MEC612 - QUALITY ENGINEERING AND MANAGEMENT
Final Examination April 2008

Time: 180 minutes, Max marks: 50, all questions carry 2 marks each except where otherwise mentioned. Use of approved Statistical / SQC Tables is permitted

1. Discuss the life and teachings of Joseph M Juran.

2. Explain the importance of Customer Focus in TQM.

3. How are non-linear characteristics used to advantage in Robust Design?

4. A sample of 10 capacitors of nominal spec 100mfd showed values: 100.6, 104, 99.3, 95.6, 98.1, 100.7, 97.1, 99.6, 94.5, 100.6. If the quality loss coefficient is Rs750, determine the average loss in this batch.

5. Explain the deficiency of Taguchi's inner array outer array design. What is the alternative design recommended?

6. Discuss the characteristics of great Quality Leaders.

7. Explain Kano's model of customer satisfaction with an example.

8. What are the recommendations in handling customer complaints?

9. Explain the various stages in the development of a team.

10. What is the importance of Deming's funnel experiment?

11. A factory maintains a control chart for averages on the width of a slot. The centre line is 12.2mm, with a subgroup size of 6 and 2.8σ upper control limit at 12.6mm. Determine the ARL if the mean has shifted to 12.3mm.

(4 marks)

12. The number of plastic containers produced every day and found nonconforming is as follows:

Day	1	2	3	4	5	6	7	8	9	10
Number inspected	515	970	1040	780	990	990	1300	950	1030	980
Number nonconforming	30	45	55	30	45	55	85	40	45	60

Day	11	12	13	14	15	16	17	18	19	20
Number inspected	1000	490	985	1040	2020	1030	975	1030	1050	990
Number nonconforming	50	25	65	50	110	55	50	50	50	50

Calculate the points to be plotted for a standardised control chart for fraction non-conforming. Do not plot the chart.

(6 marks)

13. At a factory, weld non-conformities are located by Xray inspection on a sampling basis. It is planned to implement a control chart with 2.5 sigma limits on the fraction of weld non-conformities. The weld process has an overall nonconformity rate of 2.2%. What should be the sample size to be able to detect with a 50% chance, a worsening of quality to 4%?

14. The number of non-conformities observed during proof reading a newspaper everyday for 20 days is given below. Identify a suitable control chart and calculate control limits, recalculating as necessary till all points are in control. Assume the number of pages everyday to be constant. Do not plot the chart.

Day	1	2	3	4	5	6	7	8	9	10
Non-conformities	6	0	5	3	2	3	3	0	0	4

Day	11	12	13	14	15	16	17	18	19	20
Non-conformities	9	6	0	0	0	2	3	5	3	4

(4 marks)

15. A student purchases a bike and monitors the running time between failures as below. Develop a control chart for the data assuming that a transformation of the form $x=TBF^{0.2777}$ will make the data normal. The chart need not be plotted.

TBF(hrs)	10	92	1396	15	214	3.3	643	18	1698	1116

(6 marks)

16. The diacetyl content is an important factor in the aroma of beer. The target value is 0.08 mg/L. Determine control limits for an EWMA chart and identify out of control points if any from the data for ten days as follows:

Measurement	0.0748	0.0812	0.0782	0.0773	0.082	0.0772	0.0773	0.0816	0.0829	0.0841

Estimate the standard deviation using Moving Range method. Choose weighting factor 0.1 and control limits at 2.8 sigma.

(6 marks)

17. An FMEA is being constructed for the "Brake" of a bicycle. For a failure mode breakage of brake shoe, determine the Risk Priority Number. Assume suitable data and justify.

(2 marks)

18. A TV manufacturer claims a reliability of 0.99 for a period of 24hrs. After how many days, on average in the long run, can you expect a failure for a single TV set?

(2 marks)

SOLUTIONS TO NUMERICALS:

4.

ybar	99.01
s	2.7827
Lbar	6542.5

11.

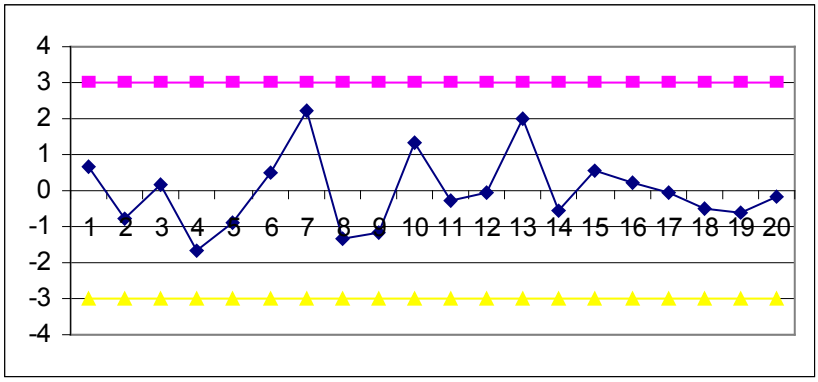
CL	12.2
n	6
L	2.8
UCL	12.6
s	0.3499
New xbar	12.3
k	0.2858
L-krootn	2.1
"-L-krootn	-3.5
Beta	0.9819
ARL	54.258

12.

20155
1045
0.051848

p	0.0583	0.0464	0.0529	0.0385	0.0455	0.0556	0.0654	0.0421	0.0437	0.0612
z	0.6555	-0.766	0.1507	-1.686	-0.907	0.5261	2.2013	-1.354	-1.181	1.3239

0.05	0.051	0.066	0.0481	0.0545	0.0534	0.0513	0.0485	0.0476	0.0505
-0.264	-0.083	2.0018	-0.549	0.5285	0.2243	-0.08	-0.478	-0.618	-0.191



All points are within control limits

13.

L	2.5
Present pbar	0.022
To detect pbar	0.04
delta	0.018
n	415.05

14.

	Trial 1	Trial 2
CL	2.9	2.5789
UCL	8.0088	7.3967
LCL	-2.209	-2.239

Now, all points are within control limits

PTO

15.

y	1.8954	3.5103	7.4702	2.1213	4.4377	1.3931	6.0234	2.2315	7.8878	7.02
MR		1.6149	3.9599	5.3489	2.2164	3.0446	4.6302	3.7919	5.6563	0.8678
MRbar	3.4701									
s	3.0763									
UCLR	11.337									
CL	4.3991									
UCL	13.628									
LCL=	-4.83									

All points are within control limits

16.

i	1	2	3	4	5	6	7	8	9	10
x	0.0748	0.0812	0.0782	0.0773	0.082	0.0772	0.0773	0.0816	0.0829	0.0841
MR		0.0064	0.003	0.0009	0.0047	0.0048	1E-04	0.0043	0.0013	0.0012
MRbar	0.00297									
d2	1.128	**sigma**	0.00263	**Target mu0**		0.08	**lamda**	0.1	**L**	2.8
z	0.07948	0.07965	0.07951	0.07929	0.07956	0.07932	0.07912	0.07937	0.07972	0.08016
UCL	0.08074	0.08099	0.08116	0.08127	0.08136	0.08143	0.08148	0.08152	0.08156	0.08158
LCL	0.07926	0.07901	0.07884	0.07873	0.07864	0.07857	0.07852	0.07848	0.07844	0.07842

All points are within control limits

18.

R	0.99
t	24
lamda t	0.01005
lamda	0.00042
MTBF	2387.98
Days	99.4992