

# Probability and Statistics

(MT2005)

Date: April 3<sup>rd</sup> 2024

## Course Instructors

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## Sessional-II Exam

Total Time (Hrs): 1

Total Marks: 45

Total Questions: 03

Roll No

Section

Student Signature

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Attempt all the questions on answer book.

**CLO 4:** Determine the type of discrete distribution and evaluate its probability distribution.

Q 1:

[Marks:4+4=8]

An article in *Information Security Technical Report* ["Malicious Software—Past, Present and Future" (2004, Vol. 9, pp. 6–18)] provided the following data on the top ten malicious software instances for 2002. The clear leader in the number of registered incidences for the year 2002 was the Internet worm "Klez," and it is still one of the most widespread threats. This virus was first detected on 26 October 2001, and it has held the top spot among malicious software for the longest period in the history of virology. The ten most widespread malicious programs for 2002 are:

Place	Name	% Instances
1	I-Worm.Klez	61.22%
2	I-Worm.Lentin	20.52%
3	I-Worm.Tanatos	2.09%
4	I-Worm.BadtransII	1.31%
5	Macro.Word97.Thus	1.19%
6	I-Worm.Hybris	0.60%
7	I-Worm.Bridex	0.32%
8	I-Worm.Magistr	0.30%
9	Win95.CIH	0.27%
10	I-Worm.Sircam	0.24%

Suppose that 20 malicious software instances are reported. The malicious sources are assumed to be independent.

- What is the probability that at least two instances are "Klez"?
- What are the expected value and standard deviation of the number of "Klez" instances among the 20 reported?

**CLO 4: Determine the type of discrete distribution and evaluate its probability distribution.**

**Q 2:**

[Marks:5+3+17=25]

Test two integrated circuits one after the other. On each test, the possible outcomes are *a* (accept) and *r* (reject) with sample space;  $S = \{aa, ar, ra, rr\}$ . Assume that all circuits are acceptable with probability 0.9 and that the outcomes of successive tests are independent. Count the number of acceptable circuits  $X$  with values ( $x = 0, 1, 2$ ) and count the number of successful tests before you observe the first reject  $Y$  with values ( $y = 0, 1, 2$ ). (If both tests are successful, let  $y = 2$ .)

- Complete the following joint probability distribution of  $X$  and  $Y$ .
- Find the marginal probability distributions for the random variables  $X$  and  $Y$ .
- Calculate the correlation between number of acceptable circuits ( $X$ ) and number of tests before observing the first reject ( $Y$ ). Also interpret the result.

$f(x,y)$		$Y$		
		0	1	2
$X$	0		0	0
	1			
	2	0		0.81

**CLO 5: Determine the type of continuous distribution and evaluate its probability distribution.**

**Q3:**

[Marks:4+4+4=12]

In a data science project focused on analyzing the sizes of files stored in a database, you're examining the file sizes with varying magnitudes. The size of each file, represented by the continuous random variable  $X$ , follows a probability density function (pdf) given by

$$f(x) = \begin{cases} Cx^2, & 1 < x < 4 \\ 0, & \text{Otherwise} \end{cases}$$

Where  $X$  represents the file size in kilobytes (KB) and  $C$  is a constant.

- Determine the value of  $C$ .
- Derive the Cumulative Distribution Function and show the complete CDF properly.
- Calculate the probability that the file size lies between 1.5 KB and 3.5 KB.