HCMC UNIVERSITY OF TECHNOLOGY AND EDUCATION

Faculty for High Quality Training

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FINAL EXAMINATION

SEMESTER 2 - ACADEMIC YEAR 2022-2023

Course name: Probability and application

Course ID: MATH132901E

Duration: 90 minutes. Number of pages: 02 pages

Open book.

Question 1. (1.0/10) A company manufactures electronic devices with two factories: Factory A and Factory B. Factory A produces 60% of the devices, while Factory B produces 40% of the devices. The defective rate for Factory A is 3%, while the defective rate for Factory B is 8%. If you purchase a device that is defective, what is the probability that it was produced by Factory A?

Question 2. (2.0/10) The lifespan, denoted by X (in years), of a product from factory H is a random variable with a probability density function

$$f(x) = \begin{cases} k(10-x)^{-3} & 0 < x < 6, \\ 0 & \text{otherwise.} \end{cases}$$

a. Find k and compute $P(X \geq 5)$.
b. Compute $E(X)$ and $\sigma(X)$.

Question 3. (1.5/10) The test scores of a class of students follow a normal distribution with mean of 7.5 and standard deviation of 0.8.
a. What is the probability that a randomly selected student scores below 7?
b. If a random sample of 10 students is taken, what is the probability that at most 3 students with test scores greater than 7?

Question 4. (3.5/10)
Observe the lifespan X (*unit: months*) of some randomly selected products from company **A**, we obtained the following data:

X	9-12	12-15	15-18	18-21	21-24	24-27	27-30	30-33
The number of products	26	36	59	76	66	46	45	36

Suppose that X has a normal distribution.
a. Calculate and interpret a confidence interval at the 99% confidence level for the true average lifespan of company **A**'s products.
b. Calculate and interpret a confidence interval at the 95% confidence level for the true proportion of Company **A**'s products that have a lifespan of over 2 years.
c. Company **A** only makes a profit when the true proportion of products that require warranty service is below 9%. There is a suggestion to offer a one-year warranty for the products. Draw a conclusion about this proposal with a significance level of 6%.

Question 5. (1.0/10) Recent incidents of food contamination have caused great concern among consumers. The article *"How Safe Is That Chicken?"* reported that 55 of 90 randomly selected Perdue brand broilers tested positively for either campylobacter or salmonella (or both), the leading bacterial causes of food-borne disease, whereas 69 of 92 Tyson brand broilers tested positive. Does it appear that the true proportion of contaminated Perdue broilers differs from that for the Tyson brand? Test the appropriate hypotheses at significance level 0.03.

Question 6. (1.0/10) Observe a paired sample of 2 random variables (X, Y), we get the following data

X	109	110	111	112	113	113	114	115	116	116	117	118	119	119	121
Y	184	187	190	194	196	198	212	204	208	211	212	217	221	223	228

Determine the correlation coefficient for the above set and the equation of the regression line. Use your regression line to estimate the value of Y when $X = 125$?

Note: Proctors are not allowed to give any unauthorised explaination.

Learning outcome mapping	**Assessed in**
[LO 2.1.1]: Compute mean, median, mode, standard deviation, variance, and know their function	Question 1
[LO 2.4.3; 2.4.4]: Become familiar with various graphical representations of data and learn to recognize misleading graphs.	Question 2
[LO 2.1.1; 2.1.2; 2.4.3; 2.4.4]: Use binomial, normal, Poisson distributions, Hyper geometric distribution and their relationships.	Questions 3
[LO 2.1.1, 2.1.2]: Calculate the confidence intervals for proportion, mean, variance based on a sample collected.	Question 4
[LO 2.1.3, 2.1.4]: Use test procedures to solve and develop proficiency in its applications.	Question 5
[LO 2.4.4]: Use linear regression model.	Question 6

May 15^{th}, 2023

Approved by program chair

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