2005 SIX SIGMA – TEST I

Time: 50 minutes, Max marks:20

Use of approved Six Sigma Tables is permitted. Choose a significance level 0.05.

1) Describe the origins of Six Sigma.

(3 marks)

2) Explain the role of Design of Experiments in Six Sigma.

(2 marks)

3) Two divisions of a class were taught a subject by the same teacher. The marks of the two divisions in the final examination were as follows:

Div A	63	61	64	40	45	42	25	69	44	47
	42	26	47	59	41	25	44	51	59	61
	68	65	44	64	59	59	46	64	59	33

Div B	81	46	85	61	59	51	19	78	85	65
	71	59	51	57	58	70	74	88	55	73
	64	74	65	53	60					

Construct a comparative stem and leaf plot. What can you conclude from the plot?

(5 marks)

4) a) What is the central limit theorem? What is its significance?
b) Ten batteries were sampled at random and found to give the following lives:

3.99	3.94	4.04	4.08	3.96	4.06	4.08	4.03	4.11	3.98

Determine the mean life of the battery that the manufacturer can claim so that 90% of all batteries will have this life.

(2+3=5 marks)

5) A cough syrup is being filled in bottles using an automatic filling machine. While setting up the machine, the amount of syrup in five bottles was measured and the mean was found to be 98.2ml. The standard deviation of the amount of syrup filled by the machine is known to be 1.63ml. According to the label, a minimum quantity of 100ml has to be filled. Is the machine setting satisfactory? Disturbing the setting is not considered advisable. Determine the p-value.

(5 marks)

6) A company claimed that their new carburettor improved the mileage of a motorcycle by 10km/l. A test was conducted to verify the claim. Six stretches of roads were used, and the bike was used in random order with the results as below:

Road	1	2	3	4	5	6
Old	69	73	75	59	62	65
New	79	81	84	73	77	77

Is the claim of the company justified?

(5 marks)

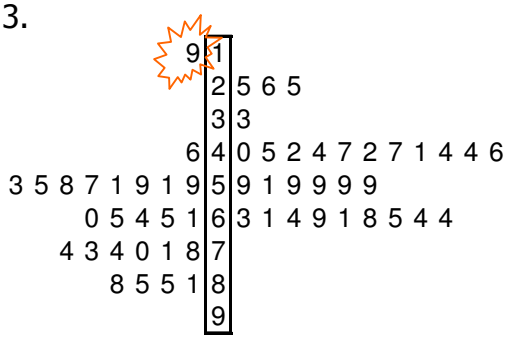
7) The surface roughness of 14 machined parts was measured by a Six Sigma team as follows. Construct a normal probability plot on ordinary graph paper. Are the values normally distributed?

1	8	21	4	43	12	7
5	1	12	25	23	32	2

(5 marks)

SOLUTIONS TO NUMERICAL PROBLEMS:

3.



Div B appears to be better, one mark appears to be an outlier.

4. b)

μ=4.027, s= 0.057164, $t_{0.1,9}$ = 1.383

μ-(t*s/$\sqrt{n}$) =4.002hrs is the minimum life that the manufacturer can claim with 90% confidence.

5.

H_a: μ<100, H_0:μ=100,

$\bar{x}$ =98.2, σ= 1.63, $z_{0.05}$ = 1.645

z_0= ($\bar{x}$-μ)/σ/$\sqrt{n}$ =-2.469

Reject the null hypothesis. pvalue=0.043381.

The machine setting is not satisfactory.

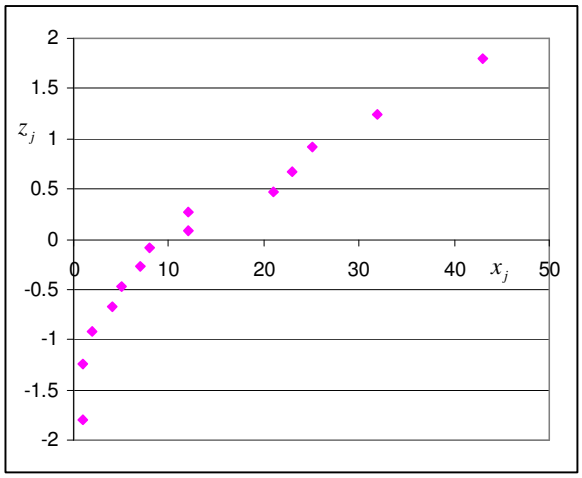
6.

Old	New	d
69	79	10
73	81	8
75	84	9
59	73	14
62	77	15
65	77	12
	dbar	11.33333
	sd	2.804758
	t0	1.164445
	tcrit	2.015049

The manufacturer's claim is not justified.

7.

xi	xj	j	(j-0.5)/n	zj
1	1	1	0.035714	-1.80275
8	1	2	0.107143	-1.24187
21	2	3	0.178571	-0.92082
4	4	4	0.25	-0.67449
43	5	5	0.321429	-0.46371
12	7	6	0.392857	-0.27188
7	8	7	0.464286	-0.08964
5	12	8	0.535714	0.089642
1	12	9	0.607143	0.27188
12	21	10	0.678571	0.463708
25	23	11	0.75	0.67449
23	25	12	0.821429	0.920822
32	32	13	0.892857	1.241867
2	43	14	0.964286	1.802746



The measurements do not appear to be normally distributed.