

# Combinatorics Handout

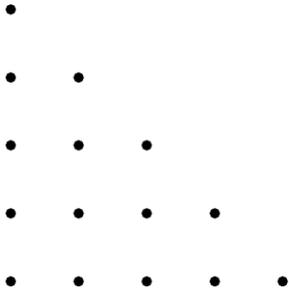
Denver Math Club

September 2018

1. Russell has 5 shirts, 4 pairs of pants, and 2 ties. How many different outfits can he wear composed of 1 shirt, 1 pair of pants, and 1 tie?
2. Henry's Hamburger Heaven offers its hamburgers with the following condiments: ketchup, mustard, mayonnaise, tomato, lettuce, pickles, cheese, and onions. A customer can choose one, two, or three meat patties, and any collection of condiments. How many different kinds of hamburgers can be ordered?
3. One thousand unit cubes are fastened together to form a large cube with edge length 10 units; this is painted and then separated into the original cubes. What is the number of these unit cubes that have at least one face painted?
4. Three tiles are marked  $X$  and two other tiles are marked  $O$ . The five tiles are randomly arranged in a row. What is the probability that the arrangement reads  $XOXOX$ ?
5. A set of three points is randomly chosen from the grid shown. Each three point set has the same probability of being chosen. What is the probability that the points lie on the same straight line?  


A 3x3 grid of points, represented by dots arranged in three rows and three columns.
6. Ten balls numbered 1 to 10 are in a jar. Jack reaches into the jar and randomly removes one of the balls. Then Jill reaches into the jar and randomly removes a different ball. What is the probability that the sum of the two numbers on the balls removed is even?

7. There are 5 yellow pegs, 4 red pegs, 3 green pegs, 2 blue pegs, and 1 orange peg to be placed on a triangular peg board. In how many ways can the pegs be placed so that no (horizontal) row or (vertical) column contains two pegs of the same color?



8. Using the letters  $A$ ,  $M$ ,  $O$ ,  $S$ , and  $U$ , we can form five-letter "words". If these "words" are arranged in alphabetical order, then the "word"  $USAMO$  occupies what position?
9. Pat is to select six cookies from a tray containing only chocolate chip, oatmeal, and peanut butter cookies. There are at least six of each of these three kinds of cookies on the tray. How many different assortments of six cookies can be selected?
10. A fair die is rolled six times. What is the probability of rolling at least a five at least five times?