SMILE WORKCARDS

Probability Pack Two

Contents

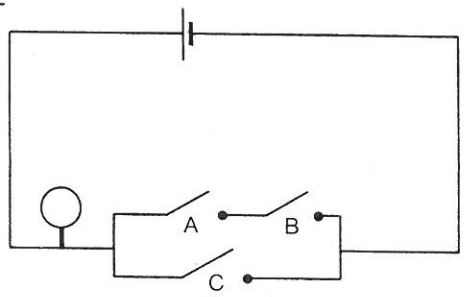
You may need: wire, bulb, battery, 4 switches

Smile **0694**

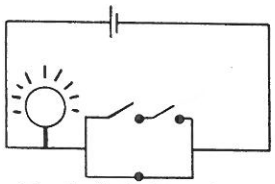
Which switches?

Key, Battery Bulb Switch.

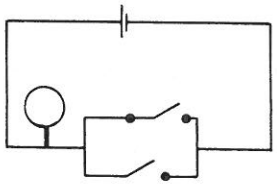
This is a diagram of an electric circuit:



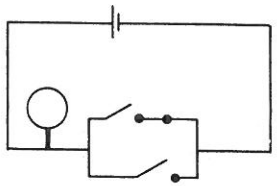
There must be a complete circuit for the bulb to light up.



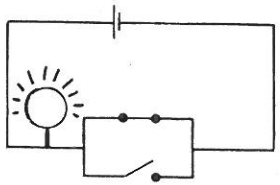
The bulb lights when C is on



A on : no light



B on : no light

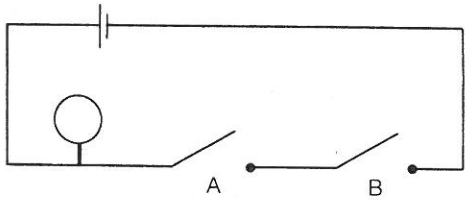


A and B on : bulb lights

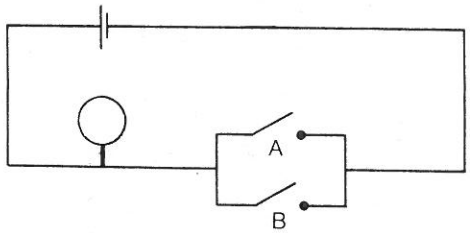
So, for the bulb to light in this circuit, EITHER A and B must both be on OR C must be on.

1. Examine these circuits.
   For each one write down which switches, or combinations of switches, will light the bulb.

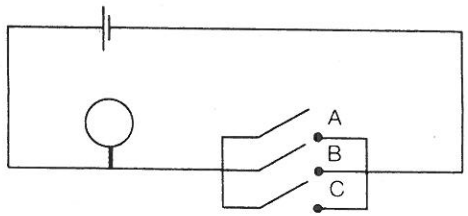
(a)



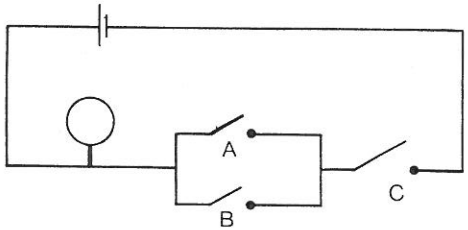
(b)



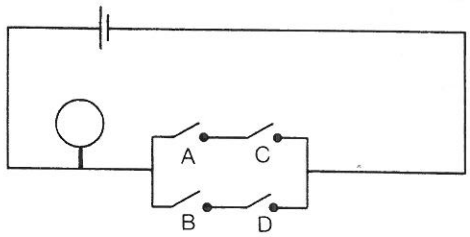
(c)



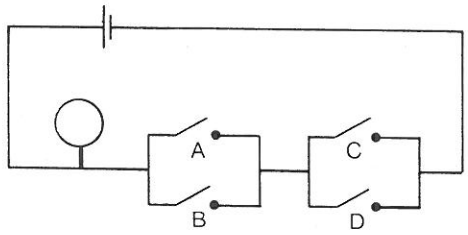
(d)



(e)



(f)



2. Make sure someone else can understand your written answers.

What's the Probability?

In mathematics, *probability* is used as a measure of the likelihood that an event will happen or not.

If an event is **certain** to happen, the probability is **1** (or 100%).

If an event is **impossible**, the probability is **0** (or 0%).

If an event has an **even chance** of happening or not happening, the probability is $\frac{1}{2}$ (0.5 or 50%).

- When tossing a coin, you can get a head or a tail. The probability of obtaining a head is one out of two, or $\frac{1}{2}$.
- When throwing a dice, the probability of obtaining a "2" is one out of six or $\frac{1}{6}$.
- When picking a card from a pack, the probability of obtaining a queen is 4 out of 52 or $\frac{4}{52}$. $\frac{4}{52}$ can be cancelled to $\frac{1}{13}$.

Give each answer as a fraction and cancel it down to its lowest form if possible.

1. Sapna tossed a dice. What is the probability that she throws:

   a) a "3" b) a "5" c) an odd number d) a number greater than 4?

2. Esme draws a card from a pack. What is the probability that she draws:

   a) a king b) a seven c) a diamond d) a black card?

3. A bag contains a red ball, a blue ball, and a yellow ball. Sam takes a ball from the bag without looking. The balls are the same size and it is equally likely that she will choose any one of them. What is the probability that she takes:

   a) the yellow ball b) the blue ball c) a ball that is <u>not</u> red?

4. A bag contains only orange flavoured sweets and Josh takes one without looking. What is the probability that he takes:

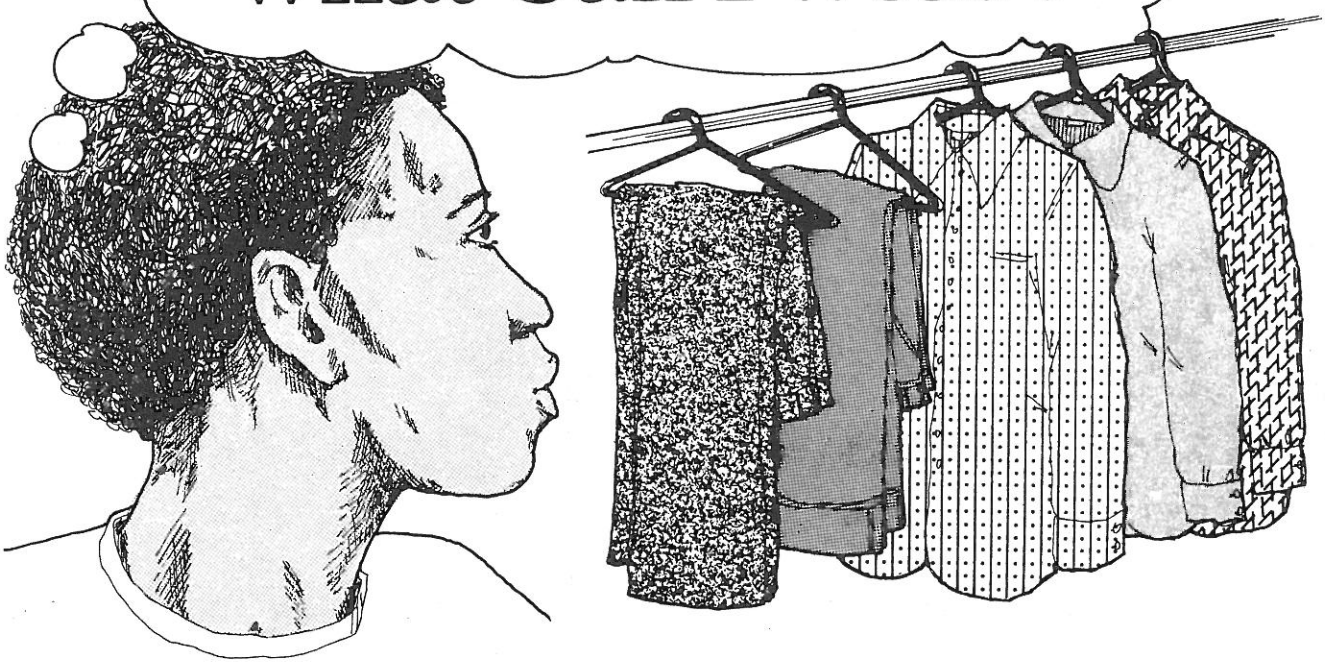
   a) an orange flavoured sweet b) a lemon flavoured sweet?

5. The numbers 1 to 10 inclusive are put in a hat. Sacha takes a number without looking. What is the probability that he draws:

   a) the number 7 b) an even number c) a prime number d) a number greater than 6?

6. A football match can end in one of three ways: a home win, a draw or an away win. Is it sensible to say that the probability of a home win is $\frac{1}{3}$? Explain your answer.

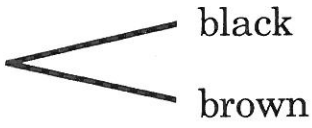
What Can I Wear?



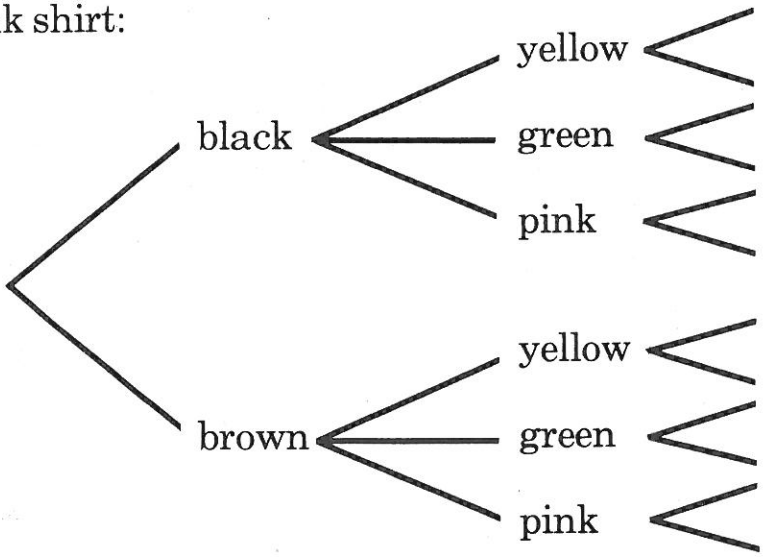
Denis has 2 pairs of trousers and 3 shirts.
There are 6 different ways he can pick his shirt and trousers.

(1) What are these 6 ways?

Denis can choose black or brown trousers:



Whichever trousers he wears, he can choose a yellow, green or a pink shirt:



(2) If Denis has a red tie and a blue tie, how many possibilities are there now? Copy the tree diagram above and complete it.

TURN OVER

(3) Denis' Saturday Night Out

Draw a tree diagram to show how many possibilities there are for Denis on Saturday night.

(4) There are three stages on Denis' journey:

Stage 1: He can go by bus or tube.

Stage 2: He can then go by train or tube.

Stage 3: He can go by taxi or walk.

Draw a tree diagram to show the number of possible ways Denis can travel.

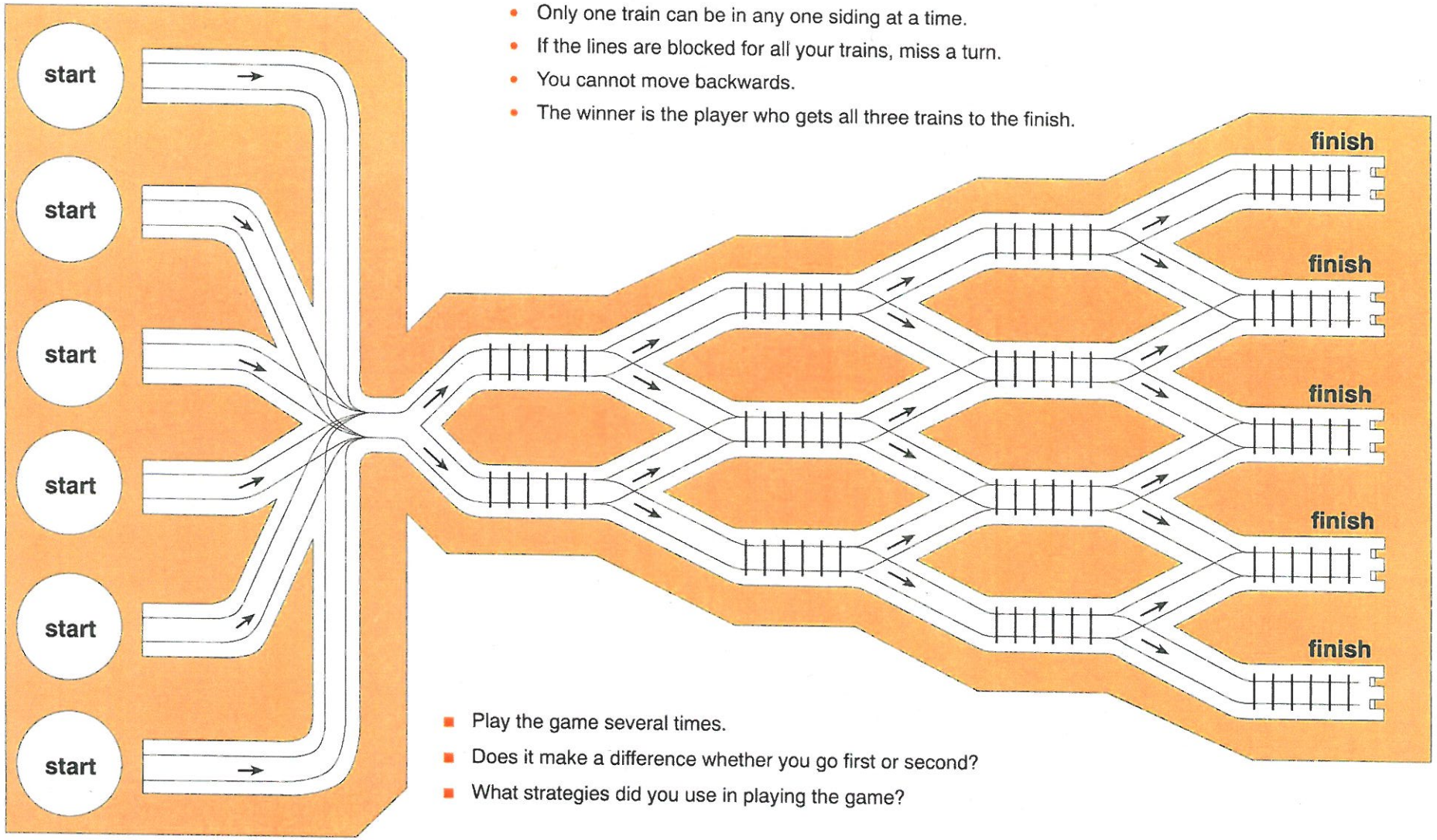
Sidings

A game for 2 players

- Each choose 3 counters of one colour.
  Each counter represents a **train**.
  Each ⫶⫶⫶⫶⫶ represents a **siding**.

Rules

- Place the (trains) counters on the six positions marked 'start'.
- Take turns to move one of your trains from the start to one of the next sidings.
- You may move any one of your trains.
- Only one train can be in any one siding at a time.
- If the lines are blocked for all your trains, miss a turn.
- You cannot move backwards.
- The winner is the player who gets all three trains to the finish.

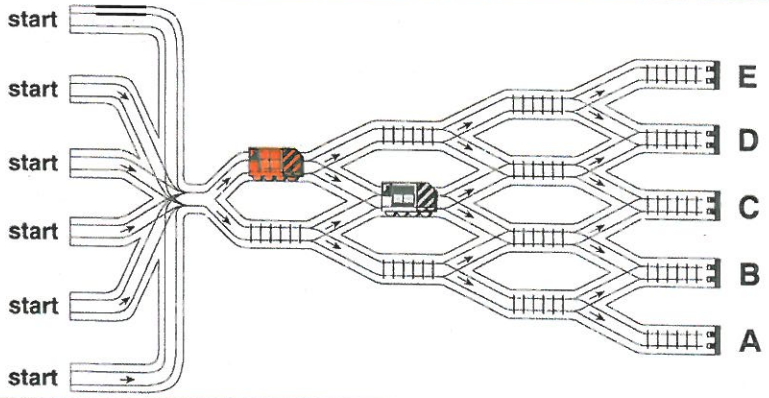


- Play the game several times.
- Does it make a difference whether you go first or second?
- What strategies did you use in playing the game?

1. From where the orange train is shown, how many finishing points can you get to? Which are they?

2. From where the grey train is shown, how many finishing points can you get to? Which are they?

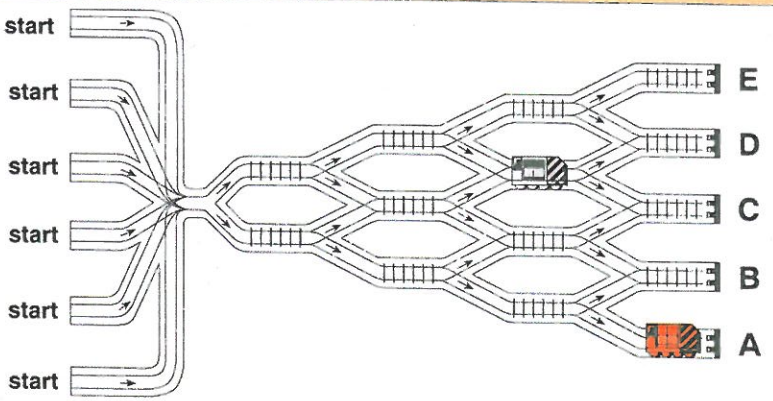
3. Answer the same questions for each of the other sidings.



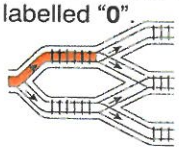
4. How many ways are there of getting to where the grey train is shown?

5. How many ways are there of getting to where the orange train is shown?

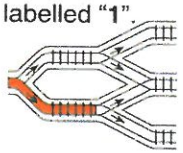
6. How many ways are there of getting to each of the 14 sidings?
What is the total number of routes to sidings **A**, **B**, **C**, **D**, and **E**?



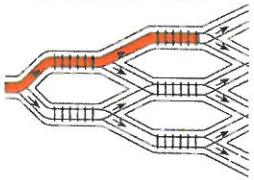
This route can be labelled "**0**".



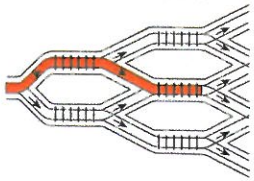
This route can be labelled "**1**".



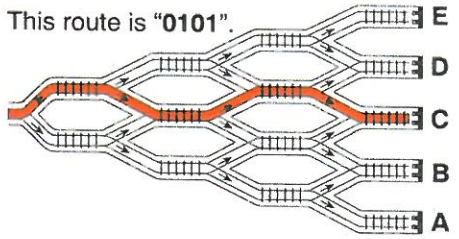
This route is "**00**".



This route is "**01**".



This route is "**0101**".



7. Find one route that finishes at **A**. What is its label? Can you find any other routes that finish at **A**?

8. a) Where would route **1011** finish?
b) How many more routes can you find that finish at the same point?

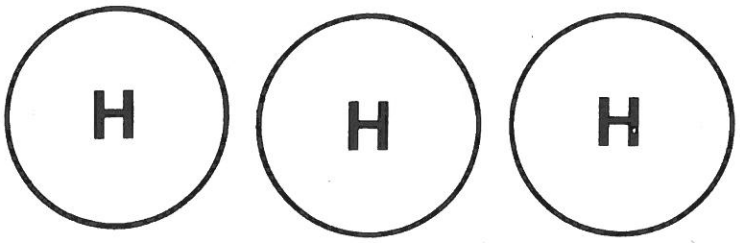
9. Copy and complete this table.

Finish	Routes
A	1111
B	1110
	1101

You will need: 3 coins

The Three Coin Problem

Here is a problem:



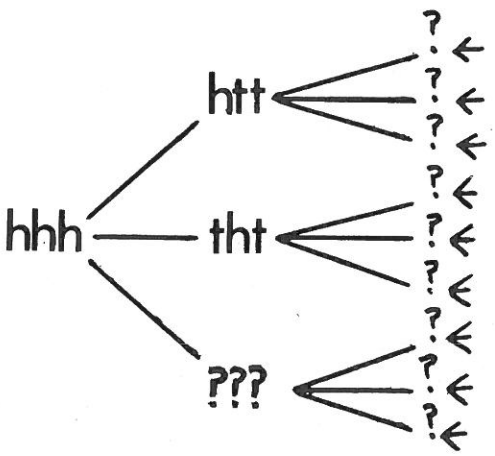
Put down 3 coins - all showing HEADS.
You must turn the coins over TWO AT A TIME.
The problem is to try and make the coins all show TAILS.

You should have found that it is impossible.

Try to PROVE it.

One way to do this would be to show every possible move that can be made, starting with 3 heads.

Write the possible results down. Here is one way to start.



You do not need to go on forever!!

Explain why not.

0737

You will need: 2 dice, squared paper.

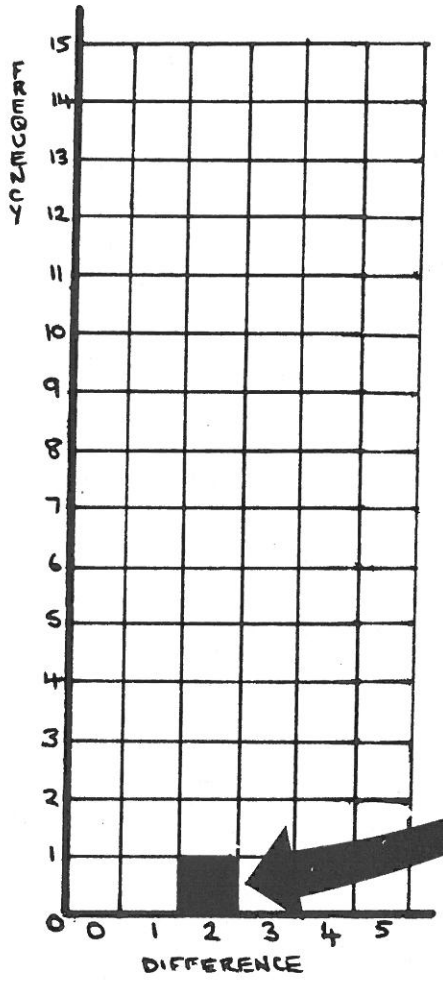
What Chance ?

(1) If you throw two dice and find the difference between the two numbers.....

(a) What is the largest difference you can get?

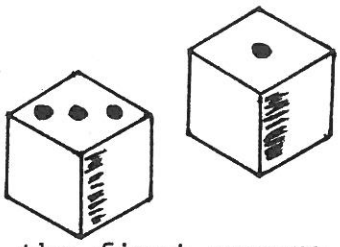
(b) What is the smallest difference you can get?

(2) Draw a graph like this:-



Throw two dice on the table and record the difference between the two numbers by shading a square in the correct column.

For Example:
if you threw



you would shade the first square in the 2 column.

Carry on until <u>one</u> of the columns reaches the top.

(a) Which column won?

(b) Can you think of a reason why?

(c) How many times did you throw the two dice?

(3) Now copy and complete this table to show all the possible differences.

Second Die

First Die	1	2	3	4	5	6
1	0	1	2	3	4	5
2	1	0				
3						
4						
5						
6						

(a) Write down anything you notice about your completed table.

(b) How many different ways of getting a difference are there altogether?

(4) a) Shade all the 0's in your table. How many?
The probability of scoring 0 is $\frac{6}{36}$. Why?

b) Shade all the 1's. How many? Probability of scoring 1 ?

c) Copy and complete this table to show all the probabilities.

Difference	0	1	2	3	4	5
Probability	$\frac{6}{36}$	$\frac{10}{36}$				

d) Add up all the probability fractions - what do you notice?

(5) PROBLEM If you win 1p each time you throw a difference of 1,2,3 or 4 and you lose 4p each time you throw a difference of 0 or 5, are you likely to make a profit after, say, 36 goes?

Try to explain your answer.

smile
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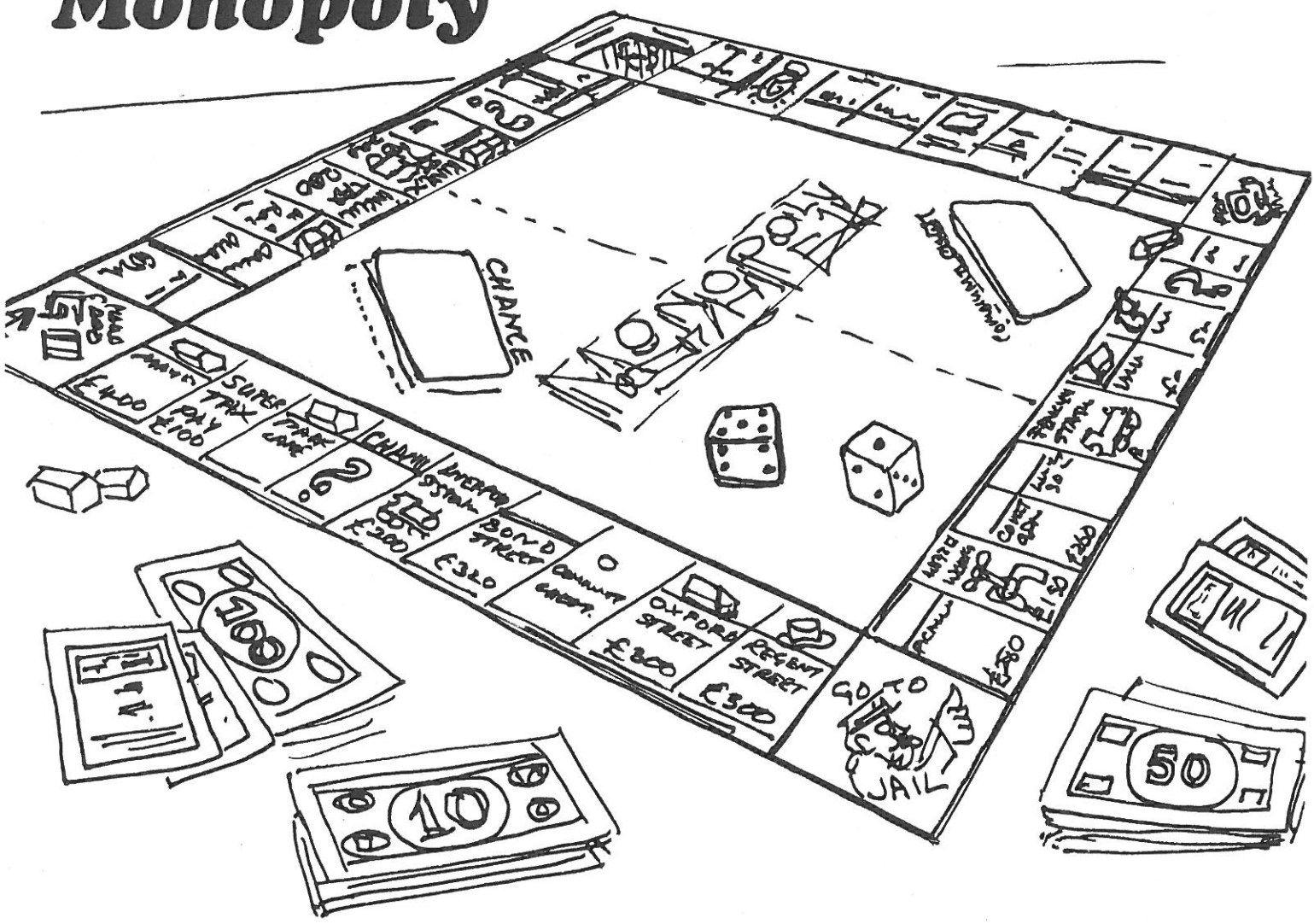
Monopoly



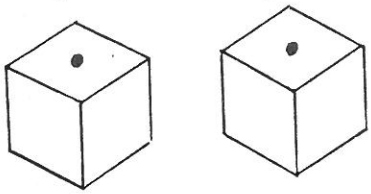
(1) You are 7 squares away from MAYFAIR which is owned by your rival and has a hotel on it, which means that if you land there it will cost you £2000 .....

.....It is your turn. Is it wise to spend money developing your own property before you throw the dice, or should you save it in case you have to pay ?

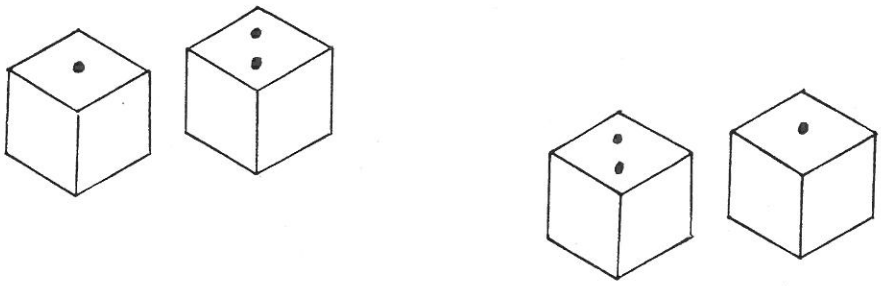
Give reasons for your decision.

Now work through the rest of this booklet;you might want to change your decision.

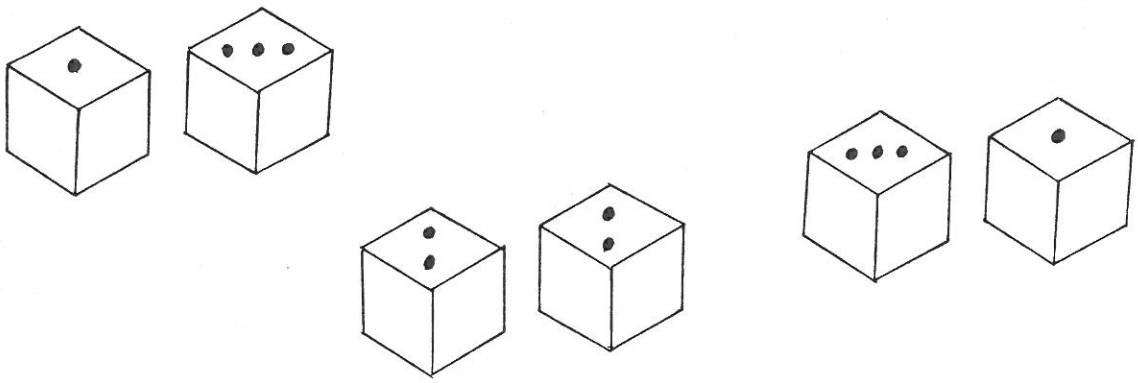
There is only one way of scoring a 2:



There are two ways of scoring a 3:



There are three ways of scoring a 4:



(2) Copy and complete this table for all the scores.
(Remember that 6 is the highest number on a dice)

Score	2	3	4	5	6	7	
Ways of getting the score	1+1	1+2 2+1	1+3 2+2 3+1	1+4			
Total	1	2	3				

(3) How many ways are there of scoring a 6?

(4) How many ways are there of scoring a 10?

(5) Are you more likely to score a 6 or a 10? Why?

(6) Are you more likely to score a 5 or a 9? Why?

(7) How many different ways are there of scoring altogether?

(8) Why is 7 away from Mayfair dangerous?

Another way to list all possible scores with two dice is to make a table.

	1	2	3	4	5	6
1	2	3	4	5	6	7
2	3	4	5			
3						
4						
5						
6						

(9) Copy and complete this table.

You should have 36 entries in the table.

(10) Now shade all the 7's. You should have shaded six altogether.

This means that there are 6 ways out of 36 to score a 7 .....

..... so the probability of scoring a 7 is $\frac{6}{36}$

(11) Use the entries in your table to copy and complete the table below, which shows the probabilities for each score.

Score	2	3	4	5	6	7	8	9	10	11	12
Probability						$\frac{6}{36}$					

(12) A Problem

At a school fete two boys run a stall where competitors roll two dice.

Wins are:

a double pays 3p

a total of 7 pays 2p

Are the boys likely to make a profit if they charge 1p a go?

(13) Now make your final decision about question (1) and explain it.