



PAMIBIA UNIVERSITY
OF SCIENCE AND TECHNOLOGY

FACULTY OF HEALTH AND APPLIED SCIENCES

DEPARTMENT OF MATHEMATICS AND STATISTICS

QUALIFICATION: Bachelor of science Honours and Applied and Statistics	
QUALIFICATION CODE: 08BSSH	LEVEL: 8
COURSE CODE: SQC801S	COURSE NAME: STATISTICAL QUALITY CONTROL
SESSION: JUNE 2019	PAPER: THEORY
DURATION: 3 HOURS	MARKS: 100

FIRST OPPORTUNITY EXAMINATION	
EXAMINER	Dr CR. KIKAWA
MODERATOR:	PROF SATHIYA APPUNNI

INSTRUCTIONS
<ol style="list-style-type: none">1. Answer ALL the questions in the booklet provided.2. Show clearly all the steps used in the calculations.3. All written work must be done in blue or black ink and sketches must be done in pencil.

PERMISSIBLE MATERIALS

1. Non-programmable calculator without a cover.

THIS QUESTION PAPER CONSISTS OF 4 PAGES (Including this front page)

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DEPARTMENT OF MATHEMATICS AND STATISTICS
STATISTICAL QUALITY CONTROL: SQC801S

FIRST OPPORTUNITY EXAMINATION, JUNE 2019
Maximum Marks - 100

1. Question One (20 marks)

The fill volume of a soft drink beverage is being analyzed for variability. Ten bottles, randomly selected from the process, are measured, and the results are as follows.

10.05, 10.03, 10.02, 10.04, 10.05, 10.01, 10.02, 10.02, 10.03, 10.01

Required to perform the manual calculations necessary to answer the following questions.

- (a) Calculate the sample average. (3 marks)
- (b) Calculate the sample standard deviation. (3 marks)
- (c) A mechatronic assembly is subjected to a final functional test. Suppose that defects occur at random in these assemblies, and that defects occur according to a poisson distribution with parameter $\lambda = 0.02$
- (i) what is the probability that an assembly will have exactly one defect? (3 marks)
- (ii) what is the probability that an assembly will have one or more defects? (3 marks)
- (d) With reference to part (c), suppose that you improve the process so that the occurrence rate is cut in half. What effect does this have on the probability that an assembly will have one or more defects? (8 marks)

2. Question Two (20 marks)

- (a) Explain the three control charts for attributes used in quality control (6 marks)
- (b) Define the concept of **fraction nonconforming** and also the statistical distribution on which the control chart for fraction nonconforming is based. (5 marks)
- (c) Based on samples of 20 Internal Revenue Service auditors, each handling 100 files, we find that the total number of mistakes in handling files is 220. Find the 95.45% upper and lower control limits. (9 marks)

3. Question Three (20 marks)

Consider the following 16 samples provided in a sample table 1. Each sample consists of 4 inspections. Determine a control chart for nonconformities. Is the process in control?

Table 1: Table of the 16 samples

Sample	No. of Nonconformities
1	1
2	3
3	2
4	1
5	0
6	2
7	1
8	5
9	2
10	1
11	0
12	2
13	1
14	1
15	2
16	3

4. Question Four (20 marks)

A process is in statistical control with $\bar{x} = 30.7$ and $\bar{R} = 2.5$. The control chart uses a sample size of $n = 2$. Specifications are at 40 ± 5 . The quality characteristic is normally distributed.

a) Determine the potential capability of the process, \hat{C}_p .

(10 marks)

b) Determine the actual capability of the process, i.e. $\hat{C}_{pk} = \min(\hat{C}_{pu}, \hat{C}_{pl})$

(10 marks)

5. Question Five (20 marks)

(a) Describe the concepts (a) Acceptance sampling, (b) single-sampling plan, (c) double-sampling plan, (d) sequential-sampling plan, (e) lot tolerance proportion defective, as used in the lot-by-lot acceptance sampling for attributes. (10 marks)

(b) Briefly discuss the logical procedure for the lot-by-lot sampling plan. (5 marks)

(c) If four samples (items) are chosen from a population with a defective rate of 0.1, what is the probability that;
(a) exactly one of the items is defective
(b) at most one is defective (5 marks)

END