Statistics Project

STATISTICS COURSE PROJECT

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Z23402515

6-24. In the 2000 Sydney Olympics, a special program initiated by IOC president Juan Antonio Samaranch allowed developing countries to send athletes to the Olympics without the usual qualifying procedure. Here are the 71 times for the first round of the 100 meter men's swim (in seconds).

60.39 49.93 53.40 51.82 50.46 51.34 50.28 50.19 52.1450.56 52.72 50.95 49.74 49.16 52.57 52.53 52.09 52.40 49.75 54.06 53.50 50.63 51.93 51.62 52.58 53.55 51.07 49.76 49.73 50.90 59.26 49.29 52.78 112.72 49.79 49.83 52.43 51.28 52.22 49.76 49.70 52.90 50.19 54.33 62.45 51.93 52.24 52.82 50.96 48.64 51.11 50.87 52.18 54.12 50.49 49.84 52.91 52.52 50.32 51.52 52.0 52.85 52.24 49.45 51.28 49.09 58.79 49.74 49.32 50.62 49.45

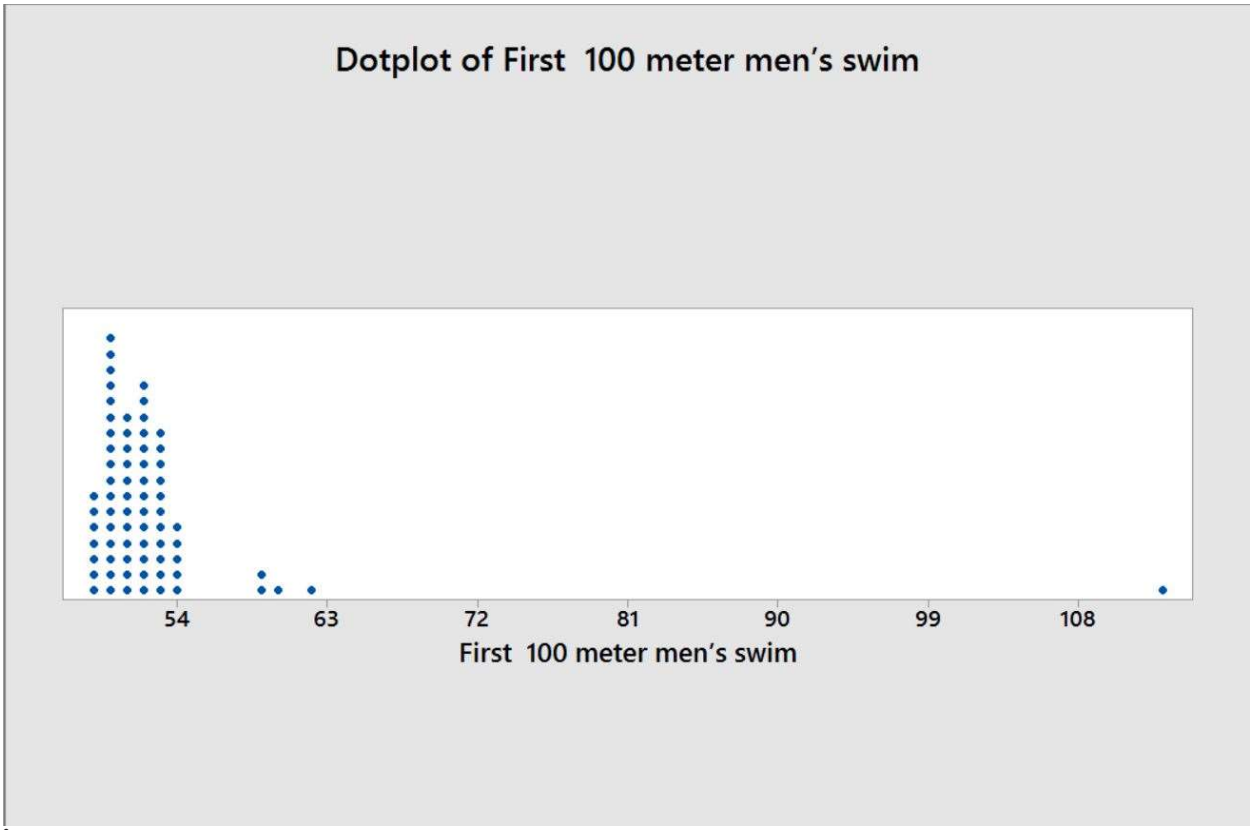
a. Find the sample mean and sample standard deviation of these 100-meter swim times.

[1]First 100 meter men's swim.

Mean	**52.64760563**
Standard Error	0.908597355
Median	51.34
Mode	50.19
Standard Deviation	**7.655977397**
Sample Variance	58.6139899
Kurtosis	55.94693946
Skewness	7.142038881
Range	64.08
Minimum	48.64
Maximum	112.72
Sum	3737.98
Count	71
Largest (1)	112.72
Smallest (1)	48.64
Confidence Level (95.0%)	1.812140284

[1] **Data generated through the "analysis data feature on excel.**

b. Construct a dot diagram of the data.



[2]

c. Comment on anything unusual that you see.

This graph shows that most swimmers swim 100 meters not faster than 54 seconds, it also shows that four of those swimmers can swim 100 meters faster than the average swimmer. Finally, it also shows that one swimmer who is an outlier, meaning this swimmer can swim a bit more than twice faster than the average swimmer.

[2] **Data was generated on Minitab.**

6-42. A semiconductor manufacturer produces devices used as central processing units in personal computers. The speed of the devices (in megahertz) is important because it determines the price that the manufacturer can charge for the devices. The following table contains measurements on 120 devices.

680 669 719 699 670 710 722 663 658 634 720 690 677 669 700 718 690 681 702 696 692 690
694 660 649 675 701 721 683 735 688 763 672 698 659 704 681 679 691 683 705 746 706 649
668 672 690 724 652 720 660 695 701 724 668 698 668 660 680 739 717 727 653 637 660 693
679 682 724 642 704 695 704 652 664 702 661 720 695 670 656 718 660 648 683 723 710 680
684 705 681 748 697 703 660 722 662 644 683 695 678 674 656 667 683 691 680 685 681 715
665 676 665 675 655 659 720 675 697 663

a. Construct a stem-and-leaf diagram for these data and comment on any important features that you notice.

Stem-and-Leaf Display: Speed of the device (MHz)

Stem-and-leaf of Speed of the device (MHz) N = 120

2	63	47
7	64	24899
16	65	223566899
35	66	0000001233455788899
48	67	0022455567899
(17)	68	00001111233333458
55	69	0000112345555677889
36	70	011223444556
24	71	0057889
17	72	000012234447
5	73	59
3	74	68
1	75	
1	76	3

Leaf Unit = 1

[3]

[3] **This Data was generated on Minitab.**

b. Compute the sample mean, the sample standard deviation, and the sample median.

Speed of the device[4]	
Mean	**686.775**
Standard Error	2.343160453
Median	**683**
Mode	660
Standard Deviation	**25.66803672**
Sample Variance	658.8481092
Kurtosis	-0.19983589
Skewness	0.379864154
Range	129
Minimum	634
Maximum	763
Sum	82413
Count	120
Largest (1)	763
Smallest (1)	634
Confidence Level (95.0%)	4.639691724

What percentage of the devices has a speed exceeding 700 megahertz?
To answer this question, we already know that our sample consists of 120 devices. We also know that only 35 devices out of those 120 have a speed exceeding 700 megahertz.

[5]719	724	702	710
720	724	702	715
720	727	703	717
720	735	704	718
720	739	704	718
721	746	704	
722	748	705	
722	763	705	
723	701	706	
724	701	710	

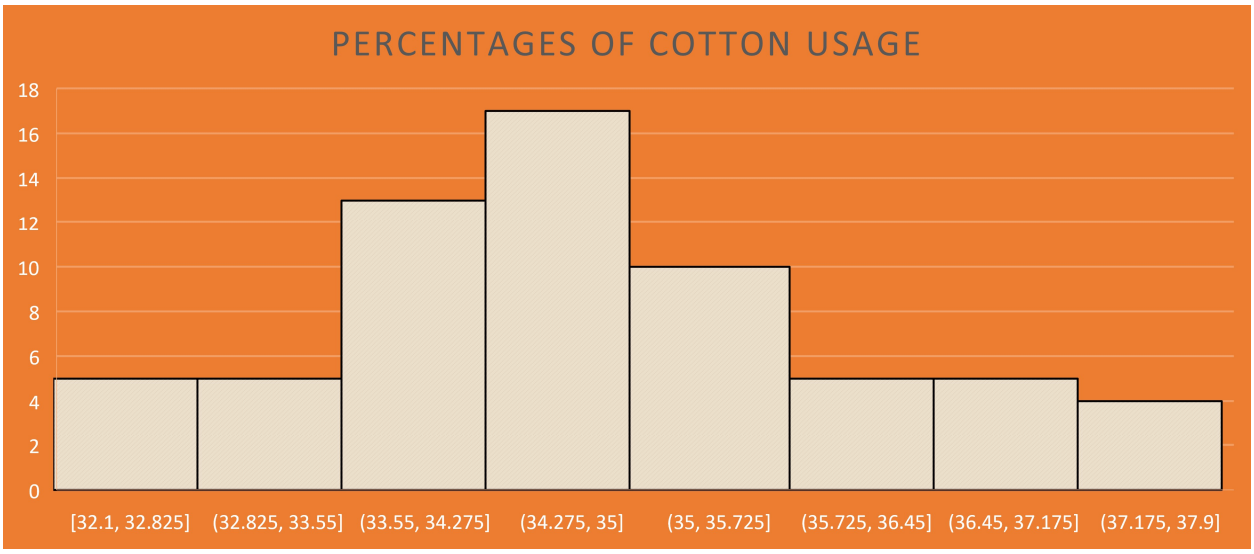
So, at this point we can just apply simple arithmetic;

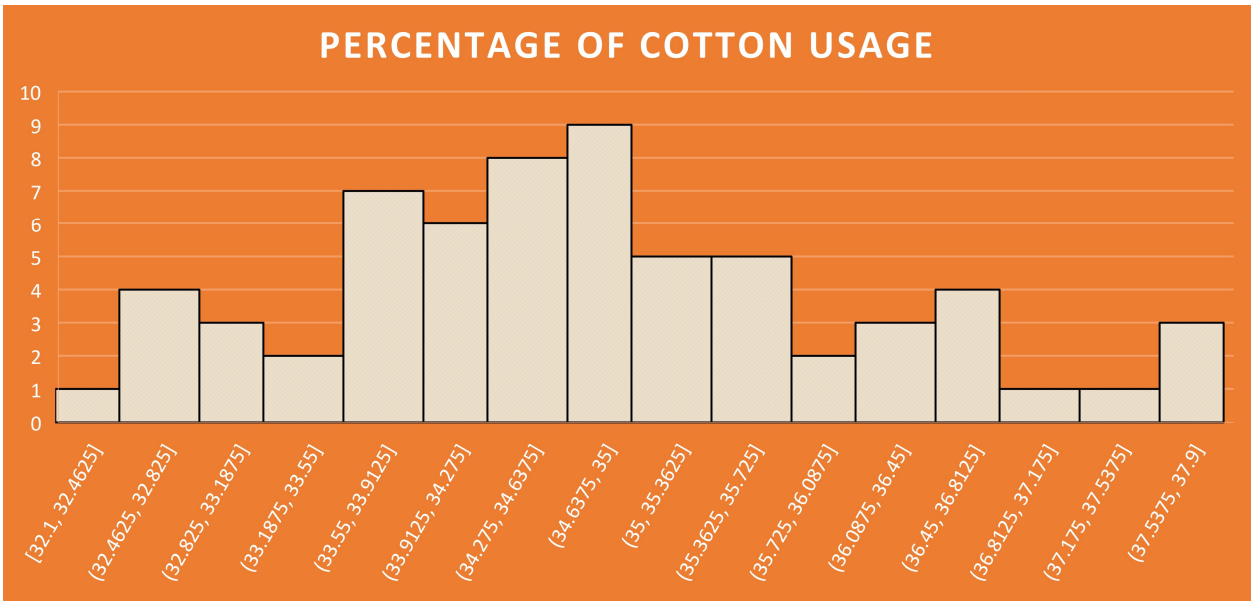
%= (35*100)/120= **29.17%**

[4] **Data generated on excel.**
[5] **Data pasted from the textbook. Montgomery, Douglas C., and George C. Runger.** ***Applied statistics and probability for engineers, (With CD)*****. John Wiley & Sons, 2007.**

6-52. Construct histograms with 8 and 16 bins for the data in Exercise 6-32. Compare the histograms. Do both histograms display similar information?

34.2 37.8 33.6 32.6 33.8 35.8 34.7 34.6 33.1 36.6 34.7 33.1 34.2 37.6 33.6 33.6 34.5 35.4 35.0 34.6 33.4 37.3 32.5 34.1 35.6 34.6 35.4 35.9 34.7 34.6 34.1 34.7 36.3 33.8 36.2 34.7 34.6 35.5 35.1 35.735.1 37.1 36.8 33.6 35.2 32.8 36.8 36.8 34.7 34.0 35.1 32.9 35.0 32.1 37.9 34.3 33.6 34.1 35.3 33.5 34.9 34.5 36.4 32.7





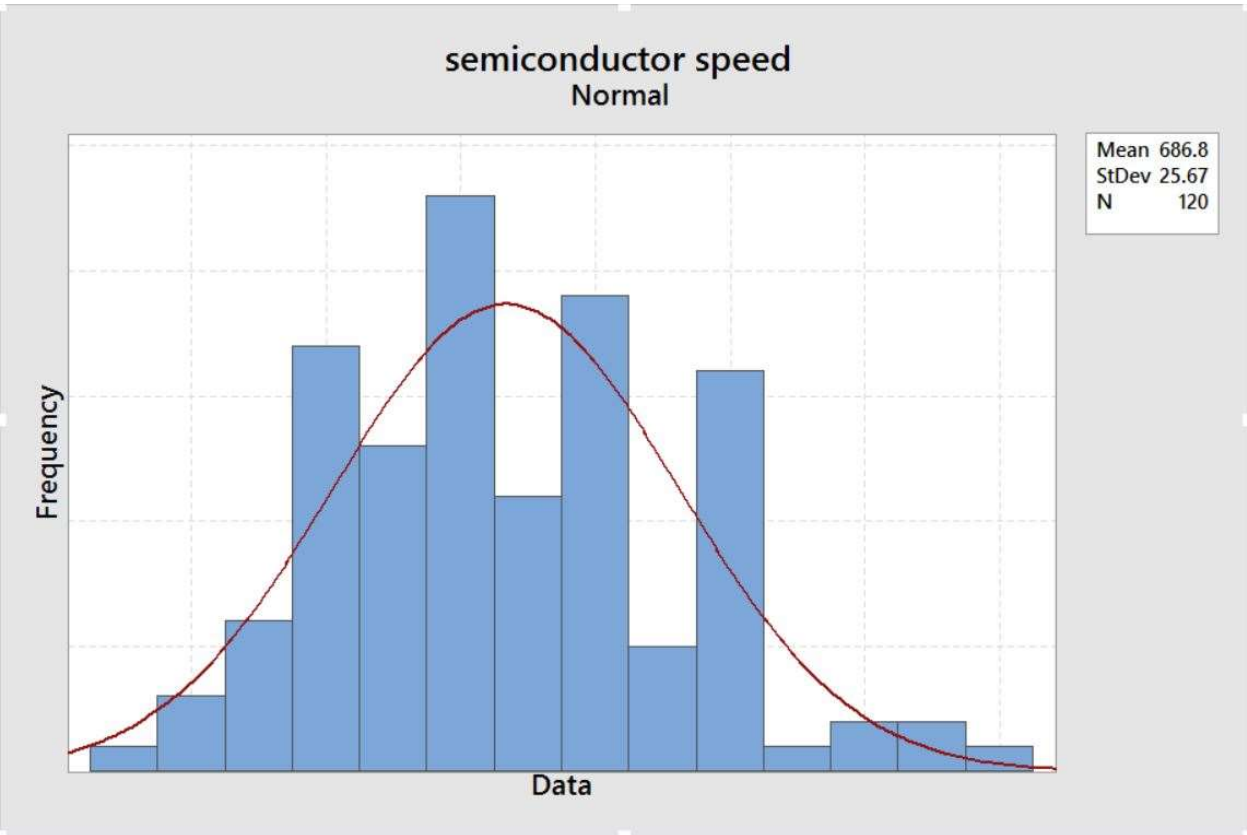
[6]

These two histograms represent the entire data which is the percentages of cotton used to manufacture men's shirt. The difference between the two histograms is that the first one with only eight bins shows how the data is normally distributed going from the lowest points to the highest points, but at the same time it is not detailing the data as much as the second graph is.

[6] **Data generated on excel.**

The downside to the second diagram is that it shows the data more spread out and it makes it very difficult to see the normal distribution curve as good as it is presented in the first graph.

6.58 Construct a histogram for the data in Exercise 6-42. Comment on the shape of the histogram. Does it convey the same information as the stem-and leaf display?



[7]

The data from the stem-and-leaf plot shows a more evenly distributed data. The stem leaf (shown above) presents the data positively skewed, whereas this histogram shows the data skewed to the left. The stem-and-leaf plot in this case shows a more accurate transition compared to the one shown in the histogram.

[7] **Data generated on Minitab.**

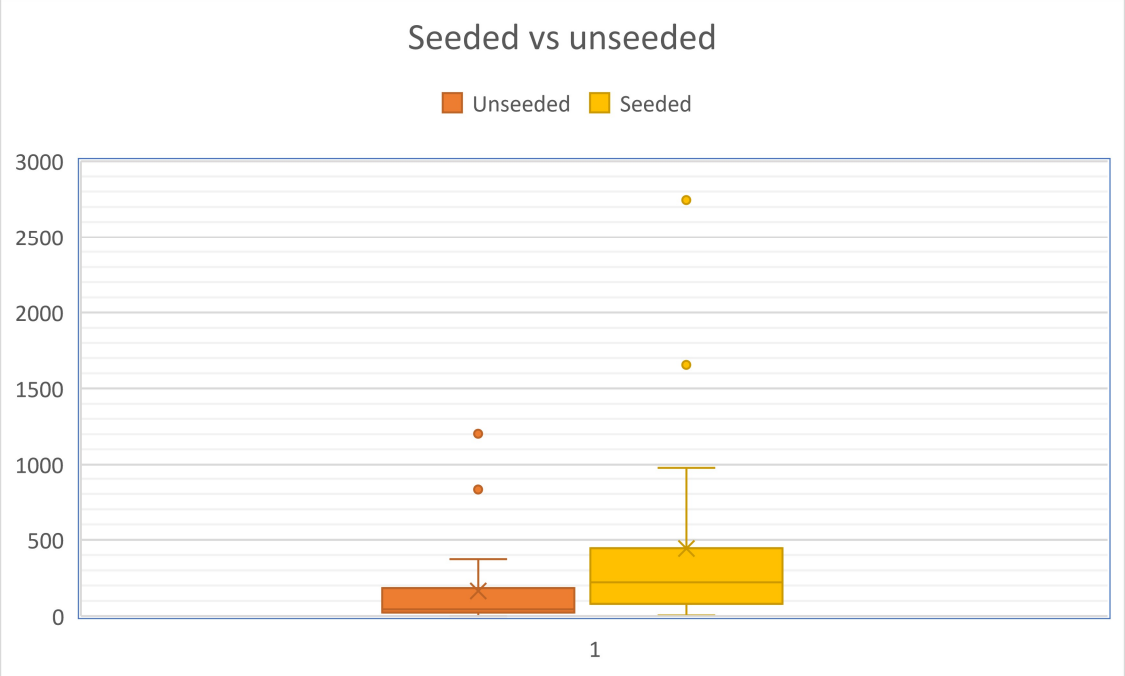
6-67. Using the data from Exercise 6-22 on cloud seeding,
Unseeded:
81.2 26.1 95.0 41.1 28.6 21.7 11.5 68.5 345.5 321.2 1202.6 1.0 4.9 163.0 372.4 244.3 47.3 87.0 26.3 24.4 830.1 4.9 36.6 147.8 17.3 29.0
Seeded:
274.7 302.8 242.5 255.0 17.5 115.3 31.4 703.4 334.1 1697.8 118.3 198.6 129.6 274.7 119.0 1656.0 7.7 430.0 40.6 92.4 200.7 32.7 4.1 978.0 489.1 2745.6
Find the median and quartiles for the unseeded cloud data.

a. **Find the median and quartiles for the seeded cloud data**.
From Minitab, we get the following data[8]

Variable	N	N*	Mean	SE Mean	StDev	Minimum	Q1	Median	Q3	Maximum
Unseeded	26	0	164.6	54.6	278.4	1.0	23.7	44.2	183.3	1202.6
Seeded	26	0	442	128	651	4	79	222	445	2746

So,
The median: 44.20
The first quartile: 23.70
The Third quartile: 183.3

b. **Make two side-by-side box plots, one for each group on the same plot.**



[9]

[8] **Data generated on Minitab**
[9] **Data generated on excel.**

c. Compare the distributions from what you can see in the side-by-side box plots.
By looking at these two plots side by side, we can see that the data from "seeded" contains much bigger data that the one from unseeded. Both data also show outliers that seem to be equally proportional to the size of the data. Both data also seem to be right skewed with two outliers each.

6-68. Using the data from Exercise 6-24 on swim times, find the median and quartiles for the data.

Swim Time data[10]	
Mean	52.64760563
Standard Error	0.908597355
Median	**51.34**
Mode	50.19
Standard Deviation	7.655977397
Sample Variance	58.6139899
Kurtosis	55.94693946
Skewness	7.142038881
Range	64.08
Minimum	48.64
Maximum	112.72
Sum	3737.98
Count	71
Largest (1)	**112.72**
Smallest (1)	**48.64**
first quartile	**50.06**
2nd quartile	**51.34**
Third quartile	**52.575**
Confidence Level (95.0%)	1.812140284

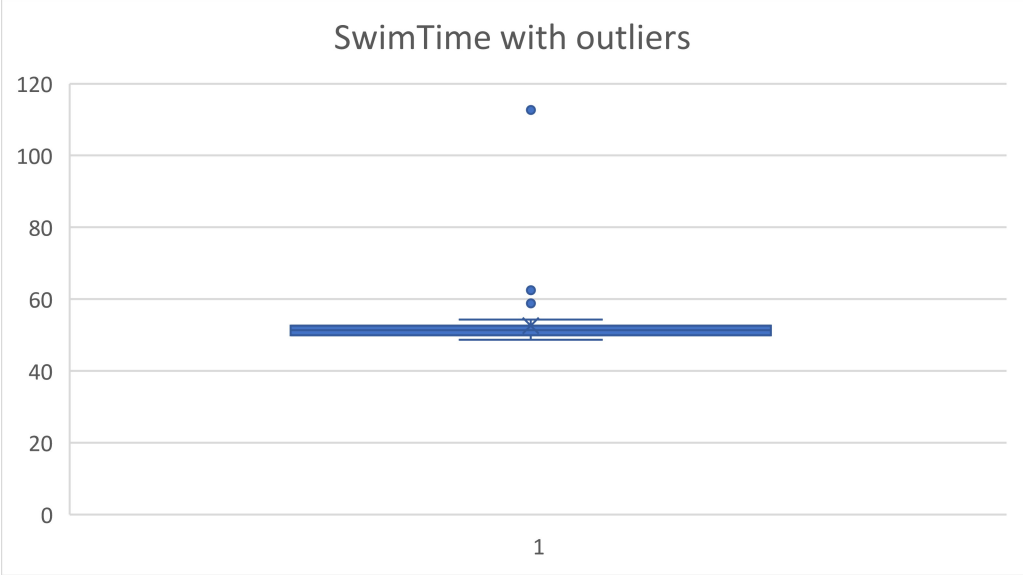
Median: 51.34

1st quartile: 50.06

3rd quartile: 52.58

[10] **Data generated on excel.**

(a) Make a box plot of the data.



(b) Repeat (a) and (b) for the data without the extreme outlier and comment.

The data will now be generated without the following five pieces of data;

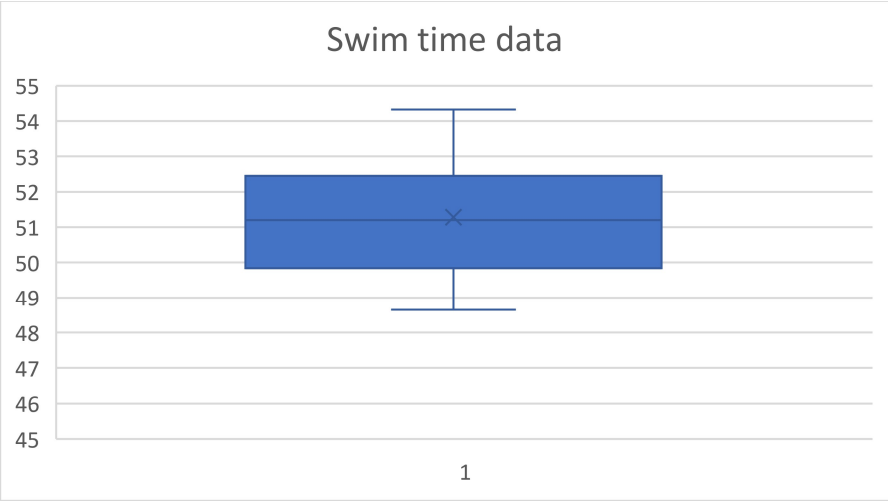
58.79	60.39	112.72
59.26	62.45	

Swim Time without outliers[11]	
Mean	51.31892308
Standard Error	0.17402933
Median	51.28
Mode	49.45
Standard Deviation	1.403069317
Sample Variance	1.96860351
Kurtosis	-0.986619151
Skewness	0.220027136
Range	5.24
Minimum	49.09
Maximum	54.33
Sum	3335.73
Count	65
Largest (1)	54.33
Smallest (1)	49.09
first Q	49.8625
Third Q	52.4225
Confidence Level (95.0%)	0.347663554

[11] **Data generated on excel.**

Median: 51.28
1st quartile: 49.09
3rd quartile: 52.42

Now, this is the boxplot* based on the data without the five outliers indicated above.



[12]

My comment on the boxplot data: The data without the outliers, shows a normal and very consistent distribution. This data obviously has no outliers because it was plotted like that intentionally.

C. Compare the distribution of the data with and without the extreme outlier.
The first set of data indicates that there are five outliers present in the data, which were indicated above. The data without outliers does not look as consistent and normally distributed as the second set of data, without outliers, does.

On the other hand, the second set of data without outliers shows a more consistent picture and also shows a set of data that is normally distributed with a bell shape and so on.

[12] **Data was generated on excel.**

11-5. See Table E11-1 for data on the ratings of quarterbacks for the 2008 National Football League season (*The Sports Network*). It is suspected that the rating (y) is related to the average number of yards gained per pass attempt (x).

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.819635144
R Square	0.67180177
Adjusted R Square	0.660861829
Standard Error	5.218737955
Observations	32

ANOVA

	df	*SS*	*MS*	*F*	*Significance F*
Regression	1	1672.465	1672.465412	61.40817124	9.58903E-09
Residual	30	817.0568	27.23522584		
Total	31	2489.522			

	Coefficients	*andard Erı*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
Intercept	14.19548847	9.058979	1.567007473	0.127601685	-4.305415711	32.69639265	-4.305415711	32.69639265
Yards per attempt (x)	10.0917446	1.287814	7.836336595	9.58903E-09	7.461677379	12.72181183	7.461677379	12.72181183

RESIDUAL OUTPUT

Observation	*Predicted Rating points (y)*	*Residuals*	*Standard Residuals*
1	98.86522569	6.634774	1.292352191
2	91.59916958	5.80083	1.129912723
3	91.49825213	5.401748	1.052177568
4	94.7276104	1.47239	0.286798892
5	86.95696706	8.043033	1.566659356
6	90.18632533	3.613675	0.703888355
7	95.03036274	-2.33036	-0.453918891
8	91.49825213	-0.09825	-0.019138007
9	86.95696706	3.243033	0.631693036
10	86.45237983	2.94762	0.574151163
11	94.22302317	-6.52302	-1.270584785
12	85.84687515	1.653125	0.322003345
13	78.07623181	8.923768	1.738213063
14	82.41568199	3.984318	0.776083989
15	83.42485645	2.975144	0.579512295
16	88.3698113	-2.36981	-0.461602865
17	87.0578845	-1.65788	-0.322930453
18	94.32394062	-9.62394	-1.874595904
19	78.88357138	5.416429	1.055037153
20	82.51659943	-0.8166	-0.159061035
21	81.30559008	-0.30559	-0.059524257
22	84.23219602	-3.9322	-0.765931424
23	79.28724116	0.912759	0.177791411
24	85.24137048	-5.14137	-1.001460048
25	78.68173648	0.918264	0.178863638
26	80.59916796	-3.49917	-0.681584206
27	76.86522245	-0.86522	-0.168532053
28	86.55329727	-12.8533	-2.50362501
29	78.17714925	-5.57715	-1.086343065
30	76.56247012	-5.16247	-1.005569934
31	65.86522084	4.134779	0.805391512
32	71.81935015	-5.31935	-1.036127757

PROBABILITY OUTPUT

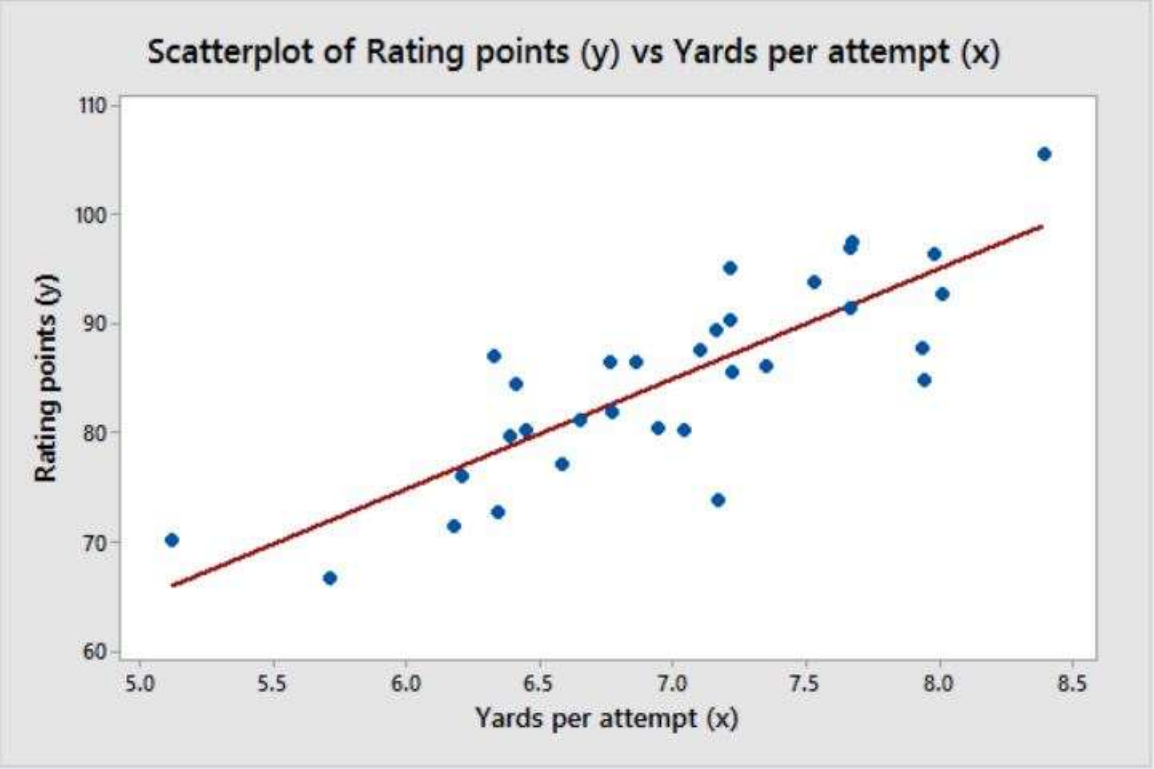
Percentile	*Rating points (y)*
1.5625	66.5
4.6875	70
7.8125	71.4
10.9375	72.6
14.0625	73.7
17.1875	76
20.3125	77.1
23.4375	79.6
26.5625	80.1
29.6875	80.2
32.8125	80.3
35.9375	81
39.0625	81.7
42.1875	84.3
45.3125	84.7
48.4375	85.4
51.5625	86
54.6875	86.4
57.8125	86.4
60.9375	87
64.0625	87.5
67.1875	87.7
70.3125	89.4
73.4375	90.2
76.5625	91.4
79.6875	92.7
82.8125	93.8
85.9375	95
89.0625	96.2
92.1875	96.9
95.3125	97.4
98.4375	105.5

Yards per attempt (x)	
Mean	6.9978125
Standard Error	0.128663833
Median	7.07
Mode	7.66
Standard Deviation	0.727832551
Sample Variance	0.529740222
Kurtosis	0.142682976
Skewness	0.326815945
Range	3.27
Minimum	5.12
Maximum	8.39
Sum	223.93
Count	32
Largest (1)	8.39
Smallest (1)	5.12
Confidence Level (95.0%)	0.262411618

Rating points (y)[13]	
Mean	84.815625
Standard Error	1.584171386
Median	85.7
Mode	86.4
Standard Deviation	8.961426635
Sample Variance	80.30716734
Kurtosis	-0.197162486
Skewness	0.013453228
Range	39
Minimum	66.5
Maximum	105.5
Sum	2714.1
Count	32
Largest (1)	105.5
Smallest (1)	66.5
Confidence Level (95.0%)	3.230938843

[13] **These tables were generated on excel.**

(a) Calculate the least squares estimates of the slope and intercept. What is the estimate of σ2? Graph the regression model.



Based on all of the data generated above

σ2= SSe/(n-2)
σ2= (817.0568)/(32-2)
σ2= 27.23522667 or **27.235.**

(b) Find an estimate of the mean rating if a quarterback averages 7.5 yards per attempt.
E(Y, given 7.5) = β0+β1(7.5)
= 14.19548847+10.0917446(7.5)
= 89.88357299 or **89.884**

(c) What change in the mean rating is associated with a decrease of one yard per attempt?
ΔE (Y given x) = β1(Δx)
= 10.0917446 (-1)
=-10.0917446 or **-10.092**

(d) To increase the mean rating by 10 points, how much increase in the average yards per attempt must be generated?
ΔE = (Y given x)/(β1(Δx))
=10/10.0917446
= 0.990908946 or **0.99091**

(e) Given that $x = 7.21$ yards, find the fitted value of x and the corresponding residual.

X=7.21
y-hat= 14.19548847+10.0917446 (7.21)

= 86.95696704

=86.9570

References

1. Data pasted from the textbook. Montgomery, Douglas C., and George C. Runger. *Applied statistics and probability for engineers, (With CD)*. John Wiley & Sons, 2007.

2. Levine, David M., et al. *Statistics for managers using Microsoft Excel*. Vol. 660. Upper Saddle River, NJ: Prentice Hall, 1999.

3. Meyer, Ruth, and David Krueger. *Minitab guide to statistics*. Prentice Hall PTR, 2001.