

## COMBINATORICS I

MATH CIRCLE (INTERMEDIATE) 10/09/2011

1) Suppose there are 5 different teacups, 3 different tea saucers, and 4 different tea-spoons in the “Tea Party” store. How many ways are there to buy a set consisting of a cup, a saucer, and a spoon?

2) There are four towns A, B, C, and D in Wonderland. In Wonderland, all roads are one-way. Suppose there are 6 different roads from A to B, 3 from A to C, 4 B to C, and 2 C to D. How many ways are there to get from A to C?

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3) Suppose we revisit the “Tea Party” store from problem 1. How many ways are there to buy two different items from the set? For example, we could buy one of the cups and one of the spoons, but not two spoons.

4) Each box in a  $8 \times 8$  checkerboard can be colored either black or white. How many different colorings of the checkerboard are there?

5) Suppose we have a ternary alphabet with only the letters 'A', 'B', and 'C'. A word in this language is an arbitrary sequence of no more than 4 letters. How many words does the language contain?

6) A captain and a deputy captain must be elected in a soccer team with 11 players. How many ways are there to do this?

7) Suppose we have pieces of fabric of 6 colors. How many ways are there to sew a flag with 3 horizontal strips (each of a different color) of equal height? Note we can distinguish the top of the flag from the bottom.

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8) How many ways are there to put 2 rooks on a chessboard so that they do not attack each other?

9) How many ways are there to put 2 kings on a chessboard so that they do not attack each other?

Problems are taken from:

- D. Fomin, S. Genkin, I. Itenberg “Mathematical Circles (Russian Experience)”
- Previous UCLA Math Circle notes