PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING

Mid Term Examination : Semester I **Academic Year :** 2008
Date : 3 August 2008 **Time : 13:30 – 16:30**
Subject : 225-345 Quality Control **Room : R 300**

ทุจริตในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น
และพักการเรียน 1 ภาคการศึกษา

PART A

Instructions :

1. **There are 2 parts (A and B), 5 questions, 100 points.**
2. **Attempt all questions.**
3. **Books and notes are allowed.**
4. **A calculator is allowed.**
5. **Borrowing things from other students is prohibited.**

Part	Problem no.	Full Score	Score
A	1	20	
	2	15	
	3	20	
B	4	20	
	5	25	
	Total	100	

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1. Control charts for $\bar{X}$ and S have been maintained on a process and have exhibited statistical control. The sample size is n = 6. The control chart parameters are as follows .

$\bar{X}$ Chart	S Chart
UCL = 708.2	UCL = 3.420
CL = 706.0	CL = 1.738
LCL = 703.8	LCL = 0.052

(a) Estimate the mean and standard deviation of the process. (5 points)

(b) What is the value of k for k-sigma control limit ? (5 points)

(c) Suppose the process mean shifts to 702.0 while the standard deviation remains constant. What is the probability of an out of control signal occurring on the first sample following the shift ?

(10 points)

2. A control chart for nonconformities is to be constructed with $\bar{c}$ = 2.0, LCL = 0 and UCL such that the probability of a point plotting outside control limits when $\bar{c}$ = 2.00 is only 0.005.

(a) Find the UCL (10 points)

(b) What is the type I error probability if the process is assumed to be out of control ? (5 points)

3. A continuous sampling plan is to be constructed in a continuous processing line of a company. The average production rate of this line is 10 pieces per minute with an average defective rate of 1.5 %. The Average Outgoing Quality Limit of the process is 1.0 %

(a) Determine a continuous sampling plan when the fraction inspection rate is 1 piece per 10 minutes. (10 points)

(b) Calculate the average fraction of total manufactured units passed under the sampling procedure in long run. (10 points)

PART B

Part	Problem no.	Full Score	Score
B	4	20	
	5	25	
	5.1	6	
	5.2	10	
	5.3	4	
	5.4	5	

4. A multiple sampling plan is as follows :

Sample no.	Sample size	Acceptance no.	Rejection no.
1	5	*	2
2	5	0	2
3	5	1	3

*** : Acceptance not permitted on the first sample.**

Assuming that lot size is large and the process average is 10% defective.

a.) What is the probability that the lot will be rejected in the first sampling ?
(5 points)

b.) What is the probability of acceptance ? **(15 points)**

5. Answer the following problems.

5.1 From the following MIL-STD-105E acceptance sampling plan for AQL 0.15%. Find the probability of acceptance of a lot. And also find the average sample number of this plan if this is a complete inspection.

$n_1 = 315 \qquad Ac = 0 \qquad \mathrm{Re} = 3$

$n_2 = 315 \qquad Ac = 3 \qquad \mathrm{Re} = 4$

5.2 Find a single sampling plan for which $p_1 = 0.01$, $\alpha = 0.05$, $p_2 = 0.10$, and $\beta = 0.10$ for lot size N = 10,000

5.3 From problem 5.2 if it is rectifying sampling plan, find the AOQ, $AOQL$, and ATI of this sampling plan.

5.4 Find MIL-STD-105E (double sampling plan) when lot size = 500 and AQL = 0.10%, inspection level I for normal inspection, tightened inspection, and reduced inspection.