IE 365
Quality Control
Fall 2017
Exam 1

Instructions: This exam is due by 8:30 am on Wednesday, October 11, 2017. Your submittal must be your work with no friends or volunteer or paid consultants. Do not submit your exam through Canvas or by e-mail. Late exams are not accepted.

1. The table below contains the results of 30 samples of size n=4. Please create appropriate control chart(s) and evaluate the status of the process.

Sample Number	Measurement $x_{i\ bar}$	Sample Number	Measurement $x_{i\ bar}$
1	3.53	16	3.53
2	3.49	17	3.52
3	3.52	18	3.49
4	3.50	19	3.52
5	3.51	20	3.49
6	3.51	21	3.55
7	3.59	22	3.47
8	3.58	23	3.52
9	3.63	24	3.51
10	3.49	25	3.50
11	3.52	26	3.51
12	3.43	27	3.47
13	3.49	28	2.51
14	3.51	29	2.52
15	3.50	30	2.51

2. As part of your new role as quality engineer, you encounter the following set of runs rules:

1. Any point outside the +/- 2 sigma line.

2. 5 of 6 in a row above or below the centerline.

What is the false alarm probability of this set of rules? Explain your answer and give an example of what might happen.

3. Recently, Valles Global Industries has started making frabbits for the international market. One of the quality characteristics has proven to be especially troublesome and a control chart is planned. Refer to the below table for the first 25 subgroups of size n= 4.

X1	X2	X3	X4
2.15096	2.18734	2.14387	2.11852
2.13966	2.19951	2.16682	2.14092
2.15415	2.22664	2.19076	2.14187
2.16848	2.13653	2.14095	2.08959
2.09638	2.137	2.16173	2.159
2.14603	2.13134	2.12941	2.11274
2.15344	2.15738	2.0907	2.11529
2.18389	2.19045	2.06751	2.20434
2.08447	2.21659	2.11229	2.20593
2.16894	2.11735	2.14119	2.19052
2.14581	2.10206	2.14869	2.16057
2.08437	2.14123	2.14433	2.1054
2.20545	2.14971	2.10673	2.19672
2.17704	2.1352	2.10508	2.09069
2.22492	2.13879	2.0912	2.17441
2.05642	2.16658	2.12842	2.12071
2.13343	2.1426	2.21892	2.09871
2.20338	2.11635	2.20076	2.13989
2.24377	2.07521	2.15963	2.15173
2.10924	2.12027	2.18261	2.16238
2.11615	2.11226	2.1622	2.08432
2.2032	2.15922	2.07972	2.17678
2.19672	2.23984	2.14953	2.32004
2.14947	2.0838	2.14176	2.25829
2.14051	2.20612	2.15264	2.21081

Assess this first set of data. Discuss what you should do.

4. Razzaghi Motorsports builds engines for race cars. One particular part is being assessed using a control chart. The specification is .3200 to .3220. Samples of n=5 are taken every 45 minutes and 15 data points are displayed in the table below. The data are shown as deviations from .3210 in .0001 inches.

	Item Number				
Sample Number	1	2	3	4	5
1	1	9	6	9	9
2	9	4	3	0	3
3	0	9	0	3	2
4	1	1	0	2	1
5	−3	0	−1	0	−4
6	−7	2	0	0	2
7	−3	−1	−1	0	−2
8	0	−2	−3	−3	−2
9	2	0	−1	−3	−1
10	0	−2	−1	−2	−2
11	−3	−2	−1	−1	2
12	−16	2	0	−4	−1
13	−6	−3	0	0	−8
14	−3	−5	5	0	5
15	−1	−1	−1	−2	−1

Now, create Xbar and R charts and determine whether this process is in-control. If so, what are the control limits? If not, throw out points outside the limits are calculate new limits. Then, plot the data shown in for points 16-26. Is the process still in-control? Discuss what is happening here.

	Item Number				
Sample Number	1	2	3	4	5
16	−1	−2	−2	0	−4
17	−2	2	−1	−1	0
18	0	4	0	0	0
19	1	2	1	1	−3
20	0	−3	3	3	−1
21	1	2	1	2	1
22	−1	0	2	−1	2
23	0	−1	0	0	0
24	1	0	−1	1	0
25	2	2	2	1	1
26	−3	2	0	1	−1

5. An experiment was conducted to investigate the filling performance of packaging equipment. Ten (10) bottles were randomly selected and the fill volume (that's how much was put in the bottle) measured in milliliters. We believe fill volume is normally distributed.

753	751
753	752
753	751
755	753
758	759

a) Do the data support the claim that standard deviation is less than 1 ml?

b) Find a 95% two-sided confidence interval on the standard deviation of fill volume.

c) Do the data support the claim that the mean is 750 ml?

d) Suppose any bottle you encounter over 755 ml costs $10 to fix? How much should this cost? Why?