National University
of Computer & Emerging Sciences Peshawar Campus

Program: BS (CS & SE)
Semester: Spring-2022
Time Allowed: **01 hour**
Course: Probability & Statistics (MT2005)

Examination: **SESSIONAL-II**
Total Marks: 40, Weightage: **15**
Date: 11/05/2022
Instructors: Osama Sohrab & Askar Ali

NOTE: ATTEMPT ALL PROBLEMS.

Problem # 01   Marks =10

(a) A system may become infected by some spyware through the internet or e-mail. Seventy percent of the time the spyware arrives via the internet, thirty percent of the time via email. If it enters via the internet, the system detects it immediately with probability 0.6. If via e-mail, it is detected with probability 0.8. What percentage of times is this spyware detected?

(b) For any three events A, B and C, show that

$$P(A \cup B \cup C) = P(A) + P(B) + P(C) - P(AB) - P(AC) - P(BC) + P(ABC)$$

Problem # 02   Marks=10

Two electronic components of a missile system work in harmony for the success of the total system. Let X and Y denote the life in hours of the two components. The joint PDF of X and Y is

$$f(x,y) = \begin{cases} ye^{-y(1+x)}, & x, y \geq 0, \\ 0, & \text{elsewhere.} \end{cases}$$

(a) Find the marginal PDFs for both random variables.

(b) What is the probability that the lives of both components will exceed 2 hours?

Problem # 03   Marks =10

A radar system is designed such that the probability of detecting the presence of an aircraft in its range is 98%. However if no aircraft is present in its range it still report (falsely) that

an aircraft is present with a probability of 5%. At any time, the probability that an aircraft is present within the range of the radar is 7%.

(a) What is the probability that no aircraft is present in the range of the radar given that an aircraft is detected?

(b) What is the probability that no aircraft is present in the range of the radar given that no aircraft is detected?

Problem # 04   **Marks =10**

(a) Find the PMF of the random variable whose CDF is given by

$$
F(a) = \begin{cases} 0 & a < 1 \\ \frac{1}{2} & 1 \leq a < 2 \\ \frac{5}{6} & 2 \leq a < 3 \\ 1 & 3 \leq a \end{cases}
$$

(b) A continuous random variable X that can assume values between $x = 2$ and $x = 5$ has a density function given by $f(x) = 2(1 + x)/27$. Find $P\{X < 4\}$.

THE END