



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

SEPTEMBER – DECEMBER 2019 TRIMESTER

SCHOOL OF BUSINESS

DEPARTMENT OF ACCOUNTING AND FINANCE

ODEL PROGRAMME

CMS 311: BUSINESS STATISTICS

Date: DECEMBER 2019

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and any other TWO Questions

Q1. i) In each of the 4 races, the democrats have 60% chance of winning.
Assuming that the races are independent of each other, what is the probability that:

- a) The Democrats will win 0 races, 1 race, 2 races, 3 races, or 4 races? **(10 Marks)**
- b) The Democrats will win at least 1 race. **(4 Marks)**
- c) The Democrats will win a majority of the races.

(4

Marks)

ii) A discrete random variable (RV) has the following Probability Distribution:

X	1	2	4	5	8
Pr(x)	0.20	0.25		0.30	0.10

Required:

- a) Find the $\Pr(4)$ **(3 MARKS)**
- b) Find the $((\Pr(x) = 2) \text{ or } (\Pr(x) = 4))$. **(3 MARKS)**
- c) Find the $\Pr(x \leq 4)$ **(3 MARKS)**
- d) Find the $\Pr(x < 4)$ **(3 MARKS)**

Q2. a) Two workers on the same job show the following results over a long period of time.

	Worker A	Worker B
Mean time of completing the job (minutes)	30	25

Standard deviation (minutes)

6

4

- i) Which worker appears to be more consistent in the time he requires to complete the job? Explain. **(7marks)**

(7 Marks)

- ii) Which worker appears to be faster in completing the job? Explain. **(6 Marks)**

- b) Suppose the manager of a plant is concerned with the total number of man-hours lost due to accidents for the past 12 months. The company statistician has reported the mean number of man-hours lost per month but did not keep a record of the total sum. Should the manager order the study repeated to obtain the desired information? Explain your answer clearly.

(7 Marks)

Q3. The price of the standard family saloon car and the company market share was recorded for a random sample of 12 car manufacturers.

Selling price \$'00	137	138	125	142	168	145	135	145	160	146	136	160
Market share %	14	15	10	8	9	7	11	5	3	5	7	2

Required:

- a) Plot the data on a scatter diagram and comment. **(4 Marks)**
b) Calculate the product moment correlation coefficient. **(10 Marks)**
c) Interpret the result obtain in (b) above **(6 Marks)**

Q4. An insurance salesperson sells an average of 1.4 policies per day.

- a) Using the Poisson formula, find the probability that this salesperson will sell no insurance policy on a certain day. **(5 Marks)**
b) Let x denote the number of insurance policies that this salesperson will sell on a given day. Using the Poisson probabilities table, write the probability distribution of x . **(5 Marks)**
c) Find the mean, variance, and standard deviation of the probability distribution developed in part b. **(10 Marks)**

CMS 311 BUSINESS STATISTICS FORMULAE

PARAMETERS

- Population mean = $\mu = (\sum X_i) / N$
- Population standard deviation = $\sigma = \sqrt{[\sum (X_i - \mu)^2 / N]}$
- Population variance = $\sigma^2 = \sum (X_i - \mu)^2 / N$
- Variance of population proportion = $\sigma_p^2 = PQ / n$
- Standardized score = $Z = (X - \mu) / \sigma$

Statistics

Unless otherwise noted, these formulas assume simple random sampling.

- Sample mean = $\bar{x} = (\sum x_i) / n$
- Sample standard deviation = $s = \sqrt{[\sum (x_i - \bar{x})^2 / (n - 1)]}$
- Sample variance = $s^2 = \sum (x_i - \bar{x})^2 / (n - 1)$
- Variance of sample proportion = $s_p^2 = pq / (n - 1)$

Counting

- n factorial: $n! = n * (n-1) * (n-2) * \dots * 3 * 2 * 1$. By convention, $0! = 1$.
- Permutations of n things, taken r at a time: ${}_nP_r = n! / (n - r)!$
- Combinations of n things, taken r at a time: ${}_nC_r = n! / r!(n - r)! = {}_nP_r / r!$

Probability

- Rule of addition: $P(A \cup B) = P(A) + P(B) - P(A \cap B)$
- Rule of multiplication: $P(A \cap B) = P(A) P(B|A)$
- Rule of subtraction: $P(A') = 1 - P(A)$

Random Variables

In the following formulas, X and Y are random variables, and a and b are constants.

- Expected value of $X = E(X) = \mu_x = \sum [x_i * P(x_i)]$
- Variance of $X = \text{Var}(X) = \sigma^2 = \sum [x_i - E(x)]^2 * P(x_i) = \sum [x_i - \mu_x]^2 * P(x_i)$
- Normal random variable = z-score = $z = (X - \mu) / \sigma$
- Chi-square statistic = $X^2 = [(n - 1) * s^2] / \sigma^2$
- f statistic = $f = [s_1^2 / \sigma_1^2] / [s_2^2 / \sigma_2^2]$
- Expected value of sum of random variables = $E(X + Y) = E(X) + E(Y)$
- Expected value of difference between random variables = $E(X - Y) = E(X) - E(Y)$

Sampling Distributions

- Mean of sampling distribution of the mean = $\mu_x = \mu$
- Mean of sampling distribution of the proportion = $\mu_p = P$
- Standard deviation of proportion = $\sigma_p = \sqrt{P * (1 - P) / n} = \sqrt{PQ / n}$
- Standard deviation of the mean = $\sigma_x = \sigma / \sqrt{n}$
- Standard deviation of difference of sample means = $\sigma_d = \sqrt{(\sigma_1^2 / n_1) + (\sigma_2^2 / n_2)}$

Standard Error

- Standard error of proportion = $SE_p = s_p = \sqrt{p * (1 - p) / n} = \sqrt{pq / n}$
- Standard error of difference for proportions = $SE_p = s_p = \sqrt{p * (1 - p) * [(1/n_1) + (1/n_2)]}$
- Standard error of the mean = $SE_x = s_x = s / \sqrt{n}$
- Standard error of difference of sample means = $SE_d = s_d = \sqrt{(s_1^2 / n_1) + (s_2^2 / n_2)}$

- Standard error of difference of paired sample means = $SE_d = s_d = \{ \text{sqrt} [(\sum(d_i - d)^2 / (n - 1))] \} / \text{sqrt}(n)$

Discrete Probability Distributions

- Binomial formula: $P(X = x) = b(x; n, P) = {}_n C_x * P^x * (1 - P)^{n-x} = {}_n C_x * P^x * Q^{n-x}$
- Mean of binomial distribution = $\mu_x = n * P$
- Variance of binomial distribution = $\sigma_x^2 = n * P * (1 - P)$
- Negative Binomial formula: $P(X = x) = b^*(x; r, P) = {}_{x-1} C_{r-1} * P^r * (1 - P)^{x-r}$
- Mean of negative binomial distribution = $\mu_x = rQ / P$
- Variance of negative binomial distribution = $\sigma_x^2 = r * Q / P^2$
- Poisson formula: $P(x; \mu) = (e^{-\mu}) (\mu^x) / x!$
- Mean of Poisson distribution = $\mu_x = \mu$
- Variance of Poisson distribution = $\sigma_x^2 = \mu$

Multinomial formula: $P = [n! / (n_1! * n_2! * \dots * n_k!)] * (p_1^{n_1} * p_2^{n_2} * \dots * p_k^{n_k})$

END