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**Prince of Songkla University  
Faculty of Engineering**

**Mid term Examination : Semester I  
Date : August 2, 2009  
Subject : 225-345 Quality Control**

**Academic Year : 2009  
Time : 13:30-16:30  
Room : R300, หัวหุ่นยนต์**

ทฤษฎีในการสอบ โทษขั้นต่ำปรับตกในรายวิชานั้น  
และพักการเรียน 1 ภาคการศึกษา

**PART A**

**Instructions:**

1. There are 2 parts (A and B), 6 questions, 100 points.
2. Attempt all questions.
3. Books and note are allowed.
4. A calculator is allowed.
5. Borrowing things from other students is prohibited.

Part	Prob. No.	Full Score	Score
A	1	20	
	2	15	
	3	15	
B	4	15	
	5	25	
	6	10	
<b>Total</b>		<b>100</b>	

**Assoc. Prof. Dr. Sunchai Klinpikul  
Asst. Prof. Dr. Nikorn Sirivongpaisal  
Instructors**

1. Control charts for variables ( $\bar{X}$  and R) are in use with the following values :

$$\begin{array}{rcl} \bar{X} & = & 360 \\ n & = & 7 \end{array}$$

$$\bar{R} = 8.90$$

Both charts exhibit control and the distribution is normal.

(a) Determine the control charts for  $\bar{X}$  and R charts at 3-sigma control limit. ( 5 points )

(b) What is the error type I of the  $\bar{X}$  chart? ( 7 points )

(c) Suppose the mean of the process shifts to 357, what is the probability that the shift will not be detected on the first sample of the following shift ? ( 8 points )

2. A process is being controlled with a fraction nonconforming control chart. The process average has been shown to be 0.07. Three sigma control limits are used, and the procedure calls for taking daily samples of 100 items.

(a) Calculate the control limits of the control chart. (5 points)

(b) If the process average is suddenly shift to 0.10, what is the probability that the shift would be detected on the first subsequent sample? (10 points)

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**3. A continuous processing line of a particle board company has an average production rate of 600 pieces per hour. The average fraction defective is 1.2%. The company uses the continuous sampling plan with a fraction inspection rate of 1 piece for every 5 minutes.**

**(a) Using AOQL 1.0%, determine the sampling plan of the company. (5 points)**

**(b) Calculate AOQ of the process. (10 points)**

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**PART B**

Part	Problem no.	Full Score	Score
<b>B</b>	4	15	
	5	25	
	5.1	5	
	5.2	5	
	5.3	15	
	6	10	

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**4. Two double sampling plans for defectives are as follows:**

Plan 1: AQL = 4%

<b>Sample no.</b>	<b>Sample size</b>	<b><u>Acceptance no.</u></b>	<b><u>Rejection no.</u></b>
1	8	0	2
2	8	1	2

Plan 2: AQL = 6.5%

<b>Sample no.</b>	<b>Sample size</b>	<b><u>Acceptance no.</u></b>	<b><u>Rejection no.</u></b>
1	8	0	2
2	8	1	2

**Assuming that lot size is large.**

- a.) What is the probability that the lot will be rejected in the first sampling for each plan? (5 points)**
  
- b.) What is the probability of acceptance for each plan? Which plan has higher probability of acceptance? (10 points)**

**5. Suppose that a vendor ships components in lots of size 5000. A single sampling plan with  $n=50$  and  $c=2$  is being used for receiving inspection. Rejected lots are 100% inspected, and all defective items are reworked and returned to the lot.**

**5.1 Find the level of lot quality (fraction defective) that will be rejected 90% of the time.**

**5.2 Design a single sampling plan with  $c=0$  that will give a 0.90 probability of rejection of lots having the quality level found in 5.1.**

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**5.3** Suppose that incoming lots are 0.5% defective. What is the probability of rejecting these lots under both plans from 5.1 and 5.2? Calculate the *ATI*, *AOQ*, and *AOQL* for both plans.





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**6. A product is supplied in lots of size  $N = 10,000$ . The AQL has been specified at 0.10%. Find the normal, tightened, and reduced double sampling plan from MIL-STD-105E, assuming general inspection level II. Also find the probability of acceptance in the first lot of each plan.**

