EXERCISE - I

A) **1.** For a binomial distribution the mean is 2 and the standard deviation is 1. Find all the constants of the distribution. **(S.U. 1999)** [**Ans. :** $n = 4,\ p = 1/2,\ q = 1/2$]

2. For a binomial distribution the mean is 12 and the variance is 4. Find all the constants. **(S.U. 2002)** [**Ans. :** $n = 18,\ p = 2/3,\ q = 1/3$]

3. Find out the fallacy if any in the following statements giving reasons :

(a) The mean of a binomial distribution is 15 and the standard deviation is 5. **(S.U. 1989)**

(b) The mean of a binomial distribution is 12 and the standard deviation is 3.

[**Ans. :** (i) False (ii) True $V(x) \not> \bar{x}$]

4. If the probability of defective bulbs is 0·2, find the mean and variance of the distribution of efective bulbs in a lot of 1000 bulbs. [**Ans. :** $\bar{x} = np = 200,\ var = npq = 160$]

5. If the mean of the binomial distribution is 2 and the variance is 4/3 find the probability of) two successes, (ii) less than two successes.

(**Hint :** Find $n, p, q.$) [**Ans. : (i)** 0·3292, **(ii)** 0·3512]

B) **1.** An examination containing multiple choice questions is designed so that the probability of a correct choice for any question by guessing alone is 0·2. What is the probability that a student will not get more than four questions right out of 20 merely by guessing? **(S.U. 1986)**

each

[**Ans. :** 0·4114]

2. In a hurdle race a player has to cross 10 hurdles. The probability that he will clear each urdle is 5 / 6. What is the probability that he will knock down less than two hurdles? **(S.U. 1997)**

[**Ans. :** 0·4845]

3. The probability that a worker will suffer from an occupational disease is 25%. What is the hance than out of 6 workers 4 or more will suffer from the disease ? **(S.U. 1986)** [**Ans. :** 0·0376]

4. 10% of the tools produced in a certain manufacturing process turn out to be defective.

(a) Find the probability that in a sample of 10 tools chosen at random exactly two will be defective. **(S.U. 1987)** [**Ans. :** 0·1937]

(b) Find the probability that out of 20 tools selected at random there are (i) exactly two defectives (ii) at least two defectives. **(S.U. 1989, 2003)**

[**Ans. : (i)** 0·2852, **(ii)** 0·3918]

5. If the probability that a new-born child is male is 0·6, find the probability that in a family of 5 children there will be exactly 3 boys. **(S.U. 1985, 2001)** [**Ans. :** 0·3456]

6. If in a lot of 500 solenoids 25 are defective, find the probability that there will be 0, 1, 2 defective solenoids in a random sample of 20 solenoids. **(S.U. 1985, 2006)**
[**Ans. : (i)** 0·3585, **(ii)** 0·3773, **(iii)** 0·1887]

7. In a room there are three lamp-sockets. A bag contains 6 working and 4 non-working bulbs. Three bulbs are selected at random and fitted in the sockets. Find the probability that there will be some light in the room. **(S.U. 1989)** [**Ans. :** 29 / 30]

8. If on an average one candidate out of 10 fails in a certain examination, find the chance that out of 5 candidates that have appeared for the examination at least 4 will be successful.
(S.U. 1985) [**Ans. :** 0·918]

9. In a locality 20% of people smoke. Find the probability that out of 6 persons chosen at random from this locality 4 or more will we found to be smokers. **(S.U. 1985, 2002)**
[**Ans. :** 0·0169]

10. Assume that on an average one telephone number out of fifteen called between 2 p.m. and 3 p.m. on weekdays is busy. What is the probability that if 6 randomly selected numbers are called (i) not more than 3, (ii) at least 3 will be busy ? **(S.U. 2003)** [**Ans. : (i)** 0·9997, **(ii)** 0·0051]

11. In a large consignment of electric bulbs, 10 percent are defective. A random sample of 20 is taken for inspection. Using Binomial distribution find the probability that (i) all are good bulbs, (ii) atmost three are defective bulbs, (iii) exactly three are defective bulbs. **(S.U. 1990, 95)**
[**Ans. : (i)** 0·1216, **(ii)** 0·8671, **(iii)** 0·1901]

12. The probability that a man aged 60 will live upto 70 is 0·65. What is the probability that out of 10 men, now 60, at least 8 would live upto 70 ? **(S.U. 1987, 90, 2006)** [**Ans. :** 0·2616]

13. The probability that a student in an evening college will graduate is 0·4. Determine the probability that out of 5 students (i) none, (ii) one, (iii) at least one will graduate. **(S.U. 1987, 2004)**
[**Ans. : (i)** 0·0778, **(ii)** 0·2592, **(iii)** 0·9222]

(C) 1. Out of 320 families with 5 children each, find the expected number of families having 0 boys, 1 boy, 2 boys, ... 5 boys, assuming boys and girls are equally likely.
(S.U. 1986, 2002, 03) [**Ans. :** 10, 50, 100, 100, 50, 10]

2. On an average a student is present on 5 days a week. Find on how many days in a course of 100 days out of 5 students of this class at least 4 will be present. [**Ans. :** 56]

3. Six fair coins are tossed simultaneously. If 192 such tosses are made find the expected number of tosses showing (i) one and only one heads (ii) no heads (iii) all heads.
[**Ans. : (i)** 18, **(ii)** 3, **(iii)** 3]

4. In a sampling of a large number of parts produced by a machine, the mean number of defectives in a sample of 20 is 2. Out of such 1000 samples how many samples would you expect to contain at least three defective ? **(S.U. 1985)** [**Ans. :** 323]

5. Out of 800 families with 5 children each how many would you expect to have (i) 3 boys, (ii) 5 girls ? **(S.U. 1988)** [**Ans. : (i)** 250, **(ii)** 25]

6. The mean of defective blades supplied in packets of 10 is one. In how many packets of this make out of 1000 packets would you expect to find at least 4 non-defective blades. [**Ans. :** 13]

7. Out of 1000 families having 3 children each, how many would you expect to have (i) 2 boys and 1 girl, (ii) 2 girls and 1 boy ? [**Ans. :** (i) 375, (ii) 375]

8. Assuming that 20 % the population is literate so that the chance of an individual being literate is 1/5 and assuming that 100 investigators can take a sample of 10 individuals to see whether they are literates, how many investigators would you expect to report that three people or less were literate ?

9. Take 100 sets of 10 tosses of an unbiased coin. In how many cases do you expect to get (a) 7 heads and 3 tails (b) 7 heads at least ? **(S.U. 2006) [Ans. : 88]**

10. On an average 3 out of ten students fail in an examination. If 1000 samples each of 10 students are taken in how many would you expect that (i) none has failed, (ii) all have failed ?
[Ans. : (i) 28, (ii) zero]

11. Five coins are tossed 320 times, find the frequency distribution of heads. **(S.U. 1998)**
[Ans. : 10, 50, 100, 100, 50, 10]

D) **1.** Seven coins are tossed at a time, 256 times. Number of heads obtained in each toss are recorded below. Fit a binomial distribution under the hypothesis that the coins are unbiased.

No. of heads	:	0, 1, 2, 3, 4, 5, 6, 7.
Frequency	:	14, 12, 38, 70, 60, 46, 14, 2.

(S.U. 1999)

[Ans. : $256\left(\frac{1}{2}+\frac{1}{2}\right)^7$ *i.e.*, 2, 14, 42, 70, 70, 42, 14, 2 **]**

2. In an experiment with 500 seeds in groups of 5 the following results were obtained.

x :	0,	1,	2,	3,	4,	5,	**Total**
f :	10,	70,	150,	160,	80,	30,	500.

where f denotes the number of groups in which x seeds germinated. Fit a binomial distribution to the data.

[Ans. : $\bar{x} = 2{\cdot}64$, $n = 5$, $p = \frac{\bar{x}}{n} = 0{\cdot}528$, $q = 0{\cdot}472$.

Frequency 12, 65, 147, 164, 92, 20 **]**

3. Five dice are thrown together 96 times. The number of times 4, 5 or 6 was actually obtained is given below. Fit a binomial distribution if (i) dice are unbiased (ii) the nature of the dice is not known.

No. of dice showing 4, 5, 6	:	0 1, 2, 3, 4, 5.
Frequency	:	1, 10, 24, 35, 18, 8.

[Ans. : (i) $p = \frac{3}{6} = \frac{1}{2}$, $q = \frac{1}{2}$ $\therefore$ $96\left(\frac{1}{2}+\frac{1}{2}\right)^5$ *i.e.* 3, 15, 30, 30, 15, 3.

(ii) $\bar{x} = 2{\cdot}86$, $p = \frac{\bar{x}}{n} = \frac{2{\cdot}86}{5} = 0{\cdot}572$, $q = 1 - p = 0{\cdot}428$ *i.e.*, 1, 9, 25, 33, 22, 6 **]**

4. Four coins were tossed 160 times and the following results were obtained,

No. of heads	:	0, 1, 2, 3, 4.
Frequency	:	17, 52, 54, 31, 6.

Fit a Binomial distribution. **(S.U. 2000) [Ans. : 17, 51, 58, 29, 5]**

5. Fit a Binomial distribution to the following data,

Value of x	:	0, 1, 2, 3, 4, 5, 6.
Frequency f	:	6, 20, 28, 12, 8, 6, 0.

(S.U. 1998) [Ans. : 6, 18, 26, 20, 8, 2, 0]