

**PRINCE OF SONGKLA UNIVERSITY
FACULTY OF ENGINEERING**

Mid Term Examination Semester 2

Academic Year : 2006

Date : December 24, 2006.

Time : 09:00 – 12:00

Subject : 225-348 Quality Control

Room : A401

**ทฤษฎีในการสอบโทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทฤษฎี
และพักการเรียน 1 ภาคการศึกษา**

Instruction :

1. There are 5 questions, 100 points.
2. Books and notes are allowed.
3. A calculator and a dictionary are allowed.
4. Borrowing things from other students is prohibited.

Problem No.	Full	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	

**Assoc. Prof. Dr. Sunchai Klinpikul
Instructor**



1. The following \bar{X} and R charts based on $n = 4$ have shown statistical control :

\bar{X} chart

UCL = 710
Center Line = 700
LCL = 690

R chart

UCL = 83.78
Center Line = 17.833
LCL = 0

a. Estimate the process parameter \bar{X}' and σ' (5 points)

b. If the specifications are at 705 ± 15 , and the process output is normally distributed, estimate the fraction of nonconforming. (10 points)

c. From \bar{X} chart, find the probability of a type-one error, assuming the standard deviation is constant. (5 points)



2. A control chart for fraction defective indicates that the current process average is 0.03. The sample size is constant at 200 units.

(a) Find a 3-sigma control limits for the control chart. (5 points)

(b) What is the probability that a shift in the process average to 0.08 will be detected on the first subsequent sample? (15 points)



3. A control chart is to be established on a process producing refrigerators. The inspection unit is one refrigerator, and a common chart for nonconformities is to be used. As preliminary data, 16 nonconformities were counted in inspecting 30 refrigerators.

(a) What is the 3 – sigma control limits ? (5 points)

(b) What is error type I for this control chart ? (7 points)

(c) What is error type II if the average number of defects is 2.00 ? (8 points)



4. (a) Find a single sampling plan for which $AQL = 0.01$, $\alpha = 0.05$, $LTPD = 0.10$ and $\beta = 0.10$. (5 points)

(b) Consider the single sampling plan found in (a), suppose that lots of $N = 2,000$ are submitted and the plan is converted to a rectified single sampling plan. Draw the AOQ curve and find the AOQL. (10 points)

(c) Calculate the ATI from the rectified sampling plan in (b) if the process average is 2 percent defective. (5 points)



5. Answer the following questions :

(1) How can you observe the control charts and conclude that the process is in statistical control ? (4 points)

(2) Given a lot size of 5,000, AQL = 0.15 %, inspection level III, tightened inspection, what is the single sampling plan ? (4 points)



(3) From the same lot size as given in question (2), if a rectified sampling plan is being used at the process average of 0.1 % and AOQL = 3.0 %, what is the proper sampling plan with minimum ATI ? (4 points)

(3) From the same lot size as given in question (2), if a rectified sampling plan is being used at the process average of 0.1 % and AOQL = 3.0 %, what is the proper sampling plan with minimum ATI ?

(4 points)

(4) What is a double sampling plan, given $\alpha = 0.05$, $\beta = 0.10$, AQL = 1.2 %, LTPD = 8.2 %, and $n_1 = n_2$.

(4 points)

(5) Given AOQL = 1.9 % and a fraction unit inspected of 1/10, what is the number of consecutive units of product inspected which found to be free of defective under CSP-1 plan ?

(4 points)

