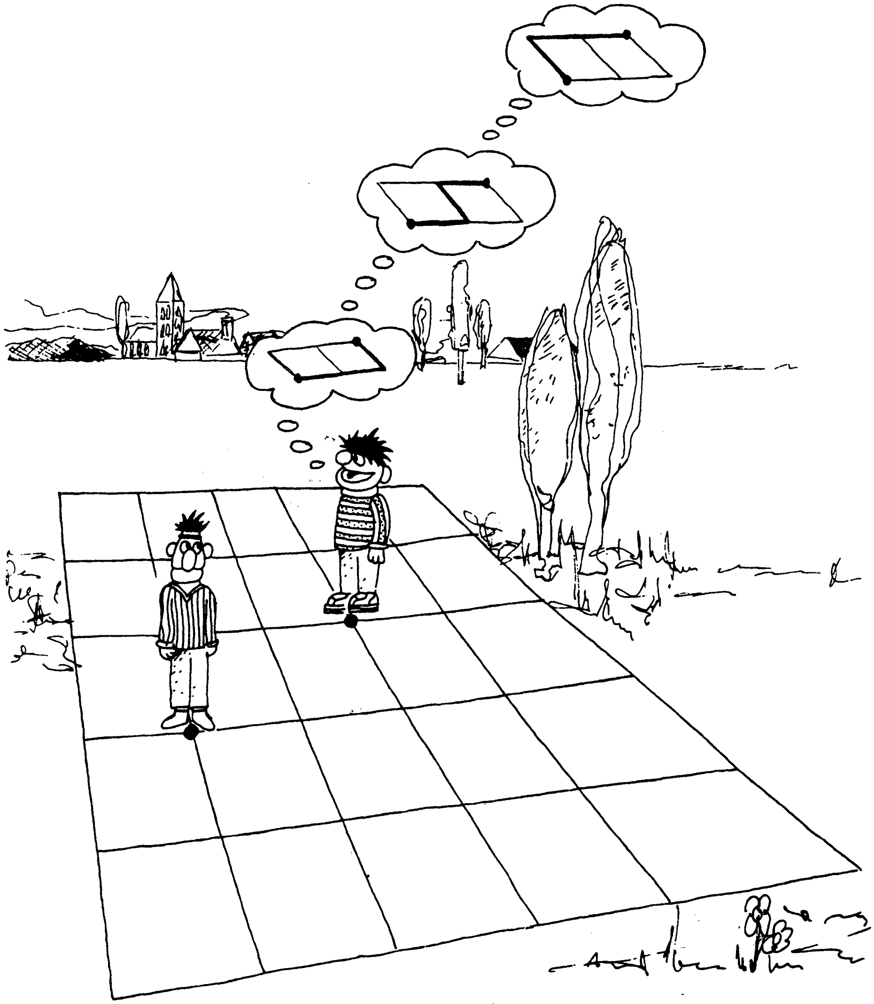
Mathematical Material for Chapter II



Counting Problems

This mathematical activity consists of eleven counting problems for grades one to six. In chapter II these assignments are used to illustrate the basic concepts of mathematisation and didactisation as well as to illustrate the starting points of Wiskobas' mathematics education.

Before reading Chapter II, the reader is asked to complete the assignments. The answers are given at the end of the mathematical material section, and the reader can find further comments on the problems later on in Chapter II.

Design based on ideas from A. Engel, H. Freudenthal, E. de Moor and A. Treffers.

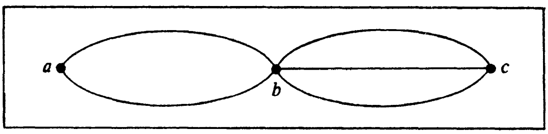
COUNTING PROBLEMS

1. *Flowers*

Given: three sets of flower petals, each of a different colour and two different coloured centres. How many differently coloured flowers can be made?

2. *Routes*

How many different routes run directly from *a* to *c* via *b*? Describe them.

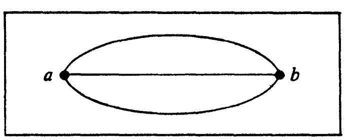


3. *Apples*

An apple tree has three branches. Each branch has three smaller branches, each of the smaller branches has three stems and each stem has one apple. How many apples are there on this tree? How can the position of an apple be indicated?

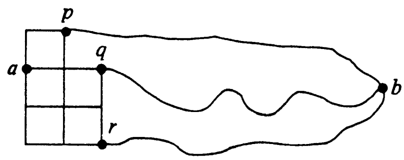
4. *To and Fro*

How many different routes are possible from *a* back to *a* via *b*?



5. *To and Fro Again*

A person lives in *a* and works in *b*. On the way to work he can use the exit roads *pb*, *qb* and *rb*, to which he can go directly, i.e. without going out of his way. The same is possible on the way back, but now in the opposite direction. How many different *aba* routes can our traveller take?

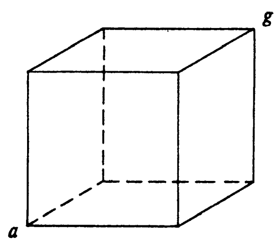


6. *Number Cards*

There are three cards numbered 1 , 2 , 3 . Find out how many different numbers can be made from the combination of these three cards.

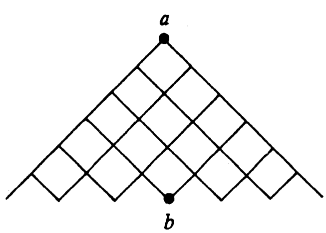
7. *The Cube Crawler*

A cube crawler goes directly from *a* to *g* along the edges of the cube. How many different routes can he take and how can these routes be described?



8. *Routes on a Highway Network*

How many different routes go from *a* to *b* on this network without making a detour?



9. *Score Progression*

In the soccer game PEC versus Heerenveen the final scores were 6—3 (at half-time 4—2). The score progression is a chain of successive goals made by either team. In our case there are nine links. A possibility is p—p—h—p—p—h—h—p—p.

How many different chains are possible? In other words: in how many different ways could the score have developed?

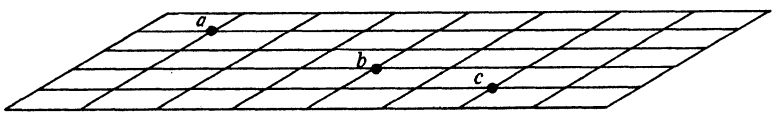
10. *Families*

Acting on the assumption that the chance per family of a boy being born is as great as the chance for a girl, indicate the boy-girl situations that can be expected in a sample of 160,000 families with four children. For example: 20,000 families with four boys; 30,000 families with three boys and one girl, etc. Explain the answer!

11. *Other Roads*

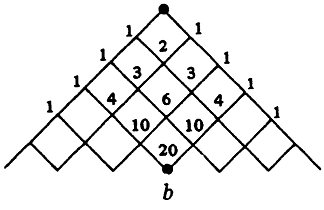
A person travels from *a* to *c* via *b* daily, taking what he considers to be the shortest route. One day he decides that he will take a different "shortest" route *abc*.

How many times will he be able to change his route?



ANSWERS

1. $3 \times 2 = 6$.
2. $2 \times 3 = 6$.
3. $3 \times 3 \times 3 = 27$.
4. $3 \times 3 = 9$.
5. *apb* contains two routes; *aqb* has 1 route; *arb* has six routes. There are nine possible routes on the way to work.
   The total number of different routes *aba* is therefore $9 \times 9 = 81$.
6. $3 \times 2 = 6$.
7. $3 \times 2 = 6$.
8. 20.



9. $15 \times 3 = 45$.

10. Approx. 10,000 families with four boys.
    Approx. 40,000 families with three boys and one girl.
    Approx. 60,000 families with two boys and two girls.
    Approx. 40,000 families with one boy and three girls.
    Approx. 10,000 families with four girls.
11. There are ten "shortest" routes of equal length *a* to *b*. There are three from *b* to *c*. The number of routes *abc* is therefore $10 \times 3 = 30$.