FACULTY OF SCIENCE AND ENGINEERING

DEPARTMENT OF MATHEMATICS AND STATISTICS

MID-TERM ASSESSMENT EXAMINATION 1

INSTRUCTIONS TO CANDIDATES

- This exam will start at 12:05, and will last 45 minutes.
- Each question will be worth either 5 Marks. There are 20 Marks worth of questions.
- All questions must be attempted (LENS students please see below)
- Write all of your answers in the exam script. Write the script number on any other documents you submit.
- It is your responsibility to return the script to collection box. An audit of scripts will take place immediately after the exam. If your script is account for in that audit, you are deemed to be absent, and will receive no marks.
- **IMPORTANT for LENS Student:** Specifically approved LENS students have to answer any 3 of the 4 questions .
  - Question 1 Part A and Question 1 Part B count as a single question. If you choose to attempt Question 1, you must answer both parts.

Attempt ALL questions

Q1. Descriptive Statistics A (3 Marks)

Consider the following data set of seven numbers:

```
23 27 28 15 32 33 17
```

For this sample, compute the following descriptive statistics:

a. (1 Mark) The mean,

b. (1 Mark) The variance,

c. (1 Mark) The standard deviation.

Part B

Data on the durations (measured in months) were collected for a random sample of product development projects. The durations for these development projects were collected and tabulated as follows:

12	11	20	19	18	9	16	15

i. (1 Mark) Calculate the mean of the project durations.

ii. (2 Marks) Calculate the variance for this sample.

iii. (1 Mark) Calculate the standard deviation for this sample.

Q1. Descriptive Statistics B (2 Marks)

The heights for a group of forty rowing club members are tabulated as follows:

127	136	136	143	146	146	146	147	150	156
156	160	161	161	163	164	166	166	167	168
169	171	171	172	172	172	172	174	175	176
176	176	180	180	182	183	184	186	186	188

a. (1 Mark) The median,

b. (1 Mark) The inter-quartile range.

Q2. Dixon Q Test For Outliers (5 Marks)

The typing speeds for one group of 12 Engineering students were recorded both at the beginning of year 1 of their studies. The results (in words per minute) are given below:

118	146	149	142	170	153
137	161	156	165	178	159

Use the Dixon Q-test to determine if the lowest value (118) is an outlier. You may assume a significance level of 5%.

i. (1 Mark) Formally state the null hypothesis and the alternative hypothesis.

ii. (1 Mark) Compute the Test Statistic.

iii (1 Mark) State the correct critical value. (See Back of Exam Paper)

iv. (2 Mark) By comparing the Test Statistic to the appropriate Critical Value, state your conclusion for this test.

Q3. Normal Distribution (3 Marks)

Assume that the diameter of a critical component is normally distributed with a Mean of 200mm and a Standard Deviation of 4mm. You are required to estimate the approximate probability of the following measurements occurring on an individual component.

i. (1 Mark) Greater than 204.9mm

ii. (2 Marks) Less than 196.2 mm

Use the normal tables to determine the probabilities for the above exercises. You are required to show all of your workings.

Q4. Confidence Interval for a Proportion (5 Marks)

The strength of dosage of a plant growth enhancement chemical is often measured by the proportion of plants that grow faster. A particular dosage of the chemical is fed to 115 plants of these plants, 94 actually show faster growth.

i. (1 Mark) Calculate a point estimate $\hat{p}$ for the proportion of plants that grow faster due to the dosage.

ii. (2 Marks) What is the standard error of the estimate?

iii. (2 Marks) Find a 95% confidence interval for the proportion.

Critical Values for Dixon Q Test

N	$\alpha = 0.10$	$\alpha = 0.05$	$\alpha = 0.01$
3	0.941	0.970	0.994
4	0.765	0.829	0.926
5	0.642	0.710	0.821
6	0.560	0.625	0.740
7	0.507	0.568	0.680
8	0.468	0.526	0.634
9	0.437	0.493	0.598
10	0.412	0.466	0.568
11	0.392	0.444	0.542
12	0.376	0.426	0.522
13	0.361	0.410	0.503
14	0.349	0.396	0.488
15	0.338	0.384	0.475
16	0.329	0.374	0.463