

Probability & Tree Diagrams Challenge

- 1 A box contains 3 red discs, 5 blue discs and 6 green discs. I remove one disc at random, note its colour then return it to the box. I then remove a second disc at random.
- (a) Find the probability that both discs are the same colour.
- (b) Find the probability that exactly one disc is red.
- (c) If I take a total of 5 discs, replacing the disc each time, find the probability that all 5 discs are red.
- 2 Another box contains 4 yellow discs and 7 black discs. I remove one at random, place it in my pocket then remove a second disc at random.
- (a) Find the probability that the discs are different colours.
- (b) If I take a total of three discs, find the probability that:
- (i) all are yellow (ii) all three are different colours.
- 3 A bag contains some red balls, some blue balls and some green balls. When a ball is removed at random the probability that it is red is $\frac{1}{3}$ and the probability that it is blue is $\frac{2}{9}$. There are more than 30 balls in the box. What is the fewest number of green balls?
- 4 Each morning the probability that Anna gets up late is $\frac{1}{5}$. If she gets up late the probability that she misses her bus is $\frac{5}{6}$. If she doesn't get up late the probability that she misses her bus is $\frac{1}{4}$.
- (a) Find the probability that, on Monday morning, she misses her bus.
- (b) Find the probability that she catches her bus every morning from Monday to Friday.
- 5 A box contains some red ball and some blue balls. There are four more blue balls than red balls. A ball is removed at random, replaced and a second ball randomly removed. The probability that the two balls are different colours is $\frac{21}{50}$. How many balls of each colour are in the box?
- 6 A box contains some white balls and some blue balls. There are 5 more blue balls than white balls. One ball is removed at random and not replaced. A second ball is then removed at random. The probability that the balls are different colours is $\frac{52}{105}$. Find the probability that both balls are white.
- 7 A prize must be randomly awarded to just one of a group of ten people. Which of the following methods is the fairest?
- A:** Fold 10 identical pieces of paper in half and put them in a bag. Nine have 'LOSE' written on them and one has 'WIN'. Line the people in alphabetical order. The first person randomly takes a piece of paper. If it says 'WIN' they are the winner and the game stops there. If it says 'LOSE' they do not replace the paper and the next person has a go.
- B:** Same as 'A' but this time the paper is put back in the bag before the next person has a go.
- C:** Same as 'B', that is each piece of paper is returned to the bag, but there are 999 'LOSE' papers and one 'WIN' paper.

ANSWERS

1 (a) $\frac{5}{14}$

(b) $\frac{33}{98}$

(c) $\frac{243}{537824}$

2 (a) $\frac{28}{55}$

(b) (i) $\frac{4}{165}$ (ii) 0

3 Minimum total number of balls is 36. So there are 16 green balls.

4 (a) $\frac{11}{30}$

(b) $\left(\frac{19}{30}\right)^5 = \frac{2476099}{24300000}$

5 There are 3 red and 7 blue.

6 There are 8 white and 13 blue balls. $P(WW) = \frac{2}{15}$

7 Only option A gives equal chances of everybody winning. Many people miss this and think that the first person to go has the best chance:

$$P(\text{first person wins}) = \frac{1}{10}$$

$$P(\text{second person wins}) = \frac{9}{10} \times \frac{1}{9} = \frac{1}{10}$$

$$P(\text{third person wins}) = \frac{9}{10} \times \frac{8}{9} \times \frac{1}{8} = \frac{1}{10}$$

etc.

In the other two cases it is advantageous to go first