ISyE 6739 Homework 1
solution

due Tuesday, Jan 23

You can use software for all problems (unless otherwise specified).

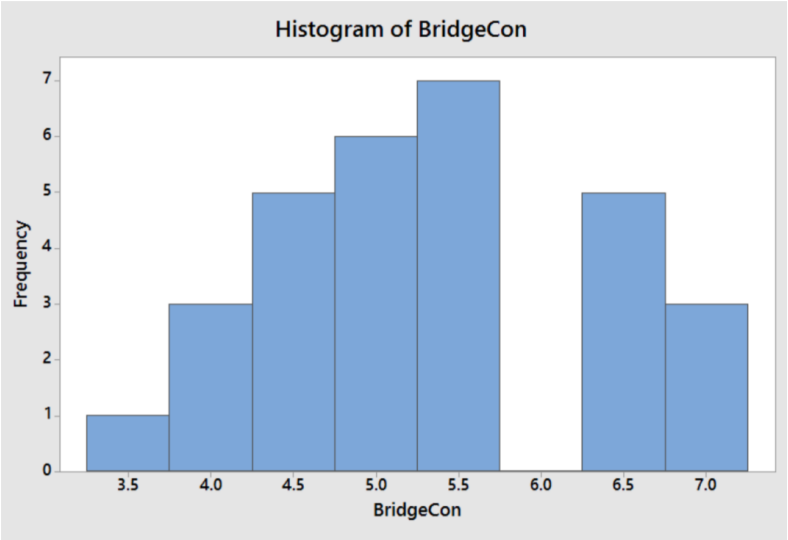
1. (6-25) The United States has an aging infrastructure as witnessed by several recent disasters, including the I-35 bridge failure in Minnesota. Most states inspect their bridges regularly and report their condition (on a scale from ~~1–17~~ 1-7) to the public. Here are the condition numbers from a sample of 30 bridges in New York State (https://www.dot.ny.gov/main/bridgedata):

5.08	5.44	6.66	5.07	6.80	5.43	4.83	4.00	4.41	4.38
7.00	5.72	4.53	6.43	3.97	4.19	6.26	6.72	5.26	5.48
4.95	6.33	4.93	5.61	4.66	7.00	5.57	3.42	5.18	4.54

   (a) Construct a stem-and-leaf diagram (do not use software).

Stem	Leaf									
3	97	42								
4	83	0	41	38	53	19	95	93	66	54
5	8	44	7	43	72	26	48	61	57	18
6	66	8	43	26	72	33				
7	0	0								

   (b) Construct a histogram (do not use software).



   (c) Do any of the bridges appear to have unusually good or poor ratings?
   Yes. Unusually good ratings: 6.88, 7.00, 6.72, 7.00; unusually poor ratings: 3.42.

   (d) If so, compute the mean with and without these bridges and comment.

   (e) Compute the sample median and the sample standard deviation.
   BridgeCon_new - data without these bridges.

Descriptive Statistics: BridgeCon, BridgeCon_new

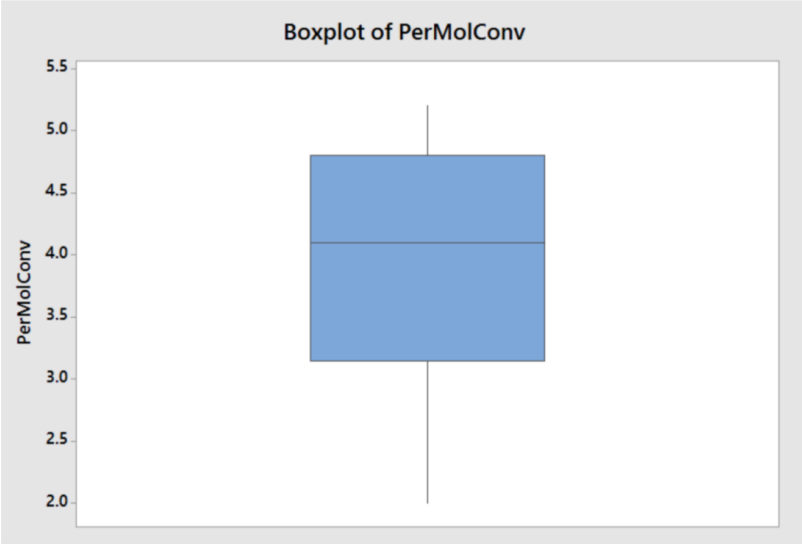
Statistics

Variable	N	N*	Mean	StDev	Median
BridgeCon	30	0	5.328	0.975	5.220
BridgeCon_new	25	5	5.156	0.750	5.080

2. (6-70) An article in Transactions of the Institution of Chemical Engineers (1956, Vol. 34, pp. 280–293) reported data from an experiment investigating the effect of several process variables on the vapor phase oxidation of naphthalene. A sample of the percentage mole conversion of naphthalene to maleic anhydride follows:

4.2	4.7	4.7	5.0	3.8	3.6	3.0	5.1	3.1	3.8
4.8	4.0	5.2	4.3	2.8	2.0	2.8	3.3	4.8	5.0

   Construct a box plot of the data (do not use software).



3. (6-41) The United States Golf Association tests golf balls to ensure that they conform to the rules of golf. Balls are tested for weight, diameter, roundness, and overall distance. The overall distance test is conducted by hitting balls with a driver swung by a mechanical device nicknamed "Iron Byron" after the legendary great Byron Nelson, whose swing the machine is said to emulate. Following are 100 distances (in yards) achieved by a particular brand of golf ball in the overall distance test.

261.3	259.4	265.7	270.6	274.2	261.4	254.5	283.7
258.1	270.5	255.1	268.9	267.4	253.6	234.3	263.2
254.2	270.7	233.7	263.5	244.5	251.8	259.5	257.5
257.7	272.6	253.7	262.2	252.0	280.3	274.9	233.7
237.9	274.0	264.5	244.8	264.0	268.3	272.1	260.2
255.8	260.7	245.5	279.6	237.8	278.5	273.3	263.7
241.4	260.6	280.3	272.7	261.0	260.0	279.3	252.1
244.3	272.2	248.3	278.7	236.0	271.2	279.8	245.6
241.2	251.1	267.0	273.4	247.7	254.8	272.8	270.5
254.4	232.1	271.5	242.9	273.6	256.1	251.6	
256.8	273.0	240.8	276.6	264.5	264.5	226.8	
255.3	266.6	250.2	255.8	285.3	255.4	240.5	
255.0	273.2	251.4	276.1	277.8	266.8	268.5	

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

Stem-and-Leaf Display: Distance

Stem-and-leaf of Distance N = 100

1	22	6
5	23	2334
8	23	677
16	24	00112444
20	24	5578
33	25	0111122334444
46	25	5555556677899
(15)	26	000011123334444
39	26	56677888
31	27	00001122223333444
12	27	66788999
4	28	003
1	28	5

Leaf Unit = 1
N = 17*

It is seen in the histogram that the distribution is left-skewed; there are no outliers.

(b) Compute the sample mean, the sample standard deviation, and the sample median. What is the 90th percentile of distances?

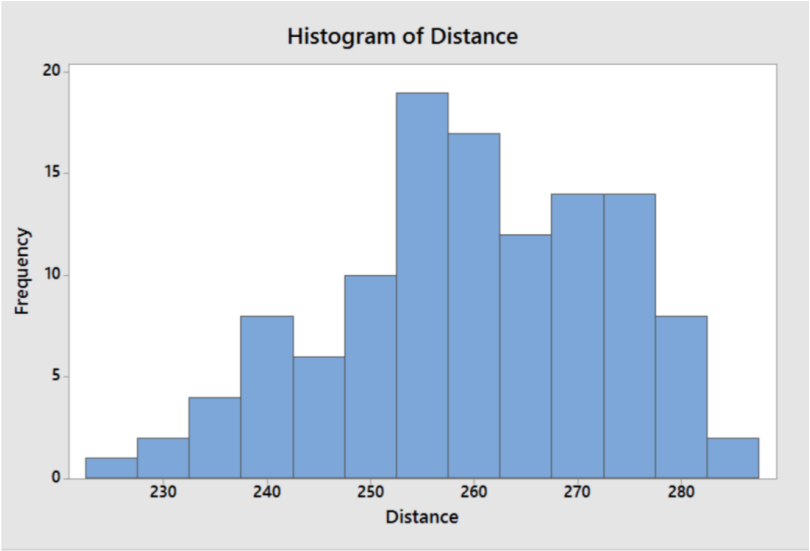
Descriptive Statistics: Distance

Statistics

Variable	N	N*	Mean	StDev	Median
Distance	100	17	260.30	13.41	260.85

$P_{90} = 276.2$

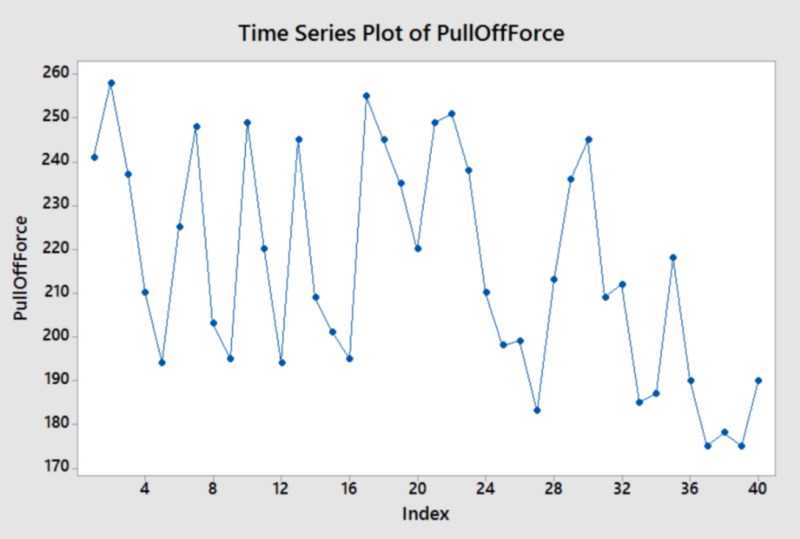
(c) Construct a histogram for the data. Comment the shape of the histogram.



The distribution is skewed to the left.

4. (6-83) The pull-off force for a connector is measured in a laboratory test. Data for 40 test specimens follow (read down, then left to right). Construct and interpret time series plot of the data.

241	203	201	251	236	190
258	195	195	238	245	175
237	249	255	210	209	178
210	220	245	198	212	175
194	194	235	199	185	190
225	245	220	183	187	
248	209	249	213	218	



The plot shows that first 20 time units (t.u.) the process is periodic with period 4; no obvious pattern after 20^{th} t.u. but in general the process shows a downward trend.