Quality Management Exercises

QM_1: The SWEETCAKE company produces three different cake rolls, each of a different flavour (vanilla, strawberry and chocolate). Each flavour is produced on a different production line, that is, chocolate on line 1, strawberry on line 2 and vanilla on line 3. After an analysis of the productive process the Quality Director of the company decides that one of characteristics that should be controlled, through control chats for variables, is the weight of the cakes. With this purpose, he collected 26 samples of 5 chocolate cake rolls each from line 1 and registered the average weight and the range for each sample:

Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Average Weight	301	307	308	302	311	310	301	310	305	305	310	303	310
Range	10	15	8	7	21	9	12	6	17	11	18	9	15
Sample	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Average Weight	310	305	312	304	310	306	312	302	307	310	303	311	308
Range	14	18	10	12	15	8	16	15	19	10	15	13	18

a) Using these data, determine the control limits for the $\overline{X}$, and R-charts.

b) In your opinion, do you think that the company should use the same control limits determined in a) to control the weight of the vanilla and strawberry cakes? Justify your answer.

c) According to the customers' requirements, the company established that the upper and lower specification limits for the cakes' weight is 285 grams and 315 grams, respectively. Do you think that the process is capable of producing chocolate cake rolls according to the established specifications? Justify your answer presenting all the assumptions made.

QM_2:

TEXTILUNIFORM is a manufacturing company that produces high quality School Uniforms T-Shirts. Daily a sample of 100 T-Shirt is carefully inspected, and the number of defective T-shirts is recorded. The following table shows a sequence of 26 results recorded over time (26 days).

Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Number of defective T-shirts	8	8	6	8	9	5	7	2	3	10	5	7	4
Sample	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**
Number of defective T-shirts	15	6	8	2	1	7	9	11	9	6	5	8	3

a) According to the data recorded, which is the appropriate control chart? Determine the 3-sigma control limits for the suggested control chart.

b) Suppose that the number of defective T-shirts on the next four days are 10, 6, 5 and 16. Is the process in control? Identify the causes of variation present in the process.

QM_3:

CORKSTOP produces thousands of cork stoppers per day. The quality manager of CORKSTOP decided to have a closer control on the production process to discover the cause of the defects on the cork stoppers. Therefore, he started to collect 20 samples of 100 cork stoppers each. The number of defects on a given day is as follows:

Sample	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
# of defects	6	4	5	1	4	2	5	3	3	2

Sample	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
# of defects	6	1	8	5	7	4	3	7	2	4

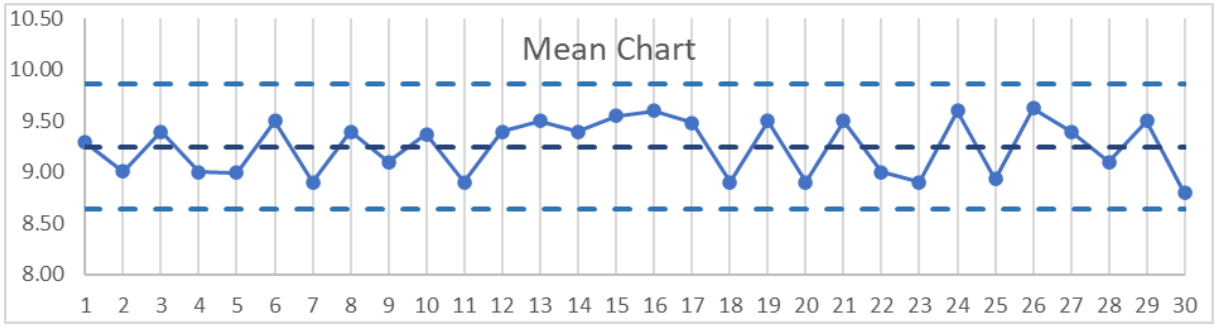
a) What control chart do you find most appropriate to analyze the collected data?

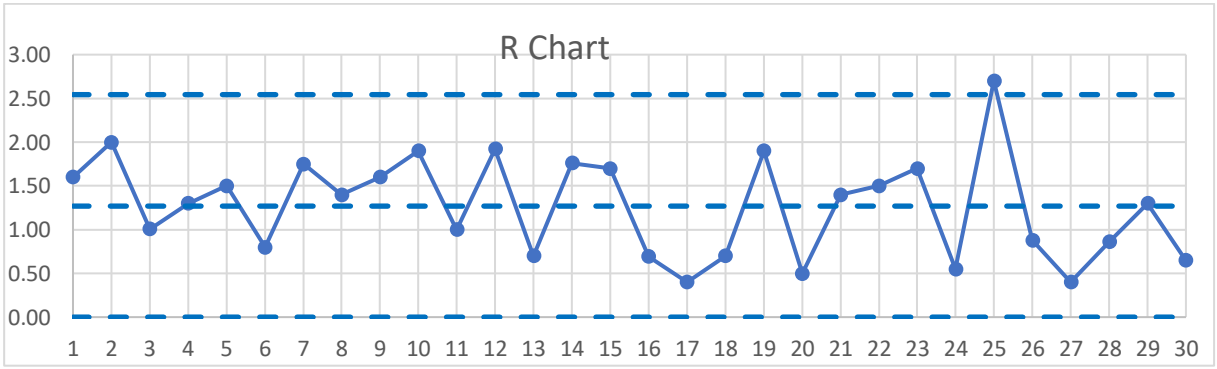
b) Draw the appropriate control chart(s) so that the control limits include 99,73% of the random variation on the entire process (3 sigma limits).

QM_4

ELEChip company produces several types of chips for the electronic industry. After an analysis of the productive process the quality director of the company decides that one of characteristics that should be controlled, through control charts for variables, is the electrical resistance. With this purpose, he collected 30 samples of 6 chips each and registered the average and the range of the electrical resistance (in ohms) for each sample. Using this data, he calculated the control limits for the mean and range control chart (shown in the table below) and drew the respective graphs.

	Mean chart	Range chart
Central line	$CL = \overline{\overline{X}} = 9.25$ ohms	CL = 1.27 ohms
3 sigma limits	UCL= 9.86 ohms LCL = 8.64 ohms	UCL = 2.54 ohms LCL = 0 ohms





a) In your opinion the control limits obtained by the quality manager (represented in the above graphs) are appropriate to start controlling the electrical resistance of the chips? Justify your answer. (Note: Is it not necessary to perform any calculation).

b) Assume that the production process of the chips is under statistical control and that the characteristic electrical resistance follows a Normal distribution. The upper and lower specification limits for the electrical resistance are 12 ohms and 8 ohms, respectively. In your opinion, is the process able to produce according to the specifications? Justify your answer (Note: If you cannot estimate the mean and standard deviation of the process, assume that they are equal to 9.1 ohms and 0.6 ohms, respectively).

Adapted from Repeat Exam, July 03, 2020.

MULTIPLE CHOICE QUESTIONS

1. The Quality Manager of an organic yogurt processing plant established, concerning the weight of yogurts, an upper specification limit of 500 grams, and a lower specification limit of 420 grams. The production process of organic yogurt has a mean of 480 grams and a standard deviation of 12 grams. Assume that the weight of organic yogurt follows a normal distribution and that the process is under statistical control. Which of the following options is correct?		
1		The process is centered, but it is not capable
2		The process is not centered, but it is capable
3		The process is not centered, and not capable
4		The process is centered, and capable

Adapted from Normal Exam, June 23, 2017.

2. One of SATAR's competitive priorities is to reduce the delays of its flights. The company's quality director decided to control the number of delayed flights using control charts. With this purpose, he collected the following data:

Day	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
Delayed flights	4	8	12	8	2	8	18	11	22	4	6	8	4	4	13
Day	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**
Delayed flights	4	6	14	6	4	6	14	8	6	4	10	3	11	6	8

Which control chart do you find most appropriate to analyze the data collected by the quality manager?		
1		Chart R
2		Chart p
3		Chart c
4		Chart $\bar{X} - R$

Adapted from Exam July 4, 2017.