

**Lesson 16: Mixed Probability Problems**



You learnt to identify the union and intersection of events as well as finding the probability of the union and intersection of events in the last lesson.



In this lesson, you will:

- solve mixed problems on probability in practical situations.

You learnt the different concepts of probability from Lesson 10 to 15. We can now apply those concepts in solving problems in practical situations.

**Example 1**

In a supermarket car park, there are spaces for 7 buses, 130 cars and 13 motorbike. If all vehicles have an equal chance of leaving at any time, find the probability that the next vehicle to leave will be:

*Total*  $7 + 130 + 13 = 150$

- (i) a bus
- (ii) a car
- (iii) a motorbike or a bus
- (iv) not a car

Solution:

(i)  $P(\text{a bus}) = \frac{7}{150}$

(ii)  $P(\text{a car}) = \frac{130}{150}$

(iii)  $P(\text{a motorbike or a bus}) = P(\text{Bike}) + P(\text{Bus})$   
 $\frac{13}{150} + \frac{7}{150} = \frac{20}{150}$

(iv)  $P(\text{not a car}) = 1 - P(\text{car})$   
 $= 1 - \frac{130}{150}$   
 $= \frac{150}{150} - \frac{130}{150}$   
 $= \frac{20}{150}$

Example 2  $0, 1, 2, 3, 4, \dots$

Consider a roulette wheel which is circular and is divided into 37 equal sectors numbered 0 to 36. The sector number 0 is coloured green. Half of the numbers 1 to 36 are coloured black and the other half are coloured red. A small ball is dropped onto the spinning roulette wheel and eventually lands on one of the numbers when the wheel stops spinning.

A gambler can bet on:

- (i) any one of the numbers 0 to 36
- (ii) even or odds
- (iii) reds or blacks
- (iv) groups of 2, 3, 4, ... 18 numbers.



What is the probability that the ball will land on:

- (a) red numbers?
- (b) an even number?
- (c) the green zero?
- (d) an even or an odd number?

Solution:  $18$  red  $18$  Black  $1$  Green

$$(a) \quad P(\text{red number}) = \frac{18 \text{ Red.}}{37}$$

$$(b) \quad P(\text{even number}) = \frac{19}{37} \leftarrow \text{including "0"}$$

$$(c) \quad P(\text{zero}) = \frac{1}{37}$$

$$(d) \quad P(\text{even or odd}) = \frac{37}{37} = 1$$

### Example 3

A mal-functioning machine produces good articles and defective articles in the ratio 4:1. Three articles are selected at random from the production line.

Find the probability of selecting...

- (a) 3 good ones
- (b) 3 defective ones
- (c) 1 good, then 2 defectives

$G \ D \ D$

Good : Bad  
 $4 : 1$   
Total 5 items

$$P(G) = \frac{4}{5} = 80\%$$

$$P(B) = \frac{1}{5} = 20\%$$

Solution:

$$(a) P(\underset{x}{G} \text{ and } \underset{x}{G} \text{ and } G) = \frac{4}{5} \times \frac{4}{5} \times \frac{4}{5} = \frac{64}{125}$$

$$(b) P(D \text{ and } D \text{ and } D) = \frac{1}{5} \times \frac{1}{5} \times \frac{1}{5} = \frac{1}{125}$$

$$(c) P(G \text{ and } D \text{ and } D) = \frac{4}{5} \times \frac{1}{5} \times \frac{1}{5} = \frac{4}{125}$$

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**NOW DO PRACTICE EXERCISE 16**

**Practice Exercise 16**

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1. A carton of 12 eggs contains five brown eggs, three speckled eggs and four white eggs. If an egg is chosen at random, what is the probability that the egg is:
    - (i) speckled?
    - (ii) white?
    - (iii) not speckled?
    - (iv) brown or speckled?
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2. A group of students is made up of 4 girls and 6 boys. Two students are to be selected to represent the group on the student representative council. They decide to write all names on identical pieces of paper, put them in a hat and choose two names randomly. Find the probability of
    - (i) two boys being selected.
    - (ii) two girls being selected
    - (iii) one girl and 1 boy.

3. If A and B are independent events and  $P(A) = 0.6$  and  $P(B) = 0.4$ , find
- (i)  $P(A \cap B)$
  
  - (ii)  $P(A' \cap B)$  where  $A'$  is the complement of A
  
  - (iii)  $P(A \cap B')$  where  $B'$  is the complement of B
  
  - (iv)  $P(A' \cap B')$
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4. Anton is an archer. The experimental probability that Anton will hit the target is  $\frac{3}{5}$ .
- (i) What is the probability that Anton will hit the target on two successive attempts?
  
  - (ii) What is the probability that Anton will hit the target on three successive attempts?
  
  - (iii) What is the probability that Anton will not hit the target on two successive attempts?

5. Ana has 3 pairs of Nike and 2 pairs of Adidas running shoes. She has two pairs of Nike, 3 pairs of Rio and a pair of Red Robin socks. Preparing for an early morning run, she grabs at random for a pair of socks and a pair of shoes.

What is the probability that she chooses:

- (i) Nike shoes and Nike socks?
  
  
  
  
  
  
  
  
  
  
- (ii) Rio socks and Adidas shoes?
  
  
  
  
  
  
  
  
  
  
- (iii) Adidas shoes and socks that are not Rio?

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**CORRECT YOUR WORK. ANSWER ARE AT THE END OF TOPIC 2**