

OLLSCOIL NA hÉIREANN, GAILLIMH
NATIONAL UNIVERSITY OF IRELAND, GALWAY.

SECOND COMMERCE SUMMER 2000
VISITING STUDENTS

QUALITY SAFETY AND ENVIRONMENTAL MANAGEMENT

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Instructions: Time allowed: 2 Hours. Attempt: Any 3 questions [All questions carry equal marks]
Statistical tables, graph paper and control chart tables are available if required

- Q1** a) Discuss the proposed changes to ISO9001: 2000. Focus on the key areas in which the 1994 version of the standard was thought to be deficient. (70% marks)
b) What elements of Total Quality Management are addressed in the new standard? (30% marks)
- Q2** Write explanatory notes on four of the following topics: (4x25% marks)
- A Product Liability Prevention Programme
 - The effect of quality on productivity
 - The seven quality tools proposed by Ishikawa
 - The process to be followed in accident investigation
 - The responsibilities of Employers for safety in the workplace
 - The business elements that make up quality costs
- Q3** a) Describe four patterns that you might see on a control chart and the appropriate corrective action required in each case. (20% marks)
- b) The data below are X-bar and R values for 24 samples of size $n=5$ taken from a process producing bearings. The measurements are made on the inside diameter of the bearing and are in millimeters.
- | Sample number | X-bar | R | Sample Number | X-bar | R |
|---------------|-------|---|---------------|-------|---|
| 1 | 34.5 | 3 | 13 | 35.4 | 8 |
| 2 | 34.2 | 4 | 14 | 34.0 | 6 |
| 3 | 31.6 | 4 | 15 | 37.1 | 5 |
| 4 | 31.5 | 4 | 16 | 34.9 | 7 |
| 5 | 35.0 | 5 | 17 | 33.5 | 4 |
| 6 | 34.1 | 6 | 18 | 31.7 | 3 |
| 7 | 32.6 | 4 | 19 | 34.0 | 8 |
| 8 | 33.8 | 3 | 20 | 35.1 | 4 |
| 9 | 34.8 | 7 | 21 | 33.7 | 2 |
| 10 | 33.6 | 8 | 22 | 32.8 | 1 |
| 11 | 31.9 | 3 | 23 | 33.5 | 3 |
| 12 | 38.6 | 9 | 24 | 34.2 | 2 |
- i) Set up an appropriate chart for this process. (40% marks)
ii) Is the process in statistical control? Why? (10% marks)
iii) Is the process capable of meeting a specification limit of 35 ± 5 ? Explain your answer. (30% marks)
- Q4** a) Discuss the process of risk assessment in the context of safety and environmental management. (50% marks)
- b) According to the Safety, Health and Welfare at Work Act, 1989, what are the main elements of a Safety Statement? (30% marks)
- c) What is an improvement notice, which can be issued by the HSA. (20% marks)
- Q5** a) What are the main elements of ISO14001; The Environmental Management Standard? (70% marks)
- b) What similarities, if any, exist between ISO9001 and ISO14001? (30% marks)

SUMMARY OF VARIABLE AND ATTRIBUTE DATA CONTROL CHARTS

~~PRODUCTION SYSTEMS I~~

Q.S. 2E, 1997

ATTRIBUTE

DATA

Chart Description	Plotted Value	Process Mean	Control Limits see **
Proportion Defective p-chart	p	$\bar{p} = \frac{f_1 + f_2 + \dots + f_m}{n_1 + n_2 + \dots + n_m}$	$\bar{p} \pm 3 \times \sqrt{\frac{\bar{p}(1-\bar{p})}{n}}$
Number Defective np-chart	f	$\bar{f} = \frac{f_1 + f_2 + \dots + f_m}{m}$	$\bar{f} \pm 3 \times \sqrt{\bar{f} \left(1 - \frac{\bar{f}}{n}\right)}$
Number of Defects c-chart	c	$\bar{c} = \frac{c_1 + c_2 + \dots + c_m}{m}$	$\bar{c} \pm 3 \times \sqrt{\bar{c}}$
Defects per Unit u-chart	u	$\bar{u} = \frac{c_1 + c_2 + \dots + c_m}{n_1 + n_2 + \dots + n_m}$	$\bar{u} \pm 3 \times \sqrt{\frac{\bar{u}}{n}}$

** Sometimes a calculation for the Lower Control Limit results in a negative number, in this case the Lower Control Limit is taken as zero.

VARIABLE

DATA

TABLE OF CONSTANTS

	n	2	3	4	5	6	7	8	9	10
$(\bar{X} - R)$ A_2		1.88	1.02	0.73	0.58	0.48	0.42	0.37	0.34	0.31
(MEDIAN) \tilde{A}_2		1.88	1.19	0.80	0.69	0.55	0.51	0.43	0.41	0.36
$(\bar{X} \pm S)$ A_3		2.66	1.95	1.63	1.43	1.29	1.18	1.10	1.03	0.98
LCLs B_3		*	*	*	*	0.03	0.12	0.19	0.24	0.28
UCLs B_4		3.27	2.57	2.27	2.09	1.97	1.88	1.82	1.76	1.72
c_4		.798	.886	.921	.940	.952	.959	.965	.969	.973
d_2		1.13	1.69	2.06	2.33	2.53	2.70	2.85	2.97	3.08
LCLR D_3		*	*	*	*	*	0.08	0.14	0.18	0.22
UCLR D_4		3.27	2.57	2.28	2.11	2.00	1.92	1.86	1.82	1.78

$$\bar{X} \text{ LIMITS} = \bar{X} \pm A_2 \bar{R} ; UCL_R = D_4 \bar{R}, LCL_R = D_3 \bar{R}$$

$$\tilde{X} \text{ LIMITS} = \tilde{X} \pm \tilde{A}_2 \bar{R} ; \dots$$

$$\bar{X} \pm S \text{ LIMITS} = \bar{X} \pm A_3 \bar{R} ; UCL_S = B_4 \bar{S}, LCL_S = B_3 \bar{S}$$