Topic: Chap 13 (Probability)

For 4 marks

1. There are 2 bags, bag I and bag II. Bag I contains 4 white and 3 red balls while another bag II contains 3 white and 7 red balls. One ball is drawn at random from one of the bags and it is found to be white. Find the probability that it was drawn from bag I. (Delhi 2010) $\left(\frac{40}{61}\right)$

2. Probabilities of solving a specific problem independently by A and B are $\frac{1}{2}$ $and \frac{1}{3}$ respectively. If both try to solve the problem independently, find the probability that (i) the problem is solved (ii) exactly one of them solves the problem. (Delhi 2011) $\left(\frac{2}{3}, \frac{1}{2}\right)$

3. A family has 2 children. Find the probability that both are boys, if it is known that
   (i) at least one of the children is a boy

   (ii) the elder is a boy.   (AI 2010) $\left(1, \frac{1}{2}\right)$

4. Assume that each born child is likely to be a boy or a girl. If a family has 2 children, what is the conditional probability that both are girls? Given that
   (ii) the youngest is a girl.

   (iii)   at least one is a girl. (Delhi 2014) $\left(\frac{1}{2}, \frac{1}{3}\right)$

5. A speaks truth in 60% of the cases, while B in 90% cases. In what percent of cases are they likely to contradict each other in stating the same fact ? In the cases of contradiction do you think, the statement of B will carry more weight as he speaks truth in more number of cases than A?
   (Delhi 2013) $\left(\frac{21}{50}\right)$;(Yes, the statement of B will carry more weight as the probability of B to speak truth is more than that of A.)

6. P, speaks truth in 70% of the cases and Q in 80% of the cases. In what percent of cases are they likely to agree in stating the same fact ? Do you think, when the agree, means both are speaking truth? (Delhi 2013) $\left(\frac{31}{50}; No\ both\ can\ tell\ a\ lie\right)$

7. A, speaks truth in 75% of the cases, while B in 90% of the cases. In what percent of cases are they likely to agree in stating the same fact? Do you think that statement of B is true? (Delhi 2013)
   $\left(\frac{3}{10};\ It\ is\ not\ necessary\ that\ the\ statement\ of\ B\ is\ always\ true, it\ may\ be\ false\ also.\right)$

8. **15 cards numbered from one to fifteen, are placed in a box and a card is drawn at random from the box. If it is known that the number on the drawn card is more than 3, find the probability that it is an even number. If 50 times this probability be the number of persons who donated blood donation camp, then find the number of such persons. Also, explain importance of blood donation.** $\left(\frac{1}{2}, 25\right)$

9. **Out of a group of 8 highly qualified doctors in a hospital, 6 are very kind cooperative with patients and so are very popular, while the other 2 remain reserved. For a health camp, 3 doctors are selected at random. Find the probability distribution of the number of very popular doctors. What values are expected from the doctors? (SP14)** ( )

Doctor should be expert in his field cooperative with the patient.

x	1	2	3
P(x)	3/28	15/28	10/28

and kind

10. In a group of 50 scouts in a camp, 30 are well trained in first aid techniques while the remaining are well trained in hospitality but not in first aid. Two scouts are selected at random from the group. Find the probability distribution of number of selected scouts who are well trained in first aid. Find the mean of the distribution also.

Write one more value which is expected from a well trained scout. (Foreign 2013)

Now mean = $\Sigma XP(X) = \frac{294}{245}$

A well trained scout should be disciplined.

X	0	1	2
P(X)	38/245	120/245	87/245

11. Out of a group of 30 honest people, 20 always speak the truth. Two persons are selected at random from the group. Find the *probability distribution of the* number of selected persons who speak the truth. Also find the mean of the distribution. What values are described in this question? (DelhiC 2013)

(P(0)=$\frac{9}{87}$, P(1)=$\frac{40}{87}$, P(2)=$\frac{38}{87}$ mean=Σxp=$\frac{116}{87}$ = 1.33 Values: Honesty,truth.)

12. **In a group of 30 scientists working on an experiment, 20 never commit error in their work and are reporting results elaborately. 2 scientists are selected at random from the group. Find the probability distribution of the no. of selected scientists who never commit error in work and reporting. Also find the mean of the distribution. What values are described in this question? (AIC 2013)**

(P(0)=$\frac{9}{87}$, P(1)=$\frac{40}{87}$, P(2)=$\frac{38}{87}$ mean=Σxp=$\frac{116}{87}$ = 1.33 Values: *Honesty,truth.***)**

13. On a multiple choice question with 3 possible answers. For each of the 5 questions, what is the probability that a candidate would get 4 or more correct answers just by guessing?
(Delhi 2010) $\left(\frac{11}{343}\right)$

14. Find the probability distribution of the no. of doublets in the throw of a pair of dice and hence find the mean. (DelhiC 2010), (AIC 2011)

Mean = $\frac{1}{2}$

x	0	1	2	3
P(x)	125/216	75/216	15/216	1/216

15. Two cards are drawn successively with replacement from a well- shuffled pack of 52 cards. Find the probability distribution of the number of aces. (DelhiC 2011)

$$\left(P(0) = \frac{144}{169}, P(1) = \frac{24}{169}, P(2) = \frac{1}{169}\right)$$

16. **Two cards are drawn simultaneously (without replacement) from a well- shuffled pack of 52 cards. Find the probability distribution of the number of aces. Also find the mean of the distribution.   (AIC10)**

Mean=$\frac{1}{2}$ PD:

x	0	1	2
P(x)	188/221	32/221	1/221

17. Two cards are drawn successively with replacement from a well shuffled pack of 52 cards. Find the probability distribution of the number of kings and hence find the mean of the distribution.
(AIC 2012) $\left(P(0) = \frac{144}{169}, P(1) = \frac{24}{169}, P(2) = \frac{1}{169}\right)$

18. An urn contains 4 white and 6 red balls. Four balls are drawn at random (without replacement) from the urn. Find the probability distribution of the number of white balls. (DelhiC 2012)

$$\left(P(0) = \frac{1}{14}, P(1) = \frac{8}{21}, P(2) = \frac{3}{7}, P(3) = \frac{4}{35}, P(4) = \frac{1}{210}\right)$$

19. Find mean and variance of the doublets if 2 dice thrown once.

Mean= $\Sigma X P(X) = \frac{1}{6}$

X	0	1
P(X)	5/6	1/6

Variance= $\Sigma X^2 P(X) - \left(\Sigma X P(X)\right)^2 = \frac{1}{6} - \frac{1}{36} = \frac{5}{36}$

20. **A pair of dice is thrown 3 times find the PD. of doublets.**

X	0	1
P(X)	125/216	75/216

21. A pair of dice is thrown 3 times find the PD. of the sum is greater than 9.

X	0	1	2	3
P(X)	1/216	75/216	15/216	125/216

22. 3 balls are drawn from a bag containing 5 white and 4 green balls. Find the probability distribution(PD) of the no. of green ball(s) drawn.

X	0	1	2	3
P(X)	5/42	20/42	15/42	2/42

23. A coin is biased so that the head is 3 times as likely as tail if the coin is tossed thrice. Find the PD of no. of tails.

X	0	1	2	3
P(X)	27/64	27/64	9/64	1/64

24. A biased die is twice as likely to show an even no. as an odd no. Find the PD. Of even no. If die is tossed twice.

X	0	1	2
P(X)	1/9	4/9	1/9

25. **An experiment succeeds twice as often as it fails. Find the probability that in the next six trials there will be at least 4 successes. (Foreign10)** $\left(\frac{496}{729}\right)$

26. **A pair of dice is thrown 7 times. If getting a total of 7 is considered a success. Find the probability of getting**

   (i)   At least 6 success

   (ii)   **At most 6 success.** $\left(\left(\frac{1}{6}\right)^5, 1 - \left(\frac{1}{6}\right)^7\right)$

27. **In a hurdle race, a player has to cross 10 hurdles. The probability that he will clear each hurdle is $\frac{5}{6}$. What is the probability that he will knock down fewer than 2 hurdles.** $\frac{5^{10}}{2 \times 6^9}$

28. How many times must a man toss a fair coin so that the probability of having at least one head is more than 90%. (4)

29. **How many times must a man toss a fair coin, so that the probability of having at least one head is more than 80%. (Delhi 2012)** (3)

30. **A and B throw a pair of dice turn by turn the first to throw 9 is awarded a prize if A starts the game, find the probability that A getting the prize.** $\left(\frac{9}{17}\right)$

31. **A and B throw a pair of dice turn by turn the first to throw 6 is awarded a prize if B starts the game, find the probability that A getting the prize.** $\left(\frac{5}{11}\right)$

For 6 marks

1. **A shopkeeper sells 3 types of flower seeds A_1, A_2 and A_3. They are sold as a mixture where the proportion are 4:4:2 respectively. The germination rates of 3 types of seeds are 45%, 60% and 35%. Calculate the probability.**
    (a) Of a randomly chosen seed to geminate.
    (b) That it is of the type A_2, given that a randomly chosen seed does not germinate. (SP14)

    $\left(0.49, \frac{16}{51}\right)$

2. **An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers, the probability of their meeting an accident respectively are 0.01, 0.03 and 0.15. One of the insured persons meets with an accident. What is the probability that he is a car driver?** **(AIC 2012)** $\left(\frac{3}{26}\right)$

3. **2 bags A and B contain 3 red 4 black balls, and 4 red and 5 black balls respectively. From bag A one ball is transferred to bag B and then a ball is drawn from bag B. The ball is found to be red in colour. Find the probability that a) the transferred ball is black? b) the transferred ball is red ?** (Foreign11 only 1st part) $\left(\frac{16}{31}, \frac{15}{31}\right)$

4. **2 bags A and B contain 5 red 4 black balls, and 3 red and 5 black balls respectively. From bag A 2 balls are transferred to bag B and then a ball is drawn from bag B. The ball is found to be red in colour. Find the probability the balls transferred balls were red?** $\left(\frac{25}{29}\right)$

5. Bag I contains 3 red 4 black balls and Bag II contains 4 red and 5 black balls. 2 balls are transferred at random from Bag I to Bag II and then a ball is drawn from bag II. The ball is found to be red in colour. Find the probability that the transferred balls were both black. (Delhi 2012) $\left(\frac{8}{77}\right)$

6. Bag I contains 3 red and 4 black balls and Bag II contains 4 red and 5 black balls. One ball is transferred from Bag I to Bag II and then 2 balls are drawn at random(without replacement) from Bag II. The balls so drawn are found to be both red in colour. Find the probability that the transferred ball is red. (SP14) $\left(\frac{5}{9}\right)$

7. Bag I contains 3 red and 4 black balls and Bag II contains 5 red and 6 black balls. One ball is drawn at random from one of the bags and is found to be red. Find the probability that it was drawn from Bag II. (Delhi 2011) $\left(\frac{35}{68}\right)$

8. **A bag contains 7 red, 4 white and 5 black balls. 2 balls are drawn at random, and are found to be white. What is the probability that all balls are white?** **(AI 2010)** $\left(\frac{1}{16}\right)$

9. **In a group of 400 people, 160 are smokers and non-vegetarian, 100 are smokers and vegetarian and the remaining are nonsmokers and vegetarian. The probabilities of getting a special chest disease are 35%,20% and 10% respectively. A person chosen from the group at random and id found to be suffering from the disease. What is the probability that the selected person is a smoker and non-vegetarian? What value is reflected in this question?** **(DelhiC 2013)** $\left(\frac{28}{45}\right)$

10. Assume that the chances of a patient having a heart attack are 40%. Assuming that a meditation and yoga course reduces the risk of heart attack by 30% and the prescription of certain drugs and certain restriction reduces the risk by 25%. At a time a patient chooses only one of the 2 options with equal probabilities. After going through one of the 2 options, the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga. Interpret the result and state which of the above stated methods is more beneficial for the patient. (Delhi 2013) $\left(\frac{14}{29}\right)$

11. **Assume that the chances of a patient having a heart attack are 50%. Assume that a meditation and yoga course reduces the risk of heart attack by 30% and the prescription of certain drugs and certain restriction reduces the risk by 25%. At a time a patient chooses only one of the 2 options with equal probabilities. After going through one of the 2 options, the patient selected at random suffers a heart attack. Find the probability that the patient followed a course of meditation and yoga. What values are reflected in this question? (AIC 2013)** $\left(\frac{14}{29}\right)$

12. In a bolt factory, machine A, B and C manufacture 25%,35% and 40% of the total production respectively. Out of their total output, 5%, 4% and 2% are defective bolts. A bolt is drawn from the total production and is found to be defective. What is the probability that it is manufactured by the machine B?   (DelhiC 2010) $\left(\frac{28}{69}\right)$

13. In a class 5% of the boys and 10% of the girls have an IQ of more than 150. In the class 60% of the students are boys and rest girls. If a student is selected at random and found to have an IQ of more than 150, find the probability that the student is a boy. (AIC10) $\left(\frac{3}{7}\right)$

14. In a class having 60% boys, 5% of the boys and 10% of the girls have an I.Q more than 150. A student is selected at random and found to have an I.Q of more than 150. Find the probability that the selected student is a boy. $\left(\frac{3}{7}\right)$

15. Suppose 5% of men and 0.25% of women have grey hair. A grey haired person is selected at random. What is the probability of this person being male? Assume that there are equal number of males and females. (Delhi 2011) (0.95)

16. Of the students in a college, it is known that 60% reside in hostel and 40% do not reside in hostel. Previous year results report that 30% of the students residing in hostel attain A grade and 20% of day scholar attain A grade in their annual examination. At the end of the year, one student is chosen at random from the college and he has an A grade, what is the probability that the selected student is a hosteller. (DelhiC 2011), (Delhi 2012) $\left(\frac{9}{13}\right)$

17. In answering a question on a multiple choice test, a student either knows the answer or guesses. Let $\frac{3}{5}$ be the probability that he knows the answer and $\frac{2}{5}$ be the probability that he guesses. Assuming that a student who guesses at the answer will be correct with probability $\frac{1}{3}$, what is the probability that the student knows the answer, given that he answered it correctly? (Foreign10) $\left(\frac{9}{11}\right)$

18. In a test, an examine either guesses or copies or knows the answer to a MCQ with 4 choices. The probability that he makes a guess is $\frac{1}{3}$ and the probability that he copies the answer is $\frac{1}{6}$. The probability that his answer is correct, given that he copied it, is $\frac{1}{8}$. Find the probability that he knew the answer to the MCQ, given that he correctly answered it. Write two consequences of cheating in the examination. $\left(\frac{24}{29}\right)$

19. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn at random and are found to both clubs. Find the probability of the lost card being of clubs. (Delhi 2010) $\left(\frac{11}{50}\right)$

20. A card from a pack of 52 playing cards is lost. From the remaining cards of the pack, three cards are drawn at random (without replacement) and are found to be all spades. Find the probability of the lost card being a spade. (Delhi 2014) $\left(\frac{10}{49}\right)$

21. A card from a pack of 52 cards is lost. From the remaining cards of the pack, two cards are drawn at random and are found to be hearts. Find the probability of the lost card being of hearts. (DelhiC 2012) $\left(\frac{11}{50}\right)$

22. **Two cards from a pack of 52 cards are lost. From the remaining cards of the pack, 1 card is drawn and is found to be club. Find the probability of missing card being of clubs.** $\left(\frac{22}{347}\right)$

23. Two cards from a pack of 52 cards are lost. From the remaining cards of the pack, 2 cards are drawn and are found to be spade. Find the probability of missing cards being of spades. $\left(\frac{1430}{26273}\right)$

24. A girl throws a die. If she gets a 5 or 6, she tosses a coin three times and notes the number of heads. If she gets 1,2,3 or 4, she tosses a coin two times and notes the number of heads obtained. If she obtained exactly two heads, what is the probability that she threw 1,2,3 or 4 with the die? (Delhi 2012) $\left(\frac{4}{7}\right)$

25. Suppose that 6% of the people with blood group O are left handed and 10% of those with other blood group are left handed 30% of the people have blood group O. If a left handed person selected at random, what is the probability that he/she will have blood group O. $\left(\frac{9}{44}\right)$

26. A man is known to speak truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is a actually a six. (Delhi 2011) $\left(\frac{3}{8}\right)$

27. Often it is taken that a truthful person commands, more respect in the society. A man is known to speak the truth 4 out of 5 times. He throws a die and reports that it is actually a six. Find the probability that it is actually a six. Do you also agree that the value of truthfulness leads to more respect in the society? (Foreign 2013)

$\left(\frac{4}{9}; \text{ Everybody trust a truthful person, so he receives respect from everyone.}\right)$

28. There are 3 coins. 1 is a 2- tailed coin another is a biased coin that comes up head 60% of the times and third is unbiased coin. One of the 3 coins is chosen at random and tossed, and it shows tails. What is the probability that it was a 2- tailed coin? (AIC 2011) $\left(\frac{10}{19}\right)$

29. **There are 3 coins. One is 2 headed coin another is a biased coin that comes up heads 75% of the times and third is unbiased coin. One of the 3 coins is chosen at random and tossed, and it shows heads, what is the probability that it was the 2 headed coin? (Foreign 2011)** $\left(\frac{4}{9}\right)$

30. **A letter is known to have come from either TATANAGAR or CALCUTTA . On the envelop just 2 consecutive letters TA are visible. What is the probability that letter has come from TATANAGAR ?** $\left(\frac{7}{11}\right)$

31. **A factory has two machines A and B. Past record shows that Machine A produced 60% of the items of output and machine B produced 40% of the items. Further 2% of the items produced by machine A and only 1% produced by machine B were defective. All the items are put into one stockpile and then one item is chosen at random from this and is found to be defective. What is the probability that it was produced by machine B? (Foreign 2011)** $\left(\frac{1}{4}\right)$

32. **An urn contains 4 white and 3 red balls. Let X be the number of red balls in a random draw of 3 balls. Find the mean and variance of X. (Foreign10)**

    $$\left(\text{Mean} = \Sigma XP(X) = \frac{9}{7} \quad \text{Variance} = \Sigma X^2 P(X) - \left(\Sigma XP(X)\right)^2 = \frac{24}{49}\right)$$

33. **From lot 10 bulbs, which include 3 defectives, a sample of 2 bulbs is drawn at random. Find the probability distribution of the no. of defective bulbs.** **(Delhi 2010)**

x	0	1	2
P(x)	14/30	14/30	2/30

34. **From a lot of 10 bulbs which include 5 defectives, a sample of 4 bulbs is drawn one by one with replacement. Find the probability distribution of number of defective bulbs. Hence find the mean of the distribution. (Delhi, 2014)**

    Mean= $\frac{16}{81} = 0.1975$

x	0	1	2	3	4
p	$\frac{16}{81}$	$\frac{32}{81}$	$\frac{24}{81}$	$\frac{8}{81}$	$\frac{1}{81}$
xp	0	$\frac{32}{81}$	$\frac{48}{81}$	$\frac{24}{81}$	$\frac{4}{81}$

35. **In class XI, 6 students opted for NCC and 4 opted for NSS and in class XII,2 students opted for NCC and 8 opted for NSS. One of the student is selected at random fro any two of the two classes and student is found to have opted NSS. Find the probability that he is of class XII.** $\left(\frac{2}{3}\right)$