



UNIVERSITY OF SWAZILAND

FINAL EXAMINATION, 2010/11

- PROGRAMME:**
- Bachelor of Science in Agricultural and Biosystems Engineering Year II**
 - Bachelor of Science in Agricultural Economics and Agribusiness Year II**
 - Bachelor of Science in Agricultural Education Year II**
 - Bachelor of Science in Agronomy Year II**
 - Bachelor of Science in Animal Science Year II**
 - Bachelor of Science in Consumer Science Year II**
 - Bachelor of Science in Consumer Science Education Year II**
 - Bachelor of Science in Food Science, Nutrition and Technology Year II**
 - Bachelor of Science in Horticulture Year II**
 - Bachelor of Science in Textile and Apparel Design and Management Year II**

COURSE TITLE: ELEMENTARY STATISTICS

COURSE CODE: AEM 201

TIME ALLOWED: TWO (2) HOURS

**INSTRUCTION: THIS PAPER CONTAINS SIX QUESTIONS;
ANSWER ANY FOUR QUESTIONS
EACH QUESTION CARRIES 25 MARKS**

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Question 1

(a) The probability that an American industry will be located in Munich is 0.7, the probability that it will be located in Brussels is 0.4, and the probability that it will be located in either Munich or Brussels or both is 0.8. What is the probability that the industry will be located:

- (i) in both cities?
 (ii) in neither city?

(8 marks)

(b) A random sample of 200 adults are classified below by sex and their level of education attained.

Education	Male	Female
Elementary	38	45
Secondary	28	50
College	22	17

Let M be the event that a male is selected; F be the event that a female is selected; E, S and C be the events that the person selected has Elementary, Secondary and College education respectively.

If a person is picked at random from this group, find the probability that:

- (i) the person is a male **(2 marks)**
 (ii) the person has elementary education **(2 marks)**
 (iii) the person is a female who has college education **(2 marks)**
 (iv) the person is a male without college education **(2 marks)**
 (v) the person is a male, given that the person has a secondary education **(3 marks)**
 (vi) The person does not have a college degree, given that the person is a female **(3 marks)**
 (vii) Are events M and S independent? Support your answer. **(3 marks)**

Question 2

A fish shop owner recorded the daily turnover (in Emalangeni) of his outlet for 300 trading days as shown in the frequency table.

Daily Turnover (E)	No. of Days
500 - < 750	15
750 - < 1000	23
1000 - < 1250	55
1250 - < 1500	92
1500 - < 1750	65
1750 - < 2000	50

- (i) Find the average turnover of the fish shop **(5 marks)**
 (ii) Find the median daily turnover of the fish shop and interpret its meaning. **(6 marks)**
 (iii) Identify the maximum daily turnover associated with the slowest 25% of trading days **(7 marks)**.
 (iv) What daily turnover separates the busiest 25% of trading days from the rest? **(7 marks)**

Question 3

The grades of 9 students on a midterm report (x) and on the final examination (y) are as follows:

x	77	50	71	72	81	94	96	99	67
y	82	66	78	34	47	85	99	99	68

- (a) Determine the strength of the relationship between midterm score and exam score. **(10 marks)**
 (b) Estimate the linear regression line **(12 marks)**
 (c) Estimate the final examination grade of a student who received a grade of 85 on the midterm report. **(3 marks)**

Question 4

- (a) If the probability that a fluorescent light has a useful life of at least 800 hours is 0.9, find the probabilities that among 20 such lights:
 (i) Exactly 18 will have a useful life of at least 800 hours; **(2 marks)**
 (ii) At least 15 will have a useful life of at least 800 hours; **(3 marks)**
 (iii) At least 2 will **not** have a useful life of at least 800 hours. **(4 marks)**
- (b) On average a certain intersection results in 3 traffic accidents per month. What is the probability that for any given month at this intersection:
 (i) No accident will occur? **(3 marks)**
 (ii) At least 2 accidents will occur? **(3 marks)**
- (c) The tensile strength of a certain metal component is normally distributed with a mean of 10,000 kilograms per square centimetres and a standard deviation of 100 kilograms per square centimetre. Measurements are measured to the nearest 50 kilograms per square centimetre.
 (i) What proportion of these components exceed 10,150 kilograms per square centimetre in tensile strength? **(5 marks)**
 (ii) If specifications require that all components have tensile strength between 9800 and 10,200 kilograms per square centimetre, what proportion of pieces would we expect to scrap? **(5 marks)**

Question 5

- (a) A UCLA researcher claims that the life span of mice can be extended by as much as 25% when the calories in their food are reduced by approximately 40% from the time they are weaned. The restricted diets are enriched to normal levels by vitamins and protein. Assuming that it is known from previous studies that $\sigma=5.8$ months, how many mice should be included in our sample if we wish to be 99% confident that the mean lifespan of the sample will be within 2 months of the population mean for all mice subjected to this reduced diet? **(12 marks)**
- (b) A machine is producing metal pieces that are cylindrical in shape. A sample of pieces is taken and the diameters are 1.01, 0.97, 1.03, 1.04, 0.99, 0.98, 0.99, 1.01 and 1.03 centimetres. Find a 99% confidence interval for the mean diameter of pieces from this machine, assuming an approximate normal distribution. **(13 marks)**

Question 6

(a) The random variable X , representing the number of cherries in a cherry puff, has the following probability distribution:

x	4	5	6	7
$P(X=x)$	0.2	0.4	0.3	0.1

(i) Find the mean μ and the variance σ^2 of X . **(5 marks)**

(ii) Find the mean $\mu_{\bar{x}}$ and the variance $\sigma_{\bar{x}}^2$ of the mean \bar{X} for random samples of 36 cherry puffs. **(4 marks)**

(iii) Find the probability that the average number of cherries in 36 cherry puffs will be less than 5.5? **(4 marks)**

(b) A manufacturer claims that the average tensile strength of thread A exceeds the average tensile strength of thread B by at least 12 kilograms. To test his claim, 50 pieces of each type of thread are tested under similar conditions. Type A thread had an average tensile strength of 86.7 kilograms with a standard deviation of 6.28 kilograms while type B thread had an average tensile strength of 77.8 kilograms with a standard deviation of 5.61 kilograms. Test the manufacturer's claim using a 0.05 level of significance. **(12 marks)**