GXS 78

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

SUMMER EXAMINATION, 2000

PRODUCTION SYSTEMS 1

SECOND YEAR INDUSTRIAL ENGINEERING AND INFORMATION SYSTEMS
SECOND YEAR MANAGEMENT ENGINEERING WITH LANGUAGE
VISITING STUDENTS

Dr. E.J. Wright
Prof. M.E.J. O'Kelly
Mr. Pat Donnellan

Time allowed: 3 hours Cambridge Elementary Statistical tables and Graph paper available.
Attempt: Any 5 questions. [Control chart formulae are attached]

Q1 a) Explain the just in time philosophy of production. (12 marks)

b) Explain the main performance differences between the JIT Pull system and the MRP Push system. Suggestion: You may use the JIT Laboratory as an example. (8 marks)

Q2 a) Explain the concept of an economic order quantity (EOQ), and show how the EOQ formula is derived: (Use diagrams to illustrate your answer) (6 marks)

$$\text{i.e. } EOQ = \sqrt{\frac{2C_0D}{C_c}}$$

b) For the following inventory data suggest an appropriate ABC Classification system: (6 marks)

Part	Cost	Usage
1	60	90
2	350	40
3	30	130
4	80	60
5	30	100
6	20	180
7	10	170
8	320	50
9	510	60
10	20	120

c) A carpet store wants a reorder point with a 95% service level and a 5% stockout probability. For the data given below calculate the reorder point and an appropriate safety stock. (8 marks)

$\bar{d} = 30$ yards per day

$L = 10$ days

$\sigma_d = 5$ yards per day

Q3 a) Describe project, batch, line and continuous process designs and explain when each would be used in terms of products, volumes, demand rates. (12 marks)

b) Describe the role and skills of the worker in each of the process in (a) above. (8 marks)

Q4 a) Describe what you consider to be the six most important elements of the ISO9001: 1994 Quality Standard and give reasons for your answers. (12 marks)

b) 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. (8 marks)

Q5 Write explanatory notes on **four** of the following topics: (4x5 marks)

- A Product Liability Prevention Programme
- Measuring quality in a manufacturing process
- Method Study
- A Safety Statement
- The responsibilities of Employers for safety in the workplace
- The elements that make up quality costs

Q6 a) For the following data calculate a 3 and a 5 month moving average forecast. (6 marks)

Month	Orders	3-month	5-month
Jan	120		
Feb	90		
Mar	100		
Apr	75		
May	110		
June	50		
July	75		
Aug	130		
Sept	110		
Oct	90		
Nov	-		

b) Which of the two methods of forecasting used in section a) gives the best result. Use Mean Absolute Deviation in determining your answer. (8 marks)

c) Outline the importance of good forecasts in a production management system. (6 marks)

Q7 a) Describe **four** patterns that you might see on a control chart and the appropriate corrective action required in each case. (6 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 millimetres.

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. (6 marks)

ii) Is the process in statistical control ? Why? (2 marks)

iii) Is the process capable of meeting a specification limit of 35 ± 5. Explain your answer. (6 marks)

Q8 a) How would you approach the implementation of ISO14001, the Environmental Management Standard. (10 Marks)

b) Discuss the process of environmental risk assessment (6 Marks)

c) What is an improvement notice, issued by the HSA? (4 marks)

PRODUCTION SYSTEMS I

SUMMARY OF VARIABLE AND ATTRIBUTE DATA CONTROL CHARTS

ATTRIBUTE DATA

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

★★ 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
[(X BAR)-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
($\bar{X}$ & S) A_3	2.66	1.95	1.63	1.43	1.29	1.18	1.10	1.03	0.98
LCL$_S$ B_3	★	★	★	★	0.03	0.12	0.19	0.24	0.28
UCL$_S$ 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
LCL$_R$ D_3	★	★	★	★	★	0.08	0.14	0.18	0.22
UCL$_R$ D_4	3.27	2.57	2.28	2.11	2.00	1.92	1.86	1.82	1.78

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

$\tilde{X}$&R " $= \bar{\tilde{X}} \pm \tilde{A}_2 \bar{R}$; " " " "

$\bar{X}$&S " $= \bar{\bar{X}} \pm A_3 \bar{R}$; $UCL_{\bar{X}} = B_4 \bar{S}$, $LCL_{\bar{X}} = B_3 \bar{S}$