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MAIN EXAMINATION

AUGUST - DECEMBER 2018 TRIMESTER

FACULTY OF COMMERCE

DEPARTMENT OF ACCOUNTING AND FINANCE

SPECIAL EXAMINATION

CMS 311: BUSINESS STATISTICS

Date: OCTOBER 2018	**Duration: 2 Hours**
INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions	

Q1. a) The probability that a student passes Statistics is 0.8 if he/she studies for the exam and 0.3 if he/she does not study. If 60% of the class studied for the exams, and a student chosen at random from the class passes:

i) What is the probability that the student passed? **(5 marks)**

ii) What is the probability that the student studied? **(5 marks)**

b) 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:

i) Plot the data on a scatter diagram and comment. **(4 marks)**

ii) Calculate the product moment correlation coefficient. **(10 marks)**

iii) Interpret the result obtain in (b) above **(6 marks)**

Q2. a) Attempt the following:

a) Define Bernoulli distribution. Also state its mean and variance. **(2 marks)**

b) Let X be a Poisson variable with P[x = 0] = 0.15. Find the mean and variance of X. **(2 marks)**

c) If P(A) = 0.3, P(B) = 0.4 and P(A/B) = 0.32. Find P(A U B) **(2 marks)**
d) Find ‘n’ if $^nP_2 = 132$ **(2 marks)**

b) Attempt the following:

a) Define independence of two events and mutually exclusive events. Can two events be independent and mutually exclusive simultaneously? Justify your answer with suitable illustration. **(3 marks)**

b) Let X and Y be two independent Binomial variables with parameters (6, 0.4) and (8, 0.4) respectively.

Find:

i) P(X + Y = 2) **(3 marks)**
ii) P(X + Y > 8) **(3 marks)**
iii) Mean of (X + Y) and variance of (X + Y) **(3 marks)**

Q3. The data below show the earnings per day (in shillings) of 50 casual workers.

236	283	222	249	265	263	221	224	228	217
204	293	259	266	296	283	242	288	238	215
240	283	226	296	245	291	211	219	212	264
207	268	245	263	284	238	274	254	251	237
263	206	248	277	238	264	253	291	281	269

Required:

a) A grouped frequency table starting with class 200 – 209, and using a class width of 10. **(6 marks)**

b) Use the frequency distribution to compute

i) The mean **(5 marks)**
ii) The standard deviation **(5 marks)**

Determine the coefficient of skewness. (use the frequency table) **(4 marks)**

Q4. a) The scores on an aptitude test required for entry into a certain job position have a mean of 500 and a standard deviation of 120. If a random sample of 36 applicants has a mean of 546, is there evidence that their mean score is different from the mean that is expected from all applicants? **(10 marks)**

b) The training department of a company wishes to determine if there is any difference in the performance between the workers that have completed a training program and those that have not completed the program. A sample of 100 trained workers reveals an average output of 74.3 parts per hour with a sample standard deviation of 16 parts per hour. A sample of 100 who have not been trained has an average output of 69.7 parts per hour with a standard deviation of 18 parts per hour. Is there evidence of a difference in output between the two groups? Write a 95% confidence interval estimate of the difference. **(10 marks)**

CMS 311 BUSINESS STATISTICS FORMULAE

PARAMETERS

- Population mean = $\mu = (\Sigma X_i) / N$
- Population standard deviation = $\sigma = \text{sqrt} [\Sigma (X_i - \mu)^2 / N]$
- Population variance = $\sigma^2 = \Sigma (X_i - \mu)^2 / N$
- 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 = $x = (\Sigma x_i) / n$
- Sample standard deviation = $s = \text{sqrt} [\Sigma (x_i - x)^2 / (n - 1)]$
- Sample variance = $s^2 = \Sigma (x_i - x)^2 / (n - 1)$
- Variance of sample proportion = $s_p^2 = pq / (n - 1)$

Counting

- n factorial: $n! = n * (n-1) * (n - 2) * . . . * 3 * 2 * 1$. 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 = $E(X) = \mu_x = \Sigma [x_i * P(x_i)]$
- Variance of X = $Var(X) = \sigma^2 = \Sigma [x_i - E(x)]^2 * P(x_i) = \Sigma [x_i - \mu_x]^2 * P(x_i)$
- 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 = σ_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 = σ_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 = $SE_d = s_d$ = { sqrt [$(\Sigma(d_i - d)^2 / (n - 1)$] } / sqrt(n)

Discrete Probability Distributions

- Binomial formula: $P(X = x) = b(x; n, P) = {}_nC_x * P^x * (1 - P)^{n - x} = {}_nC_x * P^x * Q^{n - x}$
- 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: $P = [n! / (n_1! * n_2! * ... n_k!)] * (p_1^{n_1} * p_2^{n_2} * . . . * p_k^{n_k})$

END