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 1 or 2 Marks. There are 15 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 selection of questions that have an aggregate mark of 12 Marks.
  - They may skip any three of the 1-Mark Questions
  - OR - They may skip a 1-Mark Question and a 2-Mark Question
  - The mark will be rescaled by 125 %.
  - They are advised to skip questions that are indicated by an asterisk symbol ("$*$"), but it is not compulsory that they do so.

Attempt ALL questions

Q1. Dixon Q Test For Outliers (4 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) State the Null and Alternative Hypothesis for this test.

ii. (1 Marks) Compute the test statistic

iii. (1 Mark) State the appropriate critical value.

iv. (1 Mark) What is your conclusion to this procedure

Part B

Assume that the length of injected moulded plastic components are normally distributed with a mean of 12.5mm and a standard deviation of 2.5mm. Calculate the corresponding probability for the following measurements occurring on an individual component.

i. (2 Marks) Between 12.5 and 15mms,

ii. (2 Marks) Less than 10 mms,

iii. (2 Marks) Between 12 and 15 mms,

iv. (2 Marks) Less than 10.3 mms.

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

(Write Your Answers Here)

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.

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.

Part C

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.

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 203.9mm

ii. (2 Marks) Less than 195.2 mm

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

(Write Your Answers Here)

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.