Assignment 1: Probability and Statistics
2024-2025 (Odd Semester): Department of Computer Science and Engineering

1. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accident involving a scooter driver is 0.01, a car driver is 0.03 and a truck driver is 0.15. If one of an insured person meets with an accident, what is the probability that he is a car driver?

2. A bin contains 5 defective (that immediately fail when put in use), 10 partially defective (that fail after a couple of hours of use), 25 acceptable transistors. A transistor is chosen at random from the bin and put into use. If it does not immediately fail, what is the probability it is acceptable?

3. A random variable X has the following probability function:

Value of $X = x_i$	0	1	2	3	4	5	6	7
$p(x_i)$	0	k	$2k$	$2k$	$3k$	k^2	$2k^2$	$7k^2 + k$

   a) Find k,
   b) Evaluate $P(X < 6), P(X \geq 6)$,
   c) If $P(X \leq a) > \frac{1}{2}$, find the minimum value of a,
   d) Determine the distribution function of X.

4. Suppose that two dimensional continuous random variable (X,Y) has joint probability density function given by:

$$f(x,y) = \begin{cases} 6x^2y, & 0 < x < 1, 0 < y < 1, \\ 0, & elsewhere. \end{cases}$$

   a) Verify

$$\int_0^1 \int_0^1 f(x,y)dx\,dy = 1.$$

b) Find $P(0 < X < \frac{3}{4}, \ \frac{1}{3} < Y < 2)$,

c) $P(X + Y < 1)$,

d) $P(X > Y)$ and

e) $P(X < 1 \mid Y < 2)$.

5. Given a standard normal distribution, find the value of k such that

   a) $P(Z > k)=0.3015$ and

   b) $P(k < Z < -0.18) = 0.4197$.

6. A certain machine makes electrical resistors having a mean resistance of 40 ohms and a standard deviation of 2 ohms. Assuming that the resistance follows a normal distribution and can be measured to any degree of accuracy, what percentage of resistors will have a resistance exceeding 43 ohms?

7. Suppose that it is known that the number of items produced in a factory during a week is a random variable with mean 50. What can be said about the probability that this week's production will exceed 75? If the variance of a week's production is known to equal 25, then what can be said about the probability that this week's production will be between 40 and 60?

8. Assume that 50% of all engineering students are good in Mathematics. Determine the probabilities that among 18 engineering students

   a) exactly 10

   b) at least 10

   c) at most 8

   d) at least 2 and at most 9 are good in mathematics.

9. In a book of 520 pages, 390 typo-graphical errors occur. Assuming Poisson law for the number of errors per page, find the probability that a random sample of 5 pages will contain no error.

10. In a precision bombing attack there is a 50% chance that any one bomb will strike the target. Two direct hits are required to destroy the target completely. How many bombs must be dropped to give a 99% chance or better of completely destroying the target?