



# MATHS

## BOOKS - RS AGGARWAL MATHS (HINGLISH)

### BAYES'S THEOREM AND ITS APPLICATIONS

**Solved Examples**

1. 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.



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2. A factory has three machines, X, Y and Z, producing 1000, 2000 and 3000 bolts per day respectively. The machine X produces 1%

defective bolts, Y produces 1.5% defective bolts and Z produces 2% defective bolts. At the end of the day, a bolt is drawn at random and it is found to be defective. What is the probability that this defective bolt has been produced by the machine X?



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**3.** In a bolt factory, there machines A, B, C, manufacture 25%,35% and 40% of the total production respectively. Of their respective

outputs, 5%, 4% and 2% are defective. A bolt is drawn at random from the total product and it is found to be defective. Find the probability that it was manufactured by the machine C.



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4. A company has two plants to manufacture bicycles. The first plant manufacture 60% of the bicycles and the second plant, 40%. Also, 80% of the bicycles are rated of standard quality at the first plant and 90% of standard

quality at the second plant. A bicycle is picked up at random and found to be of standard quality. Find the probability that it comes from the second plant.



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5. An insurance company insured 2000 scooter drivers, 4000 car drivers and 6000 truck drivers. The probability of an accident involving a scooter, a car and a truck are 0.01, 0.03 and 0.15 respectively. One of the insured

persons meets with an accident. What is the probability that he is a scooter driver.



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6. A doctor is to visit a patient. From past experience, it is known that the probabilities that he will come by train, bus, scooter or by car are respectively  $\frac{3}{10}$ ,  $\frac{1}{5}$ ,  $\frac{1}{10}$  and  $\frac{2}{5}$ . The probabilities that he will be late are  $\frac{1}{4}$ ,  $\frac{1}{3}$  and  $\frac{1}{12}$ , if he comes by train, bus and scooter respectively, but if he comes by car, he

will not be late. When he arrives, he is late.

What is the probability that he has come by train ?



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7. A man is known to speak the truth 3 out of 4 times. He throws a die and reports that it is a six. Find the probability that it is actually a six.



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8. In an 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  $(1/3)$  and the probability that he copies the answer is  $(1/6)$ . The probability that his answer is correct, given that he copied it, is  $(1/8)$ . The probability that his answer is correct, given that he guessed it, is  $(1/4)$ . Find the probability that he knew the answer to the question, given that he correctly answered it.



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9. By examining the chest X-ray, probability that T.B is detected when a person is actually suffering is 0.99. the probability that the doctor diagnoses incorrectly that a person has T.B. on the basis of X-ray is 0.001. in a certain city 1 in 100 persons suffers from T.B. A person is selected at random is diagnosed to have T.B. What is the chance that he actually has T.B.?



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**10.** Bag A contains 2 white and 3 red balls, and bag B contains 4 white and 5 red balls. One ball is drawn at random from one of the bags and it is found to be red. Find the probability that it was drawn from bag B.



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**11.** There are 5 bags, each containing 5 white balls and 3 black balls. Also, there are 6 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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**12.** Urn A contains 1 white, 2 black and 3 red balls, urn B contains 2 white, 1 black and 1 red balls, and urn C contains 4 white , 5 black and 3 red balls.

One urn is chosen at random and two balls are drawn. These happen to be one white and one

red. What is the probability that they come from urn A?



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**13.** 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 both spades. Find the probability of the lost card being a spade.



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## Exercise 30

1. In a bulb factory, three machines, A, B, C, manufacture 90%, 25% and 15% of the total production respectively. Of their respective outputs, 1 %, 2% and 1 % are defective. A bulb is drawn at random from the total product and it is found to be defective. Find the probability that it was manufactured by machine C.



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2. A company manufactures scooters at two plants, A and B. Plant A produces 80% and plant B produces 20% of the total product. 85% of the scooters produced at plant A and 65% of the scooters produced at plant B are of standard quality. A scooter produced by the company is selected at random and it is found to be of standard quality. What is the probability that it was manufactured at plant A?



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3. In a certain college, 4% of boys and 1% of girls are taller than 1.75 metres. Furthermore, 60% of the students are girls. If a student is selected at random and is taller than 1.75 metres, what is the probability that the selected student is a girl?



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4. In a class, 5% of the boys and 10% of the girls have an IQ of more than 150. In this class

60% of the students are boys. 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.



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5. 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.





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6. Two groups are competing for the position on the Board of directors of a corporation. The probabilities that the first and the second groups will win are 0.6 and 0.4 respectively. Further, if the first group wins, the probability of introducing a



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7. A bag A contains 1 white and 6 red balls. Another bag contains 4 white and 3 red balls. One of the bags is selected at random and a ball is drawn from it, which is found to be white. Find the probability that the ball drawn is from the bag A.



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8. There are two bags I and II. Bag I contains 3 white and 4 black balls, and bag II contains 5

white and 6 black balls. One ball is drawn at random from one of the bags and is found to be white. Find the probability that it was drawn from bag I.



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**9.** A box contains 2 gold and 3 silver coins. Another box contains 3 gold and 3 silver coins. A box is chosen at random, and a coin is drawn from it. If the selected coin is a gold coin, find

the probability that it was drawn from the second box.



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**10.** Three urns A, B and C contain 6 red and 4 white, 2 red and 6 white, and 1 red and 5 white balls respectively. An urn is chosen at random and a ball is drawn. If the ball drawn is found to be red, find the probability that the ball was drawn from the urn A.



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**11.** Three urns contain 2 white and 3 black balls, 3 white and 2 black balls, and 4 white and 1 black ball respectively. One ball is drawn from an urn chosen at random and it was found to be white. Find the probability that it was drawn from the first urn.



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**12.** There are three boxes, the first one containing 1 white, 2 red and 3 black balls, the

second one containing 2 white, 3 red and 1 black ball and the third one containing 3 white, 1 red and 2 black balls. A box is chosen at random and from it two balls are drawn at random. One ball is red and the other, white. What is the probability that they come from the second box?



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**13.** Urn A contains 7 white and 3 black balls, urn B contains 4 white and 6 black balls, urn C

contains 2 white and 8 black balls. One of these urns is chosen at random with probabilities 0.2, 0.6 and 0.2 respectively. From the chosen urn, two balls are drawn at random without replacement. Both the balls happen to be white. Find the probability that the balls drawn are from the urn C.



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**14.** There are 3 bags, each containing 5 white and 3 black balls. Also, there are 2 bags, each

containing 2 white and 4 black balls. A white ball is drawn at random. Find the probability that this ball is from a bag of the first group.



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**15.** There are four boxes, A, B C and D containing marbles. A contains 1 red, 6 white and 3 black marbles, B contains 6 red, 2 white and 2 black marbles, C contains 8 red, 1 white and 1 black marbles, and D contains 6 white and 4 black marbles. One of the boxes is selected



at random and a single marble is drawn from it. If the marble is red, what is the probability that it was drawn from the box A?



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**16.** A car manufacturing factory has two plants X and Y. Plant X manufactures 70% of the cars and plant Y manufactures 30%. At plant X, 80% of the cars are rated of standard quality and at plant Y, 90% are rated of standard quality. A car is picked up at random and is

found to be of standard quality. Find the probability that it has come from plant X.



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**17.** An insurance company insured 2000 scooters and 3000 motorcycles. The probability of an accident involving a scooter is 0.01 and that of a motorcycle of 0.02. an insured vehicle met with an accident. Find the probability that the accidental vehicle was as motorcycle.



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**18.** In a bulb factory, machines A, B and C manufacture 60%, 30% and 10% bulbs respectively. Out of these bulbs 1%, 2% and 3% of the bulbs produced respectively by A, B and C are found to be defective. A bulb is picked up at random from the total production and found to be defective. Find the probability that this bulb was produced by the machine A.



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