Set-A

AMERICAN INTERNATIONAL UNIVERSITY – BANGLADESH
Faculty of Science and Technology
Department of Mathematics
MAT 3103: Computational Statistics and Probability (All Sections)

Midterm Examination Summer: 2021-22

Total Marks: 40 Time: 1.5 hours

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Instruction: Answer any **four** sets of questions.

1. The following is the distribution of consumption of electricity (MW/locality) in different days:

Class Interval	4-6	6-8	8-10	10-12	12-14	Total
Frequency	5	8	15	18	4	50

a) How many days are there which consumption of electricity is **less than 8 MW**? 2
b) Calculate the **median** of the distribution. 4
c) Also, calculate the **standard deviation** for the distribution. 4

2. **a)** Two bits are produced one by one from a device. The device is such that it produces Fine (F) bits 30% times and Noisy (N) bits 70% times. Find the probability that **i)** both bits are Noisy, and **ii)** at least one bit is Fine. 5

b) There are 40 students in a course at AIUB, out of which, 22 are from EEE and 18 are from CSE department. The CGPA of 12 EEE and 8 CSE students are found to be good. One student is selected randomly. Find the probability that the selected student is **i)** from EEE department or CGPA is good, and **ii)** from CSE dept. given that CGPA is not good. 5

3. The joint probability density function of two continuous random variables X and Y is:

$$f(x, y) = 4xy;\ 0 < x < 1,\ 0 < y < 1.$$

a) Show that X and Y are independent random variables. 2
b) Calculate $E(2X + 3)$. 4
c) Calculate $V(4X - 2)$. 4

4. **a)** In an industry, 55% employees get wounded during work. Five employees are selected randomly. Find the probability that out of the 5, **(i)** 1 employee gets wounded, and **(ii)** at best 2 employees get wounded. 5

b) The average number of signals sent from Dhaka railway station, not reaching properly to Chittagong railway station, is 4 per day. Find the probability that on a particular day, the number of signals not reaching properly is **(i)** at best 1, and **(ii)** at least 2. 5

5. **a)** The mode of the density of light radiation is 3. Find the probability that the density of a randomly selected radiation will be **(i)** more than 2, and **(ii)** less than 4. 5

b) The average time needed to get service in a bank is 5 minutes. Find the probability that a random client will be served **(i)** within 4 to 7 minutes, and **(ii)** after 6 minutes. 5

List of formulas	
$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} x_i$	$\bar{x}_G =$ Antilog $(\frac{1}{n}\sum_{i=1}^{n} log x_i)$
$\bar{x}_H = \frac{n}{\sum_{i=1}^{n}\frac{1}{x_i}}$	$\bar{x} = \frac{1}{n}\sum_{i=1}^{n} f_i x_i$
$\bar{x}_G$= Antilog $(\frac{1}{n}\sum_{i=1}^{n} f_i log x_i)$	$\bar{x}_H = \frac{n}{\sum_{i=1}^{n}\frac{f_i}{x_i}}$
$M_e = L + \frac{\frac{n}{2} - c}{f} \times h$	$M_o = L + \frac{f_m - f_1}{2f_m - f_1 - f_2} \times h$
SK = mean – median	SK = mean – mode
MD = $\frac{1}{n}\sum_{i=1}^{n}\lvert x_i - \bar{x}\rvert$	$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n}(x_i - \bar{x})^2$
CV = $\frac{\text{Standard deviation}}{Mean} \times 100\%$	MD = $\frac{1}{n}\sum_{i=1}^{n} f_i\lvert x_i - \bar{x}\rvert$
$\sigma^2 = \frac{1}{n}\sum_{i=1}^{n} f_i(x_i - \bar{x})^2$	$E(AX \pm B) = AE(X) \pm B$
$V(AX \pm B) = A^2V(X)$	$E(AX \pm BY) = AE(X) \pm BE(Y)$
$E(X) = \sum_{x=0}^{\infty} x\, p(x)$	$E(X) = \int_x x\, f(x)\, dx$
$E(X^2) = \int_x x^2 g(x)\, dx$	$E(X^2) = \sum_{x=0}^{\infty} x^2\, p(x)$
$V(X) = E(X^2) - [E(X)]^2$	$P(H_i \mid E) = \frac{P(E \mid H_i)\, P(H_i)}{P(E)} = \frac{P(E \mid H_i)\, P(H_i)}{\sum P(E \mid H_i)\, P(H_i)}$
$P(X = k) = p(1-p)^{k-1}$	$V(AX \pm BY) = A^2V(X) + B^2V(Y)$
$P(X = x) = n_{c_x}\, p^x\, q^{n-x}$	$P(X = x) = \frac{e^{-\lambda}\lambda^x}{x!}$
$P(X > x) = e^{-\frac{x}{\lambda}}$	$P(X < x) = 1 - e^{-\frac{x}{\lambda}}$
$P(X > x) = e^{-\frac{x^2}{2\sigma^2}}$	$P(X < x) = 1 - e^{-\frac{x^2}{2\sigma^2}}$
$P(x_1 < X < x_2) = e^{-\frac{x_1}{\lambda}} - e^{-\frac{x_2}{\lambda}}$	$P(x_1 < X < x_2) = e^{-\frac{{x_1}^2}{2\sigma^2}} - e^{-\frac{{x_2}^2}{2\sigma^2}}$