⇨ **Students having ID ended by odd/even digits need to solve the following problem of odd/even serials. Each student has to solve 26 problems out of 52 problems.**

1. Out of 375 students, 120 students study economics, 170 students study accounting, and 50 students study none of the subjects. How many students do not study both of the subjects?

2. A company looks at its employee's residence and finds that, all have at least one flat, 80% have a more than one flat, 30% have a duplex flat, and 15% have more than one flat including a duplex flat. Find the probability that an employee selected at random has a flat that is not duplex.

3. A fair dice rolled twice. The event R is such that the sum of the two outcomes is 7. The event S is such that the product of the two outcomes is 12. Find the probability of R and S. Are events R and S independent? Justify your answer.

4. Two dice are rolled. Consider the events are occurred as $A = \{\text{odd } sides\ on\ the\ first\ roll\}$ and $B = \{sum\ of\ the\ dice\ is\ odd\}$. Determine whether the events are independent or not.

5. Two cards are drawn successively and without replacement from an ordinary deck of playing cards. Compute the probability of drawing a club on the first draw and a Jack on the second draw.

6. If 3 men try work with the probability of success 0.5, 0.3, 0.6, respectively. What is the probability of the work will be done?

7. In a quality checking line, 4 experts are working with the rate of success 95%, 98%, 96%, and 92%, respectively. If the experts can work independently to find a fault, find the probability that (i) the fault can't be found (ii) one of the experts will fail to find the fault.

8. In a bus out of 48 passengers, 34 are men and in another bus out of 56 passengers, 24 are women. Say a passenger is transferred from the first bus to the second bus. For the capacity problem, one of the passengers of the second bus has to come down later, find the probability that this passenger is a man.

9. A boy has three red coins and five white coins in his left hand, six red coins and four white coins in his right hand. If he shifts one coin at random from his left to right hand, what is the probability of his then drawing a coin of same/different color from his right hand?

10. Consider $\mathrm{P(A)} = 0.54$ and $\mathrm{P(B)} = 0.48$ to find $P(A \cup B)$ and $\mathrm{P(A' \cup B')}$ such that A and B are of the (i) independent events (ii) mutually exclusive events.

11. Four inspectors look at a critical component of a product. Their probabilities of detecting an error by those inspectors are different, namely, 0.98, 0.95, 0.92, 0.89 respectively. If inspections are independent, then find the probability of (i) no one detecting the error (ii) at least one detecting the error (iii) only one inspector detecting the error.

12. Die A has orange on one face and blue on five faces, Die B has orange on two faces and blue on four faces, Die C has orange on three faces and blue on three faces. If all are fair dice, picture the sample space.
    i. If the three dice are rolled, find the probability that at least two of the three dice come up orange.
    ii. If you are given, at least two of the three dice come up orange, find the probability that exactly two of the three dice come up orange.

13. Suppose that on five consecutive days an "instant winner" lottery ticket is purchased and the probability of winning is $\frac{1}{5}$ on each day. Assuming independent trials, find the probability of purchasing two winning tickets.

14. In a shopping mall, 3 customer executives sold 30%, 45%, and 25% of the total selling product in a financial year. The rates of efficiency of these three executives are 98%, 99%, and 96% respectively. If a fault is found find the probability that, it may occur by the second executive.

15. Rapid testing is a screening procedure to test Covid-19. The people appearing in the test, 23% of them false-positive while 17% of them false-negative. If the Covid-19 spreads among 7% people in Bangladesh, find the probability of a person who is suffering in Covid-19, when he/she tested negative in the test.

16. At an office, officials are classified and 30% of them efficient, 50% are moderate worker, and 20% are unfit for the work. Of efficient ones, 15% left the job; of the moderate workers, 20% left the job, and of unfit workers, 5% left the job. Given that an employee left the job, what is the probability that the employee is unfit one? Consider independence for the employee classes.

17. In a company, two managers are working with a workload ratio of 2:3. The managers do some errors in their work with 3% and 4% of their works. An investigating team found an error in the yearly work summary of the company, which manager will be responsible for this incidence?

18. A hospital receives 40% of its flu vaccine from Company A and 60% from Company B. Each shipment contains a large number of vials of vaccine. From Company A, 3% of the vials are ineffective; from Company B, 2% are ineffective. A hospital is randomly selected vials from one shipment and finds that is ineffective. What is the conditional probability that this shipment came from Company A?

19. Suppose there are 5 defective items in a lot of 100 items. A sample of size 15 is taken at random without replacement. Let X denote the number of defective items in the sample. Find the probability that the sample contains (i) at most one defective item (ii) exactly three defective items.

20. Let the random variable X be the number of days that a certain patient needs to be in the hospital. Suppose X has the *pmf* $f(x) = 0.1(5 - x); x = 1,2,3,4$. If the patient is to receive \$100 for the first day, \$50 for the second day, \$25 for the third day and have to return \$25 for the fourth day, what is the expected payment for the hospitalization? What is the standard deviation of that payment?

21. Let a random experiment be the casting of a pair of fair *five-sided* dice and let X equal the maximum of two outcomes. With reasonable assumptions, find *pmf* of X. Also, find the mean and variance of X.

22. For $f(x) = c(x + 1)^3; x = 0,1,2, \dots \dots \dots 10$, determine the constant c so that $f(x)$ satisfies the conditions of being *pmf* for a random variable X, and then depict *pmf* as line graph and histogram.

23. Let the random variable X have the *pmf* $f(x) = \frac{(|x|-1)^2}{21}; x = -4, -2, 0, 2, 4$. Compute the mean, variance, $E(X^2 - 3X + 4)$ and $V(1 - 2X)$.

24. In a bet, the betting person wins \$1, \$2 and \$3 with probabilities 0.3, 0.2 and 0.1, and loses \$1 with probability 0.4 for each \$1 bet. Find $E[3X^2 - 2X + 4]$.

25. If the *mgf* of X is $M(t) = \frac{4}{10}e^t + \frac{3}{10}e^{2t} + \frac{2}{10}e^{3t} + \frac{1}{10}e^{4t}$, find the corresponding *pmf*, mean and variance.

26. Flaws in a certain type of drapery material appear on the average of one in 120 square feet. If we assume a Poisson distribution, find the probability of no more than one flaw appearing in 60 square feet.

27. In the gambling game craps, the player wins \$1, \$2 and \$3 with probabilities 0.3, 0.2 and 0.1, and loses \$1 with probability 0.4 for each \$1 bet. What is the expected profit of the game for the player? Also, find the variance of the profit.

28. A boiler has five relief valves. The probability that each does not work is 0.05. Find the probability that (i) none of them work (ii) at least four of them work.

29. If X has a Poisson distribution such that $P(X = 1) = 2P(X = 2)$, evaluate $P(X = 5)$. Also, find the standard deviation of the distribution.

30. Let X have a Poisson distribution with a standard deviation of 2. Find $P(X \geq 1)$.

31. It is claimed that 20% of the birds in a particular region have a severe disease. Suppose that 15 birds are selected at random. Let X is the number of birds that are have the disease. Assuming independence, how X is distributed? Find $P(X \geq 2)$ and $P(X \leq 14)$.

32. It is claimed that for a particular lottery, $\frac{1}{10}$ of the 50 million tickets will win a prize. What is the probability of winning at most three prizes if you independently purchase 15 tickets?

33. A random variable X has a binomial distribution with mean 10.5 and variance 3.15. How X is distributed and find $P(X \geq 1)$.

34. Suppose that in a region the probability of arresting an innocent person is 15%. If 500 people are arrested, assuming Bernoulli experiment find the probability of arresting 35 innocent persons. Find the probability by Poisson process as well.

35. Suppose that 90% of UIU students are multi-taskers. In a random sample of 10 students are taken and let X is the number of multi-taskers. Assuming independence, how X is distributed? Find the standard deviation of X. Also, compute $P(X \geq 2)$ and $P(X > 8)$.

36. Verify that $M(t) = (0.4 + 0.6e^t)^{15}$ is a *mgf* of a binomial distribution and find the *pmf* of it. Evaluate the mean and variance of the binomial distribution?

37. Consider the *mgf* $M(t) = \frac{0.3e^t}{1-0.7e^t}$ of random variable X. How X is distributed? Find the mean and variance of X.

38. Let the *mgf* of the random variable X satisfies uniform distribution is $M(t) = \begin{cases} \frac{e^{4t}-1}{4t} ; t \neq 0 \\ 1 ; t = 0 \end{cases}$. Find the *pdf*, mean and variance of X. Also, find $P(X > 3.5)$.

39. Let the random variable X have the *pdf* $f(x) = 2e^{1-2x}; x \geq \frac{1}{2}$, find the *cdf* and hence the 3rd decile of the distribution.

40. For $f(x) = 4x^c ;\ 0 \leq x \leq 1$, find the constant c so that $f(x)$ is a *pdf* of a random variable X. Find μ, σ^2 and cdf of X. Also, sketch the graph of *pdf* and *cdf*.

41. Assume the *pdf* of X be $f(x) = 3e^{-3x} ;\ 0 \leq x < \infty$. Then, (i) Estimate the *cdf* of X (ii) Calculate the mean and variance of X (iii) Find $P(X \geq 2)$.

42. The life X (in years) of a voltage regulator of a car has the *pdf* $f(x) = \frac{3x^2}{7^3} e^{-\left(\frac{x}{7}\right)^3}$ defined in $0 \leq x < \infty$. What is the probability that it will last at least 10.5 years? If it has lasted for 10.5 years, find the conditional probability that it will last at least 7 years more. Also, find the median (position) of X.

43. Telephone calls arrive at a physician's office according to the Poisson process on average 2 every 5 minute. Let X denote the waiting time in minutes until 3 calls arrive. Find the *pdf* and compute $P(X > 2)$.

44. Accident occurs at a countryside road at a mean rate of 4 per day. Assuming that the number of accidents per hour has a Poisson process, find the probability that at 2 accidents occur in a particular day.

45. Customers arrive at a travel agency at a mean rate of 3 per 2 hours. Assuming that the number of arrivals per hour has a Poisson process, find the probability of waiting 2 hours for the first customers.

46. If X has a gamma distribution with $\theta = 5$ and $\alpha = 2$. Find $P(X \geq 6)$. What are the mean and variance of the gamma distribution?

47. If the *mgf* of a gamma distribution of a random variable X is $M(t) = (1 - 5t)^{-3}$, find the pdf, mean and variance of X. Also, find $P(X > 4)$.

48. Complains come to a police station according to a Poisson process on the average of 5 in every hour. Let X denote the waiting time in minutes until the first complain comes at a certain office hour. What is the *pdf* of X? Find $P(X \geq 10)$. Also, find the *median* and *mgf* of X.

49. If the *mgf* of the normal variable X is $M(t) = e^{25t+18t^2}$, find *pdf* of X. Also, find a constant c such that $P(|X - 25| \leq c) = 0.9332$.

50. If the *mgf* of the normal variable X is $M(t) = e^{30t+18t^2}$, then (i) Find a constant k such that $P(|z| \leq k) = 0.9544$ (ii) Evaluate $P(42.6 \leq x \leq 55.8)$. Also, find $-Z_{09656}$.

51. If X is a random variable satisfying $N(650, 625)$, find $P(631 \leq X \leq 676)$. Also, find a constant $c > 0$ such that $P(|X - 650| \leq c) = 0.6826$.

52. Consider the *mgf* of a Normal variate X is defined as $M(t) = e^{-8t+2t^2}$. Find $P(X < -5)$ and $P(X \geq -10)$. Also, find the value of C such that $P(X \leq C) = 0.725$.