**Challenge Problems – Flags and a New Expansion**

**Solve the following problem from combinatorics theory**

 1) For this problem you have flags, which are distinct, and flagpoles, which are also distinct. The flags are placed on the flagpole in an order, so that if a red flag is on top of a blue flag, that’s different than a blue flag being on top of a red flag. Assume the flagpoles are tall enough to hold all the flags.

 a. List all the ways to place 3 flags on 2 poles, so that each pole has at least one flag. Invent your own notation for the problem.

 b. How many ways are there to place 10 flags on 6 flagpoles if flagpoles are allowed to be empty?

 c. How many ways are there to place 10 flags on 6 flagpoles if flagpoles are not allowed to be empty?

 d. How many ways are there to place n flags on k flagpoles if flagpoles are allowed to be empty? Assume n and k are natural numbers.

 e. How many ways are there to place 10 flags on 6 flagpoles if flagpoles are not allowed to be empty? Assume n and k are natural numbers.