

1) Probability Distribution:

1.1) A sociologist is studying the household composition in a tribal society and is interested mainly in the number of pre-teen children in a household. It was found that 2% household do not have any child, 7% household have 1 child, 22% of the household have 2 children, 38% household have 3 children and the remaining have 4 children each. Let the random variable X represent the number of pre-teen children in a household selected at random. Find then probability distribution of X . Calculate the mean and variance X .

1.2) An insurance company is studying the number of individuals getting hurt in each auto accident. Form a random sample of 250 auto accidents taken place last year, the company has compiled the following information:

Number of individuals getting hurt:	0	1	2	3	4	5	6
Number of such auto accidents:	78	65	37	30	25	10	5

Let, X denote the number of individuals getting hurt in an auto accident. Assuming that the above sample represents the whole population of auto accidents, find an appropriate probability distribution of X . If each injured individual incurs an average medical cost of \$1200 then what is the expected medical cost per auto accident?

1.3) Each year the small Pacific island nations get hit by destructive cyclones. On an average, each cyclone causes a per household damage of \$1250. Island Nation-A has the following probability distribution for the number of cyclones it encounters per year:

Number of Cyclones per year for Nation-A:	0	1	2	3
Probability:	0.26	0.37	0.25	0.12

Similarly island Nation-B has the following probability distribution:

Number of Cyclones per year for Nation-B:	0	1	2	3
Probability:	0.43	0.42	0.12	0.03

On a large-term basis which island nations more liveable?

1.4) A popular soft-drink company did a customer survey to determine which bottle size (in millilitre) customer preferred. A random sample of 600 customers gave the following information:

Bottle size(in ml):	200	300	500	1000
Number of customers preferring this size:	320	170	90	20

If a person is chosen at random from this group of 600 customers, then

- What is the probability that he/she prefers a bottle size greater than 200 ml?
- What is the expected value of the number of millilitre a customer will prefer?
- What is the standard deviation of number of millilitres a customer will prefer?

1.5) A small software company, based in Bangalore bids on many BOD(business process outsourcing) contracts from the western countries. Current market assessment shows that the

company has a 20% chance of winning a large contract worth about \$50,000, 35% chance of winning a medium contract worth about \$25,000 and 45% chance of winning a small contract worth \$10,000. If the company bids on one small, one medium and one large contract, then what is the expected worth of contracts it gets?

1.6) A travel insurance policy for luggage cost \$50 for each piece, and will pay policy holders \$5000 for each lost luggage, or \$500 for each damage luggage. The insurance company estimates that each year, about 1 in every 1000 luggage is lost, and about 1 in 100 luggage gets damaged.

- d) Define a suitable random variable to describe this insurance probability model.
- e) What is the insurance company's expected profit from each policy?
- f) What is the standard deviation of the random variable?

2) Discrete probability Distribution:

2.1) The probability of a man hitting a target is $\frac{1}{6}$. How many times must he fire to the target so that, the probability of hitting the target at least once is more than 90%?

2.2) A super lodge has 10 rooms and 8 cars. A boarder has to make separate arrangements for sightseeing and can hire the cars from the owners. Generally 60% customers hire the car from the same owner. In the peak season owner when all the rooms are exhausted,

- i) What is the probability that there will be more demand from the boarders for cars?
- ii) Find (assuming 1 month = 30 days and rent of a room is 300 per day) the expected gross income per month from the lodge, if the chance of being occupied a room is 0.2.

2.3) Find the minimum number of throws of an unbiased die necessary to ensure that the probability of getting a six at least once is ≥ 0.5 (given $\log 2 = 0.3010$, $\log 3 = 0.4771$).

2.4) It is reported that a safety matches company produces 5% defective match sticks. Every match box contains 50 sticks. What is the probability of getting exactly 2 defective match sticks from a particular box?

2.5) A group of 3 singers and 4 dancers attended a cultural programme. 3 of them at random took dinner in a family. If they were casually requested to sing a song, how they could honour their request. Prepare a distribution table. Find the mean and variance of the distribution.

2.6) A reputed company during its year ending defective sale, claims that 30% of their goods are damaged or rejected quality. What is the probability that a customer, requiring 5 sets of fair quality, is to search for at least 8 sets?

2.7) A coin is tossed 5 times successively and the number of heads appeared is recorded. 60 such sets of experiment are done. Following is the record of such frequency distribution.

No of heads	0	1	2	3	4	5
Frequency	2	5	22	18	10	3

Fit the binomial distribution from the observed distribution and calculate the expected frequencies.

2.8) Form the following observed frequency distribution fit a Poisson distribution and calculate expected frequencies.

x	0	1	2	3	4
f	122	60	15	2	1

2.9) Given the observed distribution:

x	0	1	2	3	4	5
f	214	125	41	16	3	1

Fit the negative binomial distribution and find expected frequencies.

2.10) Fit the following hypothetical distribution to Geometric distribution and find the expected frequencies:

x	0	1	2	3	4	5	6
f	460	140	45	25	18	10	2

2.11) Seven similar coins are tossed and the number of heads noted. The experiment is noted 100 times and the number of heads in each trail is given below. Fit a Binomial distribution and calculate the expected frequencies.

2	3	4	6	4	5	5	4	5	3	1	5	1	4	4	4	4	4	3	5
5	3	5	6	5	5	4	4	3	3	7	3	5	0	5	4	6	4	6	5
4	5	5	3	5	2	1	4	7	4	3	3	3	2	6	4	6	4	5	3
4	4	4	5	2	5	3	3	3	5	6	4	3	4	2	2	3	5	4	6
2	4	6	2	4	7	2	4	5	4	0	3	5	4	4	2	2	3	5	6

2.12) The following data shows the number of misprints in each of book containing 200 pages. Fit the Poisson distribution to the frequency distribution and calculate the expected frequencies by using **spread sheet**.

1	3	1	7	0	0	1	4	4	2	1	4	5	2	2	3	4	1	0	3
5	2	1	1	1	4	0	1	2	2	1	0	1	1	1	2	1	3	1	1
3	1	3	2	2	3	3	3	3	3	2	7	9	4	0	3	3	3	0	0
2	6	1	4	2	1	3	0	1	1	2	0	1	0	1	0	1	3	2	1
2	4	3	4	2	1	4	2	5	2	1	3	0	2	0	3	3	1	2	3
2	3	2	0	1	5	1	3	1	3	2	0	3	3	0	2	2	1	3	2
5	1	0	1	3	1	0	4	3	4	2	3	1	0	1	0	0	0	2	3
3	1	4	2	0	1	2	0	1	3	4	0	3	1	1	1	0	1	0	3
8	0	1	0	2	1	1	1	2	4	5	2	1	1	1	1	2	5	0	0
2	1	0	1	2	3	2	1	1	1	6	2	1	3	0	1	2	2	5	1

3) Continuous probability distribution:

3.1) A sample of size 1000 bulbs of a company were tested and found the average life of a bulb was 2000 hrs. and standard deviation was found to be 50 hrs. Estimate the numbers of bulbs of that company are likely to glow for

iii) More than 2100 hours.

iv) Less than 1850 hours.

v) More than 1900 hours but within 2050 hours.

3.2) To pass an examination an examinee requires at least 33 marks. To pass in second division he requires at least 51 marks but less than 60 marks and to pass in the first division he requires at least 60 marks. If the distribution of marks obtained in the examination is normal, 22% failed and 1515 out of 10,000 candidates passed in the first division, what will be the mean and standard deviation of the distribution?

3.3) Fit the Normal distribution for the following frequency distribution:

Wt. in kg	40-50	50-60	60-70	70-80	80-90
No of persons	2	12	7	3	1

3.4) There are 40 students in a statistics class in a particular college. If the habit of borrowing books, from the college library, of a student is $\frac{2}{5}$, find the minimum number of copies of a book, referred in a class, to be kept in the library so to meet more than 90% demand of the students.

3.5) The number (X) of soaps of a certain quality demanded per week by customers follows the Poisson law with parameter 9. What stock of K of this quality soap should a retailer keep in order to have a probability, of more than 0.99 of meeting all demands in his shop?

3.6) A daily passenger has taken shelter by the way of his traveling the train as soon as the rain starts. If the continuation (in minutes) of the rain follows approximately a Gamma variate with parameters $\alpha = 2$ and $p = 10$ and if the rain stops within half an hour, he can avail himself of the train at the eleventh hour. Find the probability that he would get the particular train.

3.7) During Shrabani mela at Tarakeswar the incoming flows of devotees on every Monday follows exponential distribution with parameter $\frac{1}{3}$. Considering the railway transportation as the major factor and a single trip of train from Howrah to Tarakeswar as a single unit, find the probability that there is a need of more than 9 trips on any Monday. What is the probability that out of 6 Mondays in that period on 3 days, 9 trips were insufficient?

4) Bivariate Frequency Distribution

4.1) Construct a bi-variate frequency distribution table for height and weight of interval 10 for the following data. Also find the average weight when height is 140-150 cm.

Ht(in cm)	Wt(in Kg)	Ht(in cm)	Wt(in Kg)	Ht(in cm)	Wt(in Kg)	Ht(in cm)	Wt(in Kg)
159.9	59.4	156.3	72.7	146.7	65.4	147.8	41.6
153.7	69.6	159.4	55.5	149.8	58.2	153.2	48.3
156.9	55.8	159.1	59.2	162.8	43.8	160.2	54.2
158.6	55.1	156.2	58.8	149.5	53.1	152.2	55.2
163.2	60.2	156.2	56.2	154.4	64.5	161.1	65.1
159.6	59.1	159.2	58.2	155.1	52.8	158.3	52
163.2	58.1	161.1	62.1	148	44	157.5	58
162.9	58.5	150.2	40.1	157.8	75.9	150.5	61.3
152.8	48.7	149.2	41.2	146.1	48.4	149.1	41
156.7	55.9	149.2	38.4	147.1	59.2	148.3	50.9
151.3	51	153.3	48.7	148.7	43.5	148.6	47.1
164.2	54.6	156.8	59.5	149.3	49.1	140.4	43.4
150.2	44.7	156.2	48	169.8	85.3	162.2	59.8
154.1	50.3	154.2	57.1	165.2	62.8	150.3	49.6
146.9	57.4	153.3	58.9	143.2	39.6	154.1	52.4
154.9	46.3	158.6	39.1	155.3	69.8	157.3	58.7
142.9	44.5	153.2	53	159.3	65.8	148.2	31.2
133.6	44.3	154.5	38.9	158.8	99.1	160.2	59.6
146.4	37.6	152.1	67	145.9	38.8	170.2	61.1
146.4	37.6	165.6	66.8	145.7	43	159.4	78.5
153.6	68.2	142.1	41.2	159.2	49.2	159.8	52.2
147.4	44.4	157.6	45.6	157.1	56.5	153.8	62.5
156.1	47.4	157.2	39.5	152.3	57.2	145.6	42.5
155.4	78.9	155.9	50.5	142.9	50.9	155.3	39.6
154.1	58.1	147.6	55.8	147.7	58.8	150.8	60.7
157.2	46.8	170.8	60.5	158.2	49.7	163.8	63
157.6	75.1	170.9	58.5	151.1	43.8	152.2	69.5
146.8	40.9	158.9	51.5	143.8	48.5	158.6	52.8
161.3	58.2	150.7	47.8	147.2	47.1	159.8	63.2
149.2	48.8	165.7	63.1	152.4	58.1	143.5	53.3
159.2	55.1	153.9	53.5	165.6	62.5	149.5	61.6
156.9	58.1	153.7	48.4	142.2	54.9	148.2	81.7
160.1	59.1	170.1	51.3	148.5	52.6	146.2	44.2
158.8	58.1	170.1	51.3	150.6	39	149.1	40.2
160.1	58.1	149.3	43.8	150.6	39	153.4	61.6
152.2	49.5	146.3	46.4	152.8	53.5	155.7	54.8
152.7	57.1	155.4	52.7	144.9	51.5	143.1	42.4
151.6	42.9	147.3	58.3	149.9	48.7	146.8	57.2
158.3	54.7	159.4	62.9	152.5	48	149.2	56.2
158.3	54.7	148.4	41.6	154.2	38	143.6	53.6