



MATHS

BOOKS - BHARATI BHAWAN MATHS (HINGLISH)

Total Conditional Probability and Bayes' Theorem

Example

1. Three factories A, B and C produce the same product. The factory A produces twice as many as B produces while the factories B and C produce in the same quantity. It is known that 2% of the products of A as well as C are defective while 4% of the products of B are defective. All the products of the three factories are stocked together. If a product is selected at random from the stock, what is the probability that the product is defective?



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2. A lot contains 20 articles. The probability that the lot contains exactly 2 defective articles is 0.4 and the probability that the lot contains exactly 3 defective articles is 0.6. Articles are drawn in random one by one without replacement and tested till all the defective articles are found. What is the probability that the testing procedure ends at the twelfth testing ?



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3. A card from a pack of 52 cards is lost. From the remaining cards of the pack; two cards are drawn and are found to be hearts. Find the probability of the missing card to be a heart.



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4. In a competitive examination, an examinee either guesses or copies or knows the answer to a multiple choice question with four 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 the answer is correct, given that he copied it, is $\frac{1}{8}$. Find the probability that he knows the answer to the question, given that he correctly answered



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5. A speaks truth 3 times out of 4 while B speaks truth 7 times out of 10. A ball is drawn at random from a bag containing one black ball and five other balls of different colors. Both A and B report that a black ball has been

drawn from the bag. Find the probability of their assertion being true?



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6. In a bag there are six balls of unknown colours, three balls are drawn at random and found to be all black. Find the probability that no black ball is left in the bag .



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7. In a bag there are six balls of unknown colours. Three balls are drawn at random and found to be all black. Find the probability that the bag contains exactly 3 black balls.



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8. A purse contains 5 coins, each either a fifty-paise coin or one-rupee coin. Two coins are drawn at random and are found to be one-

rupee coins. Find the expected (probable) total value of the remaining coins.



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Exercise

1. There are two bags, one of which contains 3 black and 4 white balls, while the other contains 4 black and 3 white balls. A fair die is cast, if the face 1 or 3 turns up, a ball is taken from the first bag, and if any other face turns

up a ball is chosen from the second bag. Find the probability of choosing a black ball.



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2. Three urns contains 3 white and 2 black, 2 white and 3 black and 1 black and 4 white balls respectively. A ball is picked from any urn at random. What is the probability that the ball is white?



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3. An urn contains two balls each of which is either white or black. A white ball is added to the urn. What is the probability of drawing a white ball from the urn now?



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4. The probability that certain electronic component fail, when first used is 0.10. If it does not fail immediately, then the probability that it lasts for one year is 0.99. What is the

probability that a new component will last for one year?



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5. A factory A produces 10% defective valves and another factory B produces 20% defective valves. A bag contains 4 valves of factory A and 5 valves of factory B. If two valves are drawn at random from the bag, find the probability that at least one valve is defective.



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6. An unbiased coin is tossed. If the result is a head, a pair of unbiased dice is rolled and the number obtained by adding the numbers on two faces is noted. If the result is a tail, a card from a well-shuffled pack of 11 cards numbered 2, 3, 4, ..., 12 is picked and the number on the card is noted. What is the probability that the noted number is either 7 or 8?



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7. . In a bolt factory, machines M_1 , M_2 , M_3 manufacture respectively 25, 35 and 40 percent of the total product. Of their output 5, 4 and 2 percent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine M_3 ?



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9. . In a bolt factory, machines M_1 , M_2 , M_3 manufacture respectively 25, 35 and 40 percent of the total product. Of their output 5, 4 and 2 percent respectively are defective bolts. One bolt is drawn at random from the product and is found to be defective. What is the probability that it was manufactured by machine M_3 ?



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10. There are 3 bags, each containing 5 white balls and 3 black balls. Also there are 2 bags, each containing 2 white balls and 4 black balls. A white ball is drawn at random. Find the probability that this white ball is from a bag of the first group.



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11. A can hit a target 4 times in 5 shots B can hit 3 times in 4 shots and C can hit 2 times in 3

shots . The probability that B and C hit and A does not hit is



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12. A bag contains 5 balls of unknown colours. A ball is drawn and replaced twice. On each occasion it is found to be red. Again, two balls are drawn at a time. What is the probability of both the balls being red?



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13. A letter is known to have come from either MAHARASTRA or MADRAS. On the postmark only consecutive letters RA can be read clearly. What is the chance that the letter came from MAHARASTRA?



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14. A bag contains 10 coins of which at least 2 are one-rupee coins. Two coins are drawn and both are found to be not one-rupee coins.

What is the probability of the bag to contain exactly 2 one-rupee coins?



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15. . There are 3 coins in a box. The probability of getting head is $\frac{2}{3}$ for two of them , while for remaining it is $\frac{1}{2}$. A coin is chosen at random and tossed 3 times, showing head in each case. What is the probability that the coin is unbiased?



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16. A person goes to office either by car, scooter, bus or train probability of which being $\frac{1}{7}$, $\frac{3}{7}$, $\frac{2}{7}$ and $\frac{1}{7}$ respectively.

Probability that he reaches office late, if he takes car, scooter, bus or train is $\frac{2}{9}$, $\frac{1}{9}$, $\frac{4}{9}$ and $\frac{1}{9}$ respectively. Given that he reached office in time, then what is the probability that he travelled by a car?



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17. The probability that in a year of 22nd century chosen at random, there will be 53 Sundays is



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18. A bag X contains 3 white and 2 black balls; another bag Y contains 2 white and 4 black balls. A bag and a ball out of it is picked at random. What is the probability that the ball is white?





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19. There are two coupons each with a word written on them. On one of them the word PATNA is written and on the other PLATE. A coupon is taken at random and 3 letters are selected at random from the letters of the word on the coupon. The probability that the selection contains two vowels, is _____.



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20. Two persons X and Y throw two dice each. The probability that X throws a sum of at least 8 is



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21. A bag contains 3 red and 3 green balls and a person draws out 3 at random. He then drops 3 blue balls into the bag and again draws out 3 at random. The chance that the 3

later balls being all of different colors is 15 %

b. 20 % c. 27 % d. 40 %



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22. A purse contain n coins of unknown values .a coin is drawn from it at random and is found to be a rupee .Then the chance that it is the only rupee coin in the purse is



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23. In a city filmland there are 3 male superstars and 3 female superstars. A director decides to make a film with 3 superstars. If the film has 2 male superstars and 1 female superstar, the chance of the film to be a hit is $\frac{1}{3}$ while the chance is $\frac{2}{5}$ if there are 1 male and 2 female superstars. If the 3 superstars are from the same sex, the chance of the film being a hit is $\frac{2}{5}$. At the time of making the film, only 3 superstars are available to sign for the film. If the director takes them all then what is the probability of his film being a hit?



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24. Three groups A, B and C are contesting for positions on the Board of Directors of a company. The probability of their winning are 0.5, 0.3 and 0.2, respectively. If the group A wins, then the probability of introducing a new product is 0.7 and the corresponding probabilities for groups B and C are 0.6 and 0.5, respectively. Find the probability that the new product will be introduced.



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25. A purse containing 16 notes, four each of denominations Rs 10, Rs 20, Rs 50 and Rs 100, is left on a table. A maid servant steals two of the notes. After that the man takes out two notes at random from the purse and finds that they amount to Rs 200. What is the probability that an amount of Rs 200 was stolen by the maid servant from his purse?



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26. An urn contains m white and n black balls. A ball is drawn at random and is put back into the urn along with k additional balls of the same colour as that of the ball drawn. A ball is again drawn at random. What is the probability that the ball drawn now is white ?



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27. A bag contains p white and q red balls. m ($m < p, m < q$) balls are drawn from the bag one by one with replacement. Prove that

the probability of the m th ball being red is

$$\frac{q}{p + q}.$$



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28. A box contains N coins, m of which are fair and the rest are biased. The probability of getting a head when a fair coin is tossed is $1/2$ while it is $2/3$ when a biased coin is tossed. A coin is drawn from the box at random and is tossed twice. The first time it shows head and

the second time it shows tail. What is the probability that the coin drawn is fair?



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29. For a student to qualify, he must pass at least two out of three exams. The probability that he will pass the 1st exam is p . If he fails in one of the exams, then the probability of his passing in the next exam, is $p/2$ otherwise it remains the same. Find the probability that he will qualify.



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