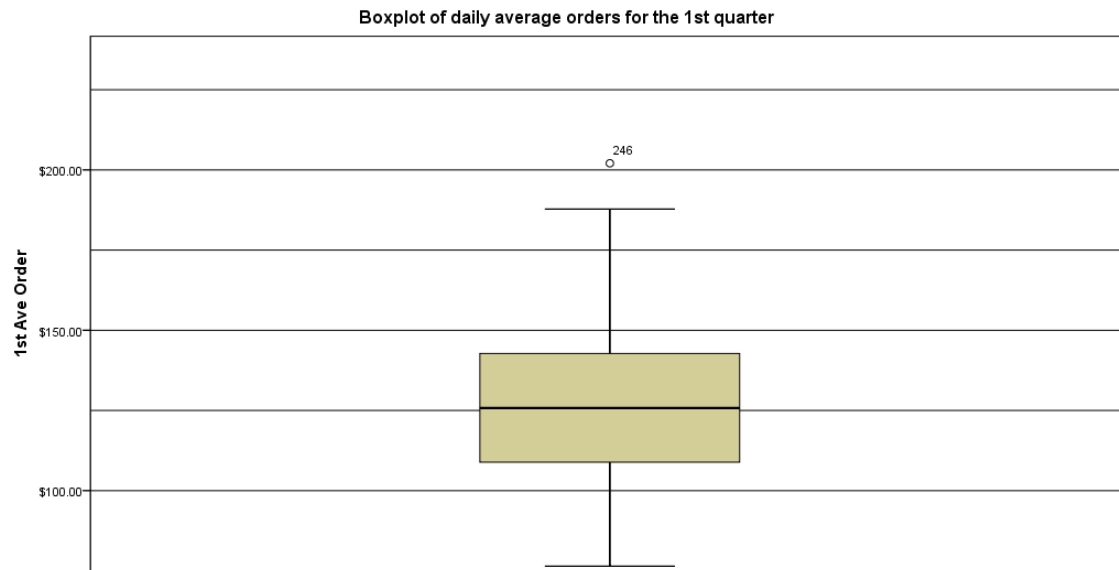
The outlier is 110, median = 156, 25% of data lies within 115 - 148 & 170 – 195 and 50% lies within 148 – 170.



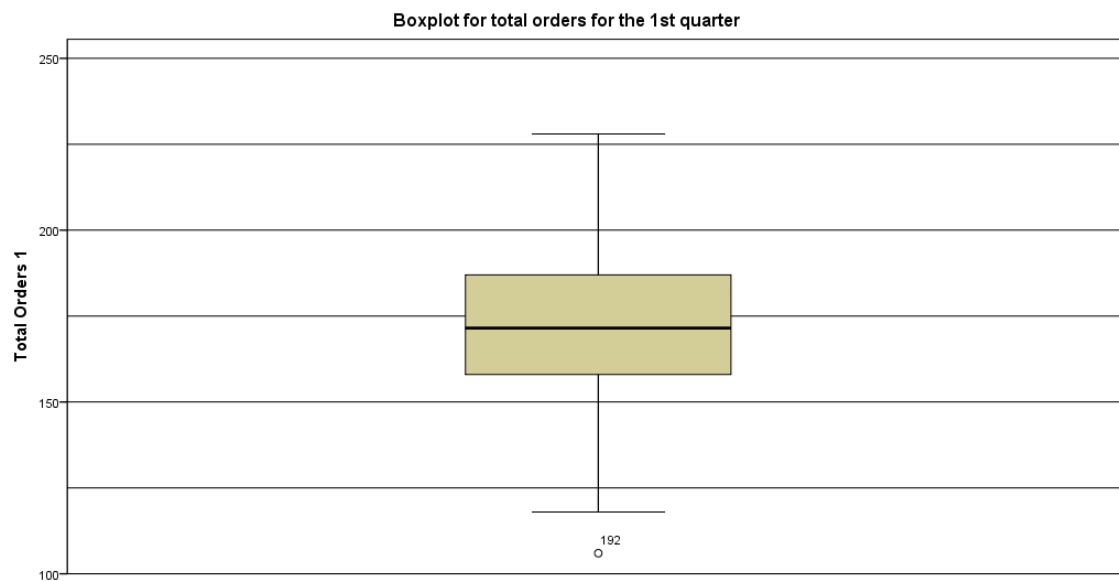
The outliers are 175, 190, 177 and median is 120, 25% of data lies within 50 - 110 & 130 – 165 and 50% lies within 110 – 130.



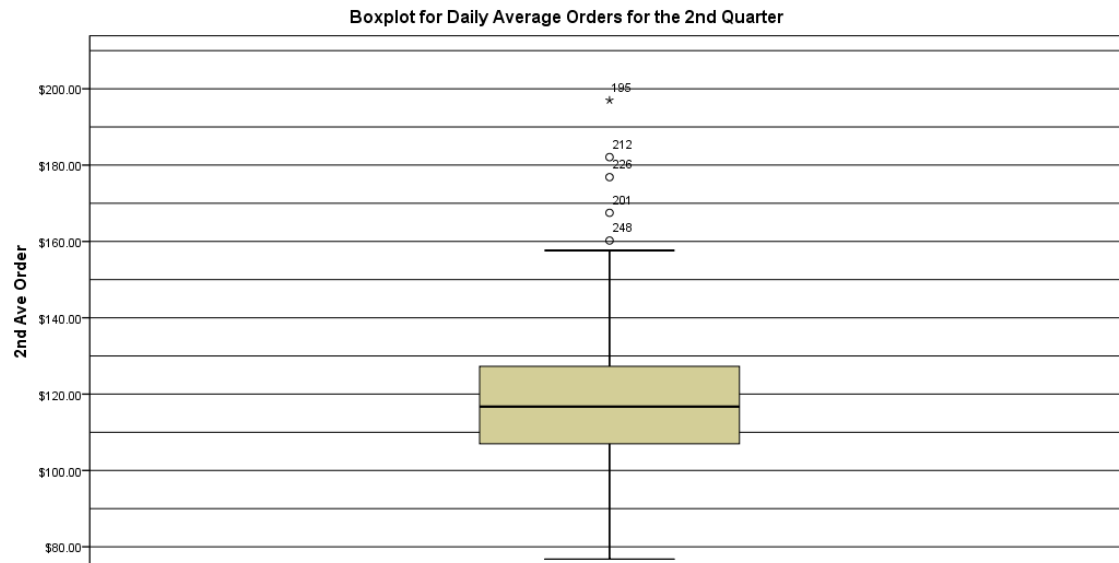
The outlier is 250, median is 172, 25% of data lies within 190 - 215 & 125 – 155 and 50% lies within 155 – 190.



The outlier is 200, median is 126, 25% of data lies within 0 - 110 & 140 – 190 and 50% lies within 110 – 140.

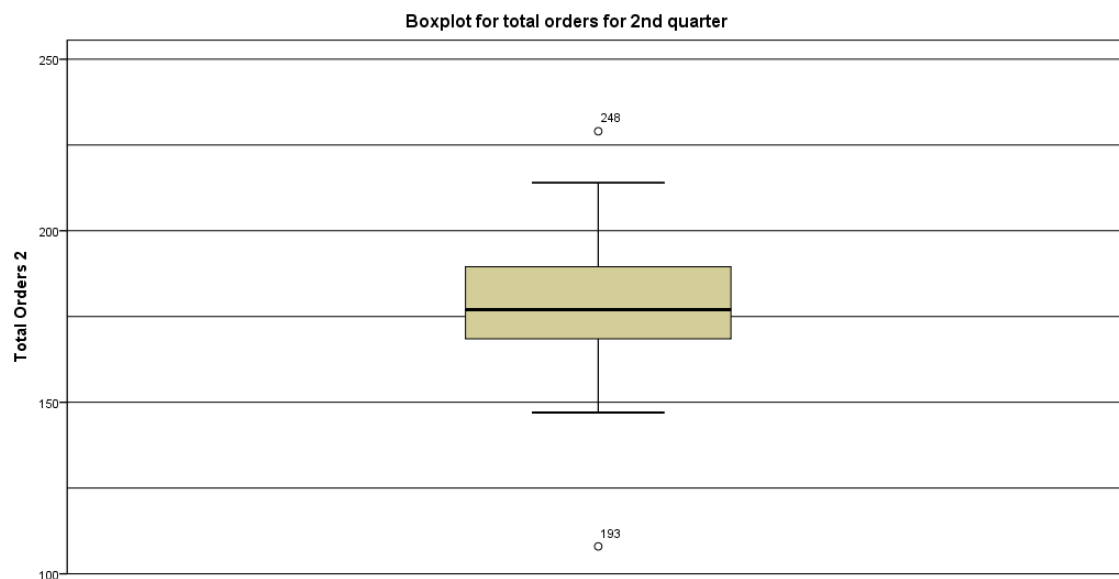


The outlier is 105; median is 172, 25% of data lies within 120 - 160 & 190 – 230 and 50% lies within 160 – 190.



The outliers are 160, 168, 178, 182, 196 and median is 116, 25% of data lies within 78 - 108 & 128 – 158 and 50% lies within 108 – 128.

The outliers are 110, 227; median is 177, 25% of data lies within 148 -165 & 190 – 215 and 50% lies within 165 – 190.



3.2 Question 2

3.2.1 Question 2a

Total Orders for 4 Quarters

		Total Orders 3	Total Orders 4	Total Orders 1	Total Orders 2
N	Valid	63	64	62	64
	Missing	190	189	191	189
Mean		155.83	171.67	171.26	177.81
Median		156.00	168.50	171.50	177.00
Mode		150 ^a	150 ^a	177	191

a. Multiple modes exist. The smallest value is shown

Daily Average Orders for the 4 Quarters

		3rd Ave Order	4th Ave Order	1st Ave Order	2nd Ave Order
N	Valid	63	64	62	64
	Missing	190	189	191	189
Mean		\$149.5126	\$120.6767	\$126.0114	\$119.9309
Median		\$132.9831	\$120.0882	\$125.7397	\$116.7149
Mode		\$66.18 ^a	\$69.96 ^a	\$76.42 ^a	\$76.77 ^a

a. Multiple modes exist. The smallest value is shown

Statistics

Total Sales

N	Valid	253
	Missing	0
Mean		\$21,836.2095
Median		\$20,679.0000
Mode		\$9,095.00 ^a
Std. Deviation		\$1.20820E4
Variance		1.460E8
Range		\$185,787.00
Minimum		\$9,095.00
Maximum		\$194,882.00
Sum		\$5.52E6
Percentiles	25	\$18,076.5000
	50	\$20,679.0000
	75	\$23,855.5000

Total Sales is \$ 5 524 561.00 which is approximately \$ 5.52 million

The sales figures in 3rd quarter are high because of an outlier valued at \$ 195 000. This figure pulls up the mean and range. If the outlier is removed then the 3rd quarter is really poor and then there will be a marginally increase in sales of about 1.5%. This means Stan is wrong in his assumption that sales are doing well.

Sales Quarter 4	Sales Quarter 3	Sales Quarter 1	Sales Quarter 2
\$1,327,508.00	\$1,482,788.00	\$1,346,084.00	\$1,368,181.00

Sales for quarter 3 include a outlier of \$ 194 882.00

The result of the measurements of central tendency is similar to the output of histograms. The average number of orders is continuously increasing from 3rd quarter to the 2nd quarter. In the 1st quarter the mean is somehow stable and in the 2nd quarter it reaches 177. It shows a positive trend because orders are increasing with time. For average order sizes the mean is decreasing because their orders are not big enough to increase the average order size. No doubt orders are taking place more frequently but their value did not contribute a lot which ultimately affects the average order size. Mean or average is the most appropriate measurement tool of the central tendency which should be taken under consideration by HH Industries.

Mode is basically the most common data, which frequently occurs in the total data set. Multiple modes exist, but it can be seen that the mode is increasing per quarter. For total order the mode increases from 150 to 191 in the 2nd quarter. Mode for Average order value increases from \$ 66 to \$76.

Median is also an important tool to measure the central tendency. The analysis of the median shows an increase of 13% for total orders and decrease of 12% for the average order size from 3rd quarter to 2nd quarter. The results are distorted by outliers.

3.211 Dealing with Outliers

If you detect outliers in the data there are several options for reducing the impact of these values. However, before you do any of these things, it's worth checking that the data have been entered correctly for the problem cases. If the data are correct then the options are remove the case, transform the data or change the score.

Deleting the outliers to get these results:

Statistics For Sales without Outliers

Statistics		Sales_Quarter4	Sales_Quarter3	Sales_Quarter1	Sales_Quarter2
N	Valid	61	62	59	61
	Missing	1	0	3	1
Mean		\$20,166.5246	\$20,772.6774	\$20,903.8814	\$20,692.3443
Std. Error of Mean		\$538.47852	\$601.33473	\$628.66785	\$532.72339
Median		\$19,627.0000	\$20,403.0000	\$20,543.0000	\$20,679.0000
Mode		\$9,095.00 ^a	\$10,919.00 ^a	\$10,742.00 ^a	\$12,491.00 ^a
Std. Deviation		\$4,205.65167	\$4,734.91437	\$4,828.88940	\$4,160.70266
Variance		17687505.987	22419414.124	23318172.831	17311446.596
Skewness		-.175	.552	-.195	.072
Std. Error of Skewness		.306	.304	.311	.306
Kurtosis		.144	.646	-.393	-.314
Std. Error of Kurtosis		.604	.599	.613	.604
Range		\$21,019.00	\$22,903.00	\$19,241.00	\$18,339.00
Minimum		\$9,095.00	\$10,919.00	\$10,742.00	\$12,491.00
Maximum		\$30,114.00	\$33,822.00	\$29,983.00	\$30,830.00
Sum		\$1.23E6	\$1.29E6	\$1.23E6	\$1.26E6
Percentiles	25	\$17,607.5000	\$17,389.5000	\$18,329.0000	\$18,553.0000
	50	\$19,627.0000	\$20,403.0000	\$20,543.0000	\$20,679.0000
	75	\$23,248.5000	\$23,594.0000	\$24,556.0000	\$23,163.0000

a. Multiple modes exist. The smallest value is shown

From the above data we can see that sales across all quarters are normally distributed. Mean is equal to median and we have small values of standard errors of Skewness and Kurtosis.

Statistics For Sales without Outliers

		Statistics			
		Sales_Quarter4	Sales_Quarter3	Sales_Quarter1	Sales_Quarter2
N	Valid	61	62	59	61
	Missing	1	0	3	1
Mean		\$20,166.5246	\$20,772.6774	\$20,903.8814	\$20,692.3443
Std. Error of Mean		\$538.47852	\$601.33473	\$628.66785	\$532.72339
Median		\$19,627.0000	\$20,403.0000	\$20,543.0000	\$20,679.0000
Mode		\$9,095.00 ^a	\$10,919.00 ^a	\$10,742.00 ^a	\$12,491.00 ^a
Std. Deviation		\$4,205.65167	\$4,734.91437	\$4,828.88940	\$4,160.70266
Variance		17687505.987	22419414.124	23318172.831	17311446.596
Skewness		-.175	.552	-.195	.072
Std. Error of Skewness		.306	.304	.311	.306
Kurtosis		.144	.646	-.393	-.314
Std. Error of Kurtosis		.604	.599	.613	.604
Range		\$21,019.00	\$22,903.00	\$19,241.00	\$18,339.00
Minimum		\$9,095.00	\$10,919.00	\$10,742.00	\$12,491.00
Maximum		\$30,114.00	\$33,822.00	\$29,983.00	\$30,830.00
Sum		\$1.23E6	\$1.29E6	\$1.23E6	\$1.26E6
Percentiles	25	\$17,607.5000	\$17,389.5000	\$18,329.0000	\$18,553.0000
	50	\$19,627.0000	\$20,403.0000	\$20,543.0000	\$20,679.0000
	75	\$23,248.5000	\$23,594.0000	\$24,556.0000	\$23,163.0000

a. Multiple modes exist. The smallest value is shown

From the above data we can see that sales across all quarters are normally distributed. Mean is equal to median and we have small values of standard errors of Skewness and Kurtosis.

Statistics For sales without Outliers

With outliers removed, the increases of the mean, median and mode is now quite obvious, as explained in the previous page. On comparing the mean and median we can conclude that the different quarters are normal distributions.

The increases of mode is obvious .The mean and the median have decreased by about 12% from the 3rd quarter to the 4th and increased slightly by 6% and then down again by 7%. This might be caused by low or no sales in Arizona and Pennsylvania in the beginning of the quarter. On comparing the mean and median we can conclude that the different quarters are normal distributions.

Total Sales for Q3

N	Valid	63
	Missing	0
Mean		\$23,536.3175
Median		\$20,650.0000
Mode		\$10,919.00 ^a
Std. Deviation		\$2.24329E4
Variance		5.032E8
Range		\$183,963.00
Minimum		\$10,919.00
Maximum		\$194,882.00
Sum		\$1.48E6
Percentiles	25	\$17,400.0000
	50	\$20,650.0000
	75	\$23,600.0000

Total Sales for Q4

N	Valid	64
	Missing	0
Mean		\$20,742.3125
Median		\$19,947.0000
Mode		\$9,095.00 ^a
Std. Deviation		\$4,876.41174
Variance		23779391.425
Range		\$24,836.00
Minimum		\$9,095.00
Maximum		\$33,931.00
Sum		\$1.33E6
Percentiles	25	\$17,665.2500
	50	\$19,947.0000
	75	\$23,409.5000

3.2.2 Question 2B

Statistics for All Quarters

		Orders PC3	D_Orders PC3
N	Valid	225	225
	Missing	0	0
Mean		31.68	99.013
Sum		7127	22277.8790

Means per Quarter.

Statistics for 4th Quarter

		D_Orders PC3	Orders PC3
N	Valid	64	64
	Missing	0	0
Mean		101.596160	30.69
Sum		6502.1542	1964

Statistics for 3rd Quarter

		D_Orders PC3	Orders PC3
N	Valid	35	35
	Missing	0	0
Mean		97.986	28.171
Sum		3429.5037	986

Statistics for 1st Quarter

		D_Orders PC3	Orders PC3
N	Valid	62	62
	Missing	0	0
Mean		100.748442	31.18
Sum		6246.4034	1933

Statistics for 2nd Quarter

		D_Orders PC3	Orders PC3
N	Valid	64	64
	Missing	0	0
Mean		95.309651	35.06
Sum		6099.8177	2244

Order Size

From the 3rd quarter the mean of orders has increased gradually from 28 to 35 in the 2nd quarter. The orders have doubled from the 3rd quarter to the 4th and then decreased by 1.5% and then increased by 16%.

Daily Average Orders

The mean started at 97 and increased to 101 and then stayed there in the 1st quarter, then decreased to 95 in the 2nd quarter. Like orders the daily average has doubled and then slowly decreased to 6100.

It looks like there was heavy promotion when the profit centre was opened. The profit centre might be the only shop in the vicinity, hence that might explain the constant order values.

In general the trend in profit centre 3 does not differ from the company's trend. Laurel's planned action to investigate the performance of each profit centre is a good idea.

3.3 Question 3

3.3.1 Question 3A

Statistics

		3rd Ave Order	4th Ave Order	1st Ave Order	2nd Ave Order
N	Valid	63	64	62	64
	Missing	190	189	191	189
Range		\$1,047.44	\$120.85	\$125.65	\$120.23
Minimum		\$66.18	\$69.96	\$76.42	\$76.77
Maximum		\$1,113.61	\$190.81	\$202.07	\$197.01
Percentiles	25	\$116.2640	\$105.8708	\$108.3763	\$106.9177
	50	\$132.9831	\$120.0882	\$125.7397	\$116.7149
	75	\$157.1040	\$133.8326	\$142.7775	\$127.3421

	3 rd Quarter	4 th Quarter	1 st Quarter	2 nd Quarter
Interquartile IQR	40.84	27.96	34.40	20.63
Lower Inner Fence	55.00	63.93	56.40	75.97
Upper Inner Fence	218.36	175.77	194.38	157.95
Outer Fence	279.62	217.71	245.98	189.23

The interquartile range (IQR) is the distance between the lower and upper quartiles. 50 per cent of observations fall within this range.

The range across the quarters is almost the same except the 3rd quarter. On comparing range with interquartile ranges we observe the following:

- The lower end of inner fence covers the low end of all the observations of the quarters.
- The high end of the inner fence does not cover all the higher observations.
- The outer fence only covers the 4th and 1st quarters.
- Extreme outliers are in the 3rd and 2nd quarters.

3.3.2 Question 3B

Statistics

		ORDERS 1	ORDERS 2	ORDERS 3	Ave Order 1	Ave Order 2	Ave Order 3
N	Valid	253	253	225	253	253	225
	Missing	0	0	28	0	0	28
Mean		95.42	45.59	31.68	155.845469	88.292103	99.012796
Std. Error of Mean		.996	.627	.459	5.5333608	2.0928975	2.1501542
Std. Deviation		15.838	9.967	6.891	88.0134920	33.2895730	32.2523132
Variance		250.832	99.346	47.488	7746.375	1108.196	1040.212
Sum		24141	11534	7127	39428.9037	22337.9021	22277.8790
Coefficient of variation		16.60%	21.86%	21.75%	56.47%	37.70%	32.57%

$$\text{Coefficient of variation} = \frac{\text{standard deviation}}{\text{mean}} \times 100$$

It is measured as a percentage.

For orders the coefficient of variation is lowest with Profit centre 1, because the mean is relatively higher even though the standard deviation is almost twice the others. The coefficient of variation for average orders is quite high for the Profit centre 1, 56% while profit centre 3 has only 32.57%. One reason is the high standard deviation for profit centre 1.

3.3.3 Question 3C

The findings and recommendations are as follows:

- There is a steady growth of orders.
- Most orders across the Profit centres are quite small which means there will give small contributions to the order value.
- The standard deviation of sales is quite high.
- The orders are small.
- With normal distribution it means 80% of the products provide only 20% of the revenue. The company needs to sell higher value products and phase out the weaker products.
- The company needs phase out products with the lowest revenue.
- The marketing department needs to come up with solutions of the company's problems.
- Promotions for poor selling products need to be done.

3.4 Question 4

Poisson distribution is a type of probability distribution that is often useful in describing the number of events that will occur in a specific period of time or in a specific area or volume.

- a) Out of 250 working days machine 1 is down for 27 days & machine 2 is down for 27 days.

$$P(x) = \frac{27}{250},$$

Question 4b (i)

Probability of one machine to be down (Number of 01 or 10 in the given table = 52)

$$P(1) = \frac{52}{250} = 0.208$$

Number of days machine will be down = $0.208 \times 250 = 52$ days

Question 4b (ii)

Probability of two machines to be down (Number of 00 in the given table = 1)

$$P(2) = \frac{1}{250} = 0.004$$

Number of days two machines will be down = $0.004 \times 250 = 1$ day

3.5 Question 5

Yearly cost of copy machines

	<i>One machine down</i>	<i>Two machines down</i>
Probability of machine down	0.208	0.004
Cost of copies per day lost (150 * 0.05)	7.50	7.50
Days_machine down (Px * 250)	52	1
Yearly loss of earnings (days * copies cost)	390	7.5
Charges for service calls	68	100
Cost of service calls (cost * Days_down)	3536	100
Cost for the year	3926	107.50
Expected cost for the year	4033.50	

3.6 Question 6

Alternatives for the copy machines

Option 1	
<i>per machine for 3 years</i>	
Leasing cost (monthly cost * 36 months)	\$6,300.00
No of days without copier	38
Lost copies	5625
Cost of lost copies	\$281.25
Total cost	£6,581.25
Cost of two machines	\$13,162.50
Option 2	
Initial cost	\$8,750.00
Days without copier	13
Lost copies	1,913
Cost of copies	\$95.63
Service charge for 2 years	\$2,231.25
Total cost for Option 2	\$11,076.88
Option 2 is cheaper by	£2,085.63

3.7 Question 7

To improve HH Industries communication we need to analyse calls data.

Statistics

Number of Calls received per hour

N	Valid	198
	Missing	1
Mean		27.49
Std. Error of Mean		.664
Median		27.00
Mode		23
Std. Deviation		9.343
Variance		87.287
Range		40
Minimum		8
Maximum		48
Sum		5443
Percentiles	25	20.75
	50	27.00
	75	35.00

Mean = Median and the mode is a little lower than the other two.

Poisson Distribution using Excel							
<i>For accumulative we use 1</i>							
<i>Mean = 8</i>							
x	0	1	2	3	4	5	6
Probability	0.000335463	0.003019164	0.013753968	0.04238	0.099632	0.191236	0.313374
x	7	8	9	10	11	12	13
Probability	0.452960809	0.592547341	0.716624259	0.815886	0.888076	0.936203	0.965819
x	14	15	16	17	18	19	20
Probability	0.98274301	0.991768989	0.996281979	0.998406	0.99935	0.999747	0.999906

If Laurel wants to be 98% sure that a sales rep answers a maximum of 8 calls then the Company needs 2 Representatives.

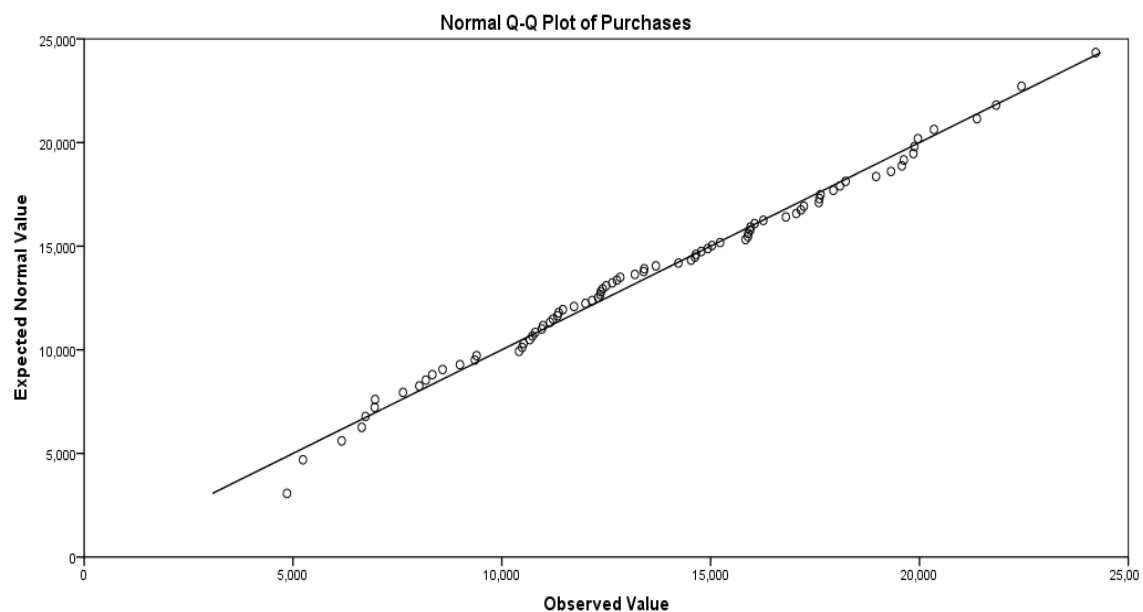
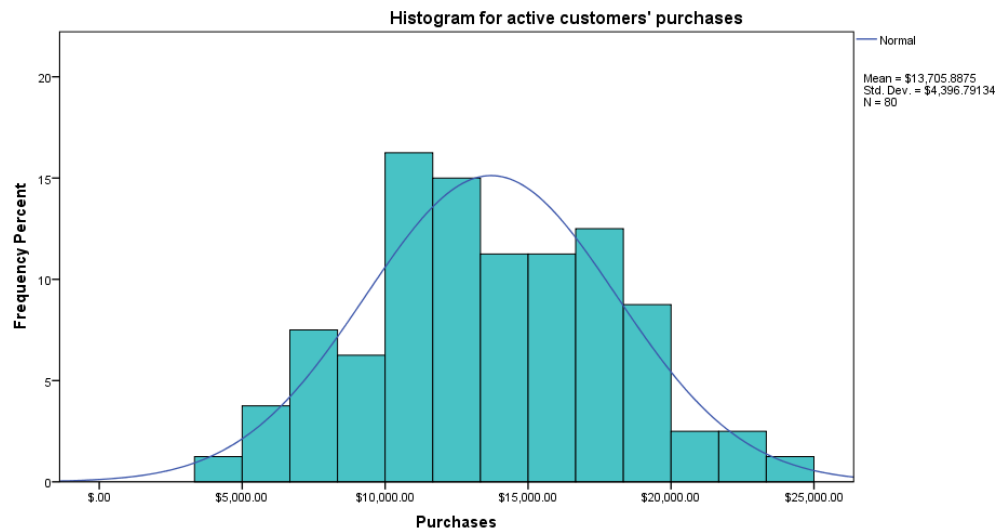
Recommendation of Representatives = 2

x	0.0000	1.0000	2.0000	3.0000	4.0000	5.0000	6.0000
Probability	0.1353	0.4060	0.6767	0.8571	0.9473	0.9834	0.9955

YES

Answering 2 calls does not change the recommendations in 7b. if the average of calls answered is 2 then to be 98% confident the calls to be answered will be 5. With a maximum of 5 calls to be answered, then only 1 person is required to answer the calls.

3.8 Question 8



The Histogram shows us that the distribution looks normal distributed. Just to be sure, we use a Q-Q plot.

The normal Q-Q chart plots the values you would expect to get if the distribution were normal (expected values) against the values actually seen in the data set (observed values). The expected values are a straight diagonal, whereas the observed are plotted as individual points. From the chart we can see that the data is almost normally distributed since the

observed (dots) fall almost exactly along the straight line (meaning that the observed values are the same as you expect from a normally distributed data set).

It is reasonable to believe that the data is from a normal distribution.

Statistics

Purchases

N	Valid	80
	Missing	0
Mean		\$13,705.8875
Median		\$13,291.5000
Std. Deviation		\$4,396.79134
Variance		19331774.101



Green: purchases less than \$10 000.00

Red: purchases more than \$20 000.00

Blue: purchases between \$10 000.00 and \$20 000.00

Accounts greater than \$20 000.00

$$z = \frac{x-\mu}{\sigma} = \frac{20000-13705}{4396} = 1.4315$$

$$P(z \geq 1.43) = 0.5 - 0.4236 = 0.0764$$

8 % of customers have accounts greater than \$ 20 000.00

Accounts less than \$10 000.00

$$z = \frac{x-\mu}{\sigma} = \frac{10000-13705}{4396} = -0.84286$$

$$P(z \leq -0.84286) = 0.5 - 0.2995 = 0.2005$$

20 % of customers have accounts less than \$ 10 000.00

Proportion of customers with accounts between \$10 000.00 and \$ 20 000.00 is 72 %

4.0 Conclusions and Recommendations

- 80% of the products provide only 20% of the revenue. The company needs to sell higher value products and phase out the weaker products.
- Most orders across the Profit centres are quite small which means there will give small contributions to the order value.
- The lower value products take up 80% of the company's resources. The company needs to free up human resources and money which is tied up with these products.
- There is a steady growth of orders.
- The company needs to investigate which products provide the lowest revenue.
- The marketing department needs to come up with solutions of the company's problems.
- Future promotions need to be done after extensive research of situation analysis.

4.1 Copy machines

If we do not take time value of money under consideration while taking decision then the Second option is a better option. Even if the initial investment is higher than option 1, the other important thing is that option 2 has a low downtime. After this 3 year period, the copier now belongs to HH Industries under option 2, which means lower maintenance costs.

4.2 Call Centre

All callers will be answered by the 2 representatives. The only concern is what they can do when they are not answering phones. The range of calls answered ranges from zero to 8. The company needs something else the representatives can do when they are not answering phones. 80% of telephone operators will answer 20% of calls.

If the average of calls answered is 2 then 1 person can answer all the calls. The Company needs a call management system in place. This PBX system will be able to monitor in detail all the calls.

4.3 Active Customers

The company should pay attention to the Pareto principle which states that "80% of sales come from 20% of your customers". This also means 80% of the company's resources is spent on 20% of the company's customers. It would make sense that the company let go the non-profitable customers and use the resources released on the profitable clients.

5.0 References

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