Name _____ Student ID _____

Prince of Songkla University
Department of Industrial Engineering, Faculty of Engineering

Mid Term Examination: Semester 2   Academic Year: 2009
Date: 20 December 2009   Time: 13:30-16:30
Subject: 225-345 Quality Control   Room: A401

ทุจริตในการสอบ โทษขั้นต่ำ คือ ปรับตกในรายวิชาที่ทุจริต และพักการเรียนหนึ่งภาคการศึกษา

Instructions: Read carefully
1. All materials are allowed.
2. There are 5 problems. Do all of them. Also show your work clearly and legibly.
3. Answer the questions in this test paper, only.
4. You must write your name and your student ID in every page of the test.
5. Total score is 100 points.

Distribution of Score

Problem	Points	(a)	(b)	(c)
1	20	4	9	7
2	20	10	10	
3	20	8	12	
4	20	5	15	
5	20	10	10	

Tests are prepared by
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Problem 1: (20 points) Sample of size $n = 12$ are collected from a process every half hour. After 30 samples have been collected, the calculation of $\bar{\bar{X}} = 20.0$, $\bar{S} = 1.5$ and $\bar{R} = 2.0$ has been made. Assume that both charts exhibit under control condition and that the quality characteristic is normally distributed.

(a) Find the 3-sigma control limits on $\bar{X}$ and S charts.

(b) From problem (a), if the process mean shifts to 22, what is the probability of concluding that the process is still in control?

(c) If process engineer would like to use $\overline{X} - R$ chart instead of $\overline{X} - S$ chart in problem (a), find the 2-sigma control limits on $\overline{X}$ and R charts from the above given information.

Problem 2: (20 points) The data below represent the number of defects per 1000 meters in telephone cable produced in the XYZ company.

Sample no.	Number of defects	Sample no.	Number of defects	Sample no.	Number of defects
1	1	9	0	17	3
2	1	10	19	18	6
3	3	11	24	19	7
4	7	12	6	20	4
5	8	13	9	21	9
6	10	14	11	22	20
7	5	15	15		
8	13	16	8		

(a) Select and build the appropriate control chart in the provided graph paper (Page 5). And from your control chart, would you conclude that the process is in statistical control?

(b) What control limits would you recommend for future process control of this company?
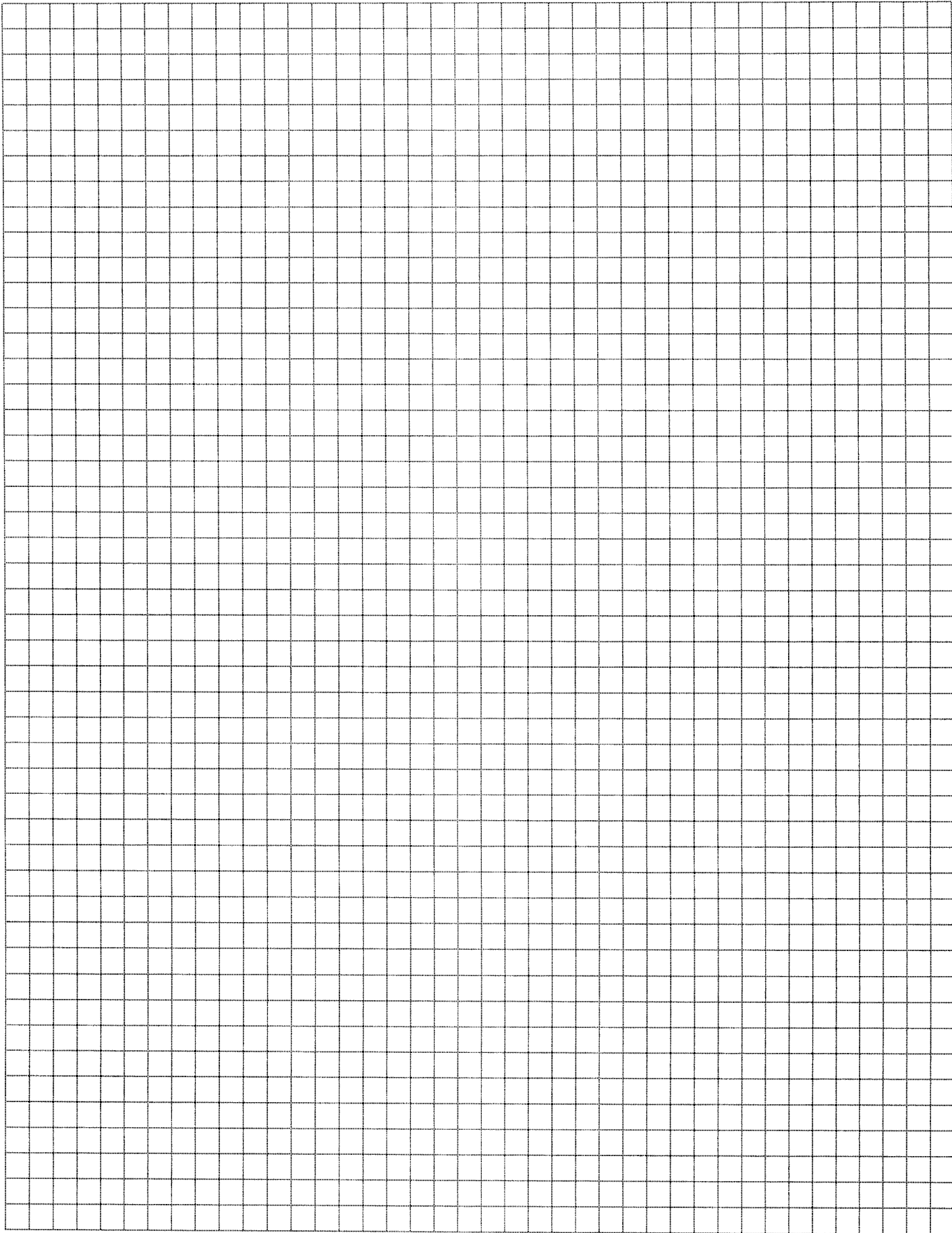
Problem 3: (20 points) A double sampling plan for a particular QC inspection point is the following.

$$N = 10,000$$
$$n_1 = 50, c_1 = 0$$
$$n_2 = 100, c_2 = 2$$

(a) Find the probability of accepting the lot if the fraction defective is 0.01.

(b) If this plan is converted to a rectified double sampling plan, what is the average outgoing quality and the average total number if inspection per lot?

Problem 4: (20 points) 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 fraction defective is 10%.
(a) What is the probability that the lot will be rejected in the first sampling?

(b) What is the probability of acceptance?

Problem 5: (20 points) 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.

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