

Walter Reed Math Counts - Combinatorics II

Problem Set

15 January, 2016

Problem 1

King Arthur asks his Queen to sew a silk tournament flag for him. He would like the flag to be made from four vertical strips of different colors: green, black, white, and yellow. How many ways are there for the Queen to design the flag?

Note: The answer to this question does not depend on the shape of the tournament flag!

Problem 2

How many different ways are there to add together 16 numbers?

Problem 3

Suppose an electricity generating windfarm has two models of wind turbines on the farm: Type S is the old model, and takes 15 minutes to generate $160kW$ ($kW = \text{kilowatt}$, a measure of electrical energy). The Type T model, on the other hand, is brand new and can generate $160kW$ in half the time as Type S. How long does it take for Type S and Type T wind turbines to generate $160kW$ of electricity *together*?

Problem 4

Martians are very mathematical beings. Their entire language is built up combinatorially. There are only 6 letters in the Martian alphabet. All Martian words are exactly 4 letters long. There are three Martian "dialects", labeled a, b, and c, each with a different rule for what combinations of letters make up words:

a. Suppose that any sequence of 4 letters is a valid Martian word, for example if the Martian Alphabet had the letters: @, #, \$, %, & and ^, then a Martian

word would be something like $\$ \# \& ^{\wedge}$. How words are there in the Dialect-a Martian language?

b. Suppose any sequence of 4 *non-repeating* letters is a valid Martian word. How many words are there in this Martian dialect?

c. Suppose any sequence of 4 letters *that has at least one repetition* is a valid Dialect-c Martian word. How many words are there in this language? (Hint: How can you use the answers to *a* and *b* above to figure out an easy way to solve *c*?)

Problem 5

a Find 4 positive integer numbers such that their sum is equal to their product (Look at small numbers first).

b Find 1000 positive integer numbers such that their sum is equal to their product (Hint: Take the previous part as inspiration).