

Exercise – 1.3

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A. Theoretical Review Questions

1. What do you understand by conditional probability? Explain it with suitable example. State multiplication theorem of probability for dependent events.
2. State Bayes's theorem for three mutually exclusive and exhaustive events.

B. Practical Questions

1. In a certain school, 20% of the students failed in English, 15% of the students failed in Mathematics, and 10% of the students failed both in English and Mathematics. A student is selected at random. If he failed in English, what is the probability that he also failed in Mathematics?
2. The probability that a management trainee will remain with a company is 0.6. The probability that an employee earns more than Rs. 10000 per year is 0.50. The probability that an employee is a management trainee who remained with the company or who earns more than Rs. 10000 per year is 0.70. What is the probability that an employee earns more than Rs. 10000; per year given that he is a management trainee who stayed with the company?
3. The probability that a person stopping at a petrol pump will get his tyres checked is 0.12, the probability that he will get his oil checked is 0.29 and the probability that he will get both checked is 0.07. Find the probability that
 - (i) a person stopping at this pump will have neither his tyres nor oil checked.
 - (ii) a person who has his oil checked will also have his tyres checked.
4. It is known that 20% of the males and 5% of the females are unemployed in a certain town consisting of equal number of males and females. A person is selected at random and found to be unemployed. What is the probability that the selected unemployed person is (i) male? (ii) female?
5. Of 250 employees of a company, a total of 130 smoke cigarettes. There are 150 males working for this company, 85 of the males smoke cigarettes. What is the probability that an employee chosen at random:
 - (i) does not smoke cigarettes ?
 - (ii) is female and smokes cigarettes ?
6. The distribution of 500 workers of a factory according to the sex and nature of work is as follows:

	Skilled	Unskilled	Total
Male	250	50	300
Female	150	50	200
Total	400	100	500

If a worker is chosen at random, what is the probability that selected worker is

- (i) male and skilled worker
 - (ii) unskilled worker.
7. The records of 400 examinees are given below:

Score	Educational qualification			Total
	B. A.	B. Sc.	M. B. S.	
Below 50	90	30	60	180
50 – 60	20	70	70	160
Above 60	10	30	20	60
Total	120	130	150	400

If an examinee is selected from this group of examinees, find the probability that

- (i) he is a M. B. S. degree
 - (ii) he is a B. Sc. degree, given that his score is above 60,
 - (iii) his score is below 50, given that he is a B.A. degree.
 - (iv) his score is above 60, given that he is a B.Sc. degree.
 - (v) he is a B.A. degree, given that his score is below 50.
8. The personnel department of a company has records which show the following of its 200 engineers.

Age	Bachelor's degree only	Master's degree	Total
Under 30	90	10	100
30 – 40	20	30	50
over 40	40	10	50
Total	150	50	200

If one engineer is selected at random from the company, find

- (i) the probability he has only a bachelor's degree,
- (ii) the probability he has a master's degree, given that he is over 40,
- (iii) the probability he is under 30, given that he has only a bachelor's degree.

9. A bag contains 5 white and 3 black balls. Two balls are drawn at random one after the other without replacement. Find the probability that both balls drawn are (i) black and (ii) white.
10. A box contains 6 red, 4 white and 5 blue balls. From this box, 3 balls are drawn in succession. Find the probability that they are drawn in the order red, white and blue if each ball is (i) replaced (ii) not replaced.
11. Find the probability of drawing a queen, a king and a knave in that order from a pack of cards in three consecutive draws, the cards drawn not being replaced.
12. (i) Two sets of candidates are competing for the positions on the Board of Directors of a company. The probabilities that the first and second sets will win are 0.6 and 0.4 respectively. If the first set wins, the probability of introducing a new product is 0.8 and the corresponding probability if the second set wins is 0.3. What is the probability that the new product will be introduced? [TU 2054 MBA]
 (ii) Two urns contain 4 white, 6 blue and 4 white, 5 blue balls. One of the urn is selected at random and a ball is drawn from it. Find the probability that the ball drawn is white.
13. The probabilities of X, Y and Z becoming managers are $\frac{4}{9}$, $\frac{2}{9}$ and $\frac{1}{3}$ respectively. The probabilities that the bonus scheme will be introduced if X, Y and Z becoming managers are $\frac{3}{10}$, $\frac{1}{2}$ and $\frac{4}{5}$ respectively.
 (i) What is the probability that the bonus scheme will be introduced?
 (ii) If the bonus scheme has been introduced, what is the probability that the manager appointed was X?
14. (a) A factory produces a certain types of output by three machines. The respectively daily production figures are:
 Machine X: 1500 units, Machine Y: 3000 units, Machine Z: 4500 units
 Past experience shows that 1.5% of the output produced by machine X, 2% of the output produced by machine Y and 2.2% of the output produced by machine Z is defective. An item is drawn at random and found to be defective. What is the probability that it comes from the output of machine Y? [TU 2041 MBA]
 (b) There are three machines A, B and C producing 1000, 2000 and 3000 articles per hour respectively. These machines are known to be producing 10, 40 and 90 defective articles respectively. One article is selected at random from an hour production of these three machines and found to be defective. What is the probability that the defective article is produced from (i) machine A, (ii) machine B, and (iii) machine C?
[TU 2016 R,MBS]
15. Two urns contain 1 white, 6 red and 4 white, 3 red balls. One of the urns is selected at random and a ball is drawn from it. Find
 (i) the probability of drawing a white ball.
 (ii) the probability of drawing the ball from first urn if the ball drawn is white.
16. Assume that a factory has two machines. Past records shows that machine I produces 20% of the items of output and machine II produces 80% of the items. Further, 6% of the items produced by machine I were defective and only 1% produced by machine II were defective. If a defective item is drawn at random, what is the probability that it was produced by (i) machine I (ii) machine II?
17. In 2018, there will be three candidates for the position of principal – C_1 , C_2 and C_3 . The chances of their selection are in the proportion 4: 2: 3 respectively. The probability that C_1 , if selected, will introduce co-education in the college is 0.3. The probabilities of C_2 and C_3 doing the same are respectively 0.5 and 0.8. What is the probability that there will be co-education in the college in 2018. Also, find the probability that principal C_2 introduces co-education in the college.
18. (i) In a bolt factory, machines A and B manufacture equal number of bolts. Of the total of their output, 1% and 2% are defective. A bolt is drawn at random from the total production and found to be defective. From which machine, the defective bolt is expected to have been produced?
 (ii) In a bolt factory, machines A, B and C manufacture 60%, 25% and 15% respectively. Of the total of their output 1%, 2% and 1% are defective bolts. A bolt is drawn at random from the total production and found to be defective. From which machine the defective bolt is expected to have been manufactured?
19. In a certain university, the percentages of Hindu, Muslims and Christians among students are 50, 25 and 25 respectively. If 50% of Hindu, 90% of Muslims, and 80% of Christians are smokers, find the probability that a randomly selected smoker student is a Muslim.
20. (i) The probability that a man fishing at a particular place will catch 1, 2, 3 and 4 fishes are 0.4, 0.3, 0.2 and 0.1 respectively. What is the expected number of fish caught?
 (ii) A and B enter into a bet according to which A will get Rs. 200 if it rains on that day and will lose Rs. 100 if it does not rain. The probability of raining on that day is 0.7. What is the mathematical expectation of A?

21. (i) In a business venture, a man can make a profit of Rs. 2,000 with a probability of 0.4 or have a loss of Rs. 1000 with a probability of 0.6. What is his expected profit?
- (ii) Anil company estimates the net profit on a new product it is launching to be Rs. 3000000 during the first year if it is 'successful' Rs. 1000000, if it is 'moderately successful' and a loss of Rs. 1000000 if it is 'unsuccessful.' The firm assigns the following probabilities to first year prospects for the product.
Successful 0.15, moderately successful 0.25. What is the expected value of first year net profit for this product?
22. (i) A random variable X has the following probability distribution.

X	-1	0	1	2
Probability	$\frac{1}{3}$	$\frac{1}{6}$	$\frac{1}{6}$	$\frac{1}{3}$

Compute the expectation of X.

- (ii) Find the expected sales of Toyota car in Kathmandu city in a week from the following information:

Day	Sun	Mon	Tues	Wed	Thurs	Fri
Sales	90	60	90	50	75	55
Probability	0.25	0.18	0.12	0.05	0.20	0.20

Answers

B.

1. $\frac{1}{2}$ 2. $\frac{2}{3}$ 3. (i) 0.66 (ii) 0.24 4. (i) $\frac{4}{5}$ (ii) $\frac{1}{5}$
5. (i) $\frac{12}{25}$ (ii) $\frac{9}{50}$ 6. (i) $\frac{1}{2}$ (ii) $\frac{1}{5}$ 7. (i) $\frac{3}{8}$ (ii) $\frac{1}{2}$ (iii) $\frac{3}{4}$ (iv) $\frac{3}{13}$ (v) $\frac{1}{2}$
8. (i) $\frac{3}{4}$ (ii) $\frac{1}{5}$ (iii) $\frac{3}{5}$ 9. (i) $\frac{3}{28}$ (ii) $\frac{5}{14}$ 10. (i) $\frac{8}{225}$ (ii) $\frac{4}{91}$
11. 0.00048 12. (i) 0.60 (ii) $\frac{19}{45}$ 13. (i) $\frac{23}{45}$ (ii) $\frac{6}{23}$
14. (a) 0.33 (b) (i) $\frac{1}{14}$, $\frac{2}{7}$, $\frac{9}{14}$ 15. (i) $\frac{5}{14}$ (ii) $\frac{1}{5}$
16. (i) $\frac{3}{5}$ (ii) $\frac{2}{5}$ 17. $\frac{23}{45}$, $\frac{5}{23}$
18. (i) B (ii) $\frac{12}{25}$, $\frac{2}{5}$, $\frac{3}{25}$; A 19. 0.333
20. (i) 2 (ii) Rs. 110 21. (i) Rs. 200 (ii) Rs. 100000
22. (i) $\frac{1}{2}$ (ii) 72.6

