

## Daffodil International University

# Department of Computer Science and Engineering Faculty of Science & Information Technology Semester Final Examination, Spring 2024

Course Code: STA 227, Course Title: Statistics and Probability

Level: 2 Term: 2 Batch: 63

Time: 02:00 Hrs

Marks: 40

## Answer ALL Questions

[The figures in the right margin indicate the full marks and corresponding course outcomes. All portions of each question must be answered sequentially.]

1.	a)	A digital ma	rketing	age	ncy m	nanages	multi	ple w	ebsites	for v	arious	clients.	They are	[2]	CO1
		interested in predicting website traffic to optimize their marketing strategies and resource										CO			
		allocation. They collect data on various factors that may influence website traffic, such as advertising expenditure, social media engagement, search engine ranking, and time of day.													
		They want to build a predictive model that can accurately forecast website traffic based on													
		these factors. <b>Define</b> a multiple linear regression model to predict website traffic based on various IT-													
		related factors		near i	regress	sion mo	odel to	predic	t webs	site trai	ne bas	eu on va	illous II		
1	b)	Consider the		nent (	of rolli	ing a pa	ir of 6-	sided	dice si	multan	eously	and show	v the	[2]	
		Sample Space	e. Also	Find	I the pr	robabili	ty of sa	me nu	ımbers			1	1 72 1	£13	
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		EF JULY			,				-1-:1:4-	0				[5]	
	(a)	Compare wh	ich cha	racte	eristic i	is show	ing mo	re vari	ability	!					
	a)						1 -	C -1		- f		atant va	riabla	151	DISTRICT
	<i>b)</i>	Show the sha	pe char	acter	istics l	by the f	ormula	of ske	ewness	of mo	re consi	istent va	riable	[5]	
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<i>b)</i>	Probability that a patient recovers from a rare blood disease is 0.4. if 5 people are known to have this disease. Simplify the probabilities that,  i) Exactly 3 people will survive ii) At least two survive iii) None will survive iv) find the mean and variance of the distribution.	[5]
c)	<b>Justify</b> that there is a significant relationship between Length of service and yearly wages (use data question no-03) used at the 0.05 significance level, interpret your findings. [Tabulated Value: 2.306].	[5]

## **Formulas**

## **Basic Concepts of Probability**

General Rule of Addition

$$P (A \text{ or } B) = P (A \cup B) = P(A) + P(B) - P(A \cap B)$$

Special Rule of Addition

$$P (A \text{ or } B) = P (A \cup B) = P(A) + P(B)$$

Conditional Probability

$$P(B|A) = P(A \text{ and } B) / P(A) = \frac{P(A \cap B)}{P(A)}$$

## Hypothesis testing

Z test statistics 
$$Z = \frac{\bar{x} - \mu}{\frac{\sigma}{\sqrt{n}}}$$

t test statistics 
$$t = \frac{\overline{X} - \mu}{s / \sqrt{n}}$$

Testing the significance of the correlation

$$t = \frac{r}{\sqrt{\frac{1 - r^2}{n - 2}}}$$

### Measure of Dispersion

Range=  $X_{max}$  -  $X_{min}$ 

Mean Deviation, M.D =  $\frac{\sum_{i=1}^{n} |x_i - \overline{x}|}{n}$ 

Population variance

$$\sigma^2 = \frac{\sum_{i=1}^N (X_i - \mu)^2}{N}$$

Population standard deviation,  $\sqrt{\sigma^2}$ 

Sample variance

$$s^2 = \frac{\sum_{i=1}^{N} (X_i - \bar{X})^2}{n - 1}$$

Sample standard deviation,  $\sqrt{s^2}$ 

Coefficient of variation for

population, C.V= $\frac{\sigma}{\mu}$ ×100

Coefficient of variation for sample,

$$C.V = \frac{s}{\bar{x}} \times 100$$

# Correlation and Regression analysis

Regression Coefficient

$$\hat{\beta}_{l} = \frac{\sum_{i=1}^{n} (x_{i} - \overline{x})(y_{i} - \overline{y})}{\sum_{i=1}^{n} (x_{i} - \overline{x})^{2}}$$

$$\hat{\beta}_0 = \overline{y} - \hat{\beta}_1 \overline{x}$$

#### Correlation Coefficient

$$r = -\frac{N\Sigma xy - (\Sigma x)(\Sigma y)}{\sqrt{\left[N\Sigma x^2 - (\Sigma x)^2\right]\left[N\Sigma y^2 - (\Sigma y)^2\right]}}$$

$$r = \frac{\sum_{i=1}^{n} (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum_{i=1}^{n} (X_i - \bar{X})^2} \sqrt{\sum_{i=1}^{n} (Y_i - \bar{Y})^2}}$$

#### **Binomial Distribution**

$$f(x;n,p) = \begin{cases} \binom{n}{x} p^x q^{n-x} & \text{for } x = 0,1,2,...,n \\ 0; & \text{otherwise} \end{cases}$$

Poison Distribution

$$f(x;\lambda) = \begin{cases} \frac{e^{-\lambda} \lambda^x}{x!} & \text{for } x = 0, 1, 2, ..., \infty. \\ 0; & \text{otherwise} \end{cases}$$

#### Shape of the distribution

Coefficient of Sknewness,

$$\begin{aligned} \text{Sk} &= \frac{3 \times (Mean-Median)}{standard\ deviation} \\ \text{Kurtosis}\ \beta_2 &= \frac{\mu_4}{\mu_2^2} \end{aligned}$$

Kurtosis 
$$\beta_2 = \frac{\mu_2}{\mu_2^2}$$