

Math 245: Counting Problems written by the Fall 2013 Discrete Math Class.

DUE: Thursday, November 21, 2013

The following problems are verbatim and are in no particular order. Please write up solutions (not just answers) to each problem, except your own (unless you think you made a mistake, or did not submit a solution with your problem!). If you believe the problem has no solution or that a solution cannot be determined, state that and explain your reasoning.

1. Mrs. Vanden Eynden would like to create the most beautiful rainbow in the world ignoring the tradition ROYGBV (Red Orange Yellow Green Blue Violet) color scheme, but still only using 6 colors. She has a box of 36 crayons.
 - A. How many crayons does she have?
 - B. How many variations of a rainbow can she make if the order matters, and she does not use any of the same colors twice? Hint: she will still use the colors red orange yellow green blue and violet, just not in the same order as a rainbow.
2. You are to create a password that is 7 characters (A-Z, 0-9) long that includes only one capital letter and one number 0-9. Also, there are to be no small case letters repeated. How many possibilities are there?
3.
 - a. How many positive four-digit integers are divisible by 8?
 - b. What would be the probability that a randomly chosen positive four-digit integer is divisible by 8?
4. Dr. Jenny wants to create a new 8-organism human centipede. She chooses the “more worser” bottom eight students in a Discrete Mathematics class. The students are denoted by the following symbols: Mu, Lambda, Gamma, Theta, Beta, Epsilon, Delta, and Alpha. To accomplish her creation, she must first line up the organisms in a single file line. In how many ways can this be done if Delta and Epsilon insist on being placed standing next to each other?
5. You have 20 California burritos, 20 bean burritos, and 20 shrimp burritos. None of them are labeled. What is the least number of burritos you would have to eat before you eat two California burritos?
6. In the country of Discreté Mathematistan, the scooters all have unique scooter identification numbers with 4 letters followed by 5 numbers. How many different combinations are there if the first letter is always x and repetition is not allowed?
7. Suppose you are playing a game where there are 12 snozzberry muffins in a muffin tray and you must pick one and eat it. In ten of the muffins there are poison snozzberries and in two there are golden tickets to visit Santa's corporately endorsed sweatshop in the North Pole. Now suppose the first five people to pick a muffin choose the poison muffins. The sixth person fortunately chooses a muffin with a golden ticket! Now it's your turn.
 - a) What is the probability that you will pick a muffin with the golden ticket?
 - b) Would you have a better chance of picking a muffin with a golden ticket if you were the first person to choose one?
8. There are 33 students in a discrete math class. The class is separated into 3 groups. Group Q.E.D. has 15 students, group Raunchy P's has 6 students, and group Q.E.F.D has 12 students. Suppose that a doctor is discreetly creating a linear assortment of humans and the Dr. is in desperate need for a student to be the “middle piece”. The doctor decides a member of the Raunchy P's will make an excellent middle piece. But wait, just when you thought it couldn't get any worser it turns out that the doctor is pre-faded and can't see the student's faces! How many students would the good doctor have to choose in order to guarantee that at least 1 of the students is a member of the Raunchy P's?
9. Sally, Joe and Nick all go out dancing with their 7 friends. But once they get to the dance, 3 of their friends get in a fight and will not dance with each other. How many people can then dance with each other?
10. In a computer science class, there are 31 male students, 1 male instructor, and 5 female students. The instructor assigns people into groups for a collaborative project. How large must each group be in order for there to be at least one female in each group? Find the smallest group size where every group is the same size.
11. Suppose that in California, all automobile license plates have four letters followed by four digits. How many license plates could begin with the word MATH followed by four distinct digits?
12. A student is trying to hack his professor's computer to change his grades to get an A in the class. He got stuck with the professor's computer password. He is still new hacker (does not have a lot of experience). He decided to ask his professor to show him his grade, so he could see the professor typing the password. He could tell that the password that the professor typed was longer than 8 characters, and less than 13. He saw the professor using letters and numbers for his password. He also could eliminate 10 digits (numbers and letters combined) by watching the professor typing his password. He made a table to figure out the different passwords that use letters and numbers, how many passwords are there?

13. A gamer has a giftcard to game stop, he can choose one of 8 different action titles. One of 12 different Shooter games. Lastly one of 6 different racing games. In how many ways can he Select one from each category?
14. There are 3 papers in a hat with a letter on each paper, "x", "y", and "z". Pull out the letters one at a time, without replacing them, to spell a word. How many outcomes are there?
15. The game store is selling the new PS4 games with a buy two get one free deal, and there are only 8 launch titles. How many different ways can Tom get 3 different games?
16. There were 27 survivors living in a camp. They were thriving with food, water, and ammunition until they were over run by bandits and thieves. Now there are only 8 survivors left. They are running extremely low on supplies, so they must venture into town in order to gather food, water, and ammunition. They need 5 people for this expedition and the rest will have to guard the camp. How many different 5- person teams can be created from a group of 8 survivors if each survivor has an equal chance of being selected?
17. A cat competition has narrowed its contestants to a group of 15. In how many unique ways can the remaining contestants place 1st, 2nd, 3rd, and 4th?
18. A Grossmont College student ID card has seven digit numbers?
 - a. How many ID cards can be formed if repetition of the digit is allowed?
 - b. How many ID cards can be formed if repetition of the digit is not allowed?
19. The Central Intelligence Agency is searching for 5 suspects. The 5 suspects are on one of 6 different continents (excluding the Antarctica) and no suspects can be on the same continent at any one time. How many different continents can the suspects be on? All things equal, what is the probability that one suspect is in a continent south of another?
20. Given 34 people in a classroom (33 students and one teacher), what is the probability that at least two people in this classroom have the same birthday (Day and Month is the same, not year)?" Assuming that birthdays are equally likely to occur in a 365 day year (ignore 366 day leap year possibility).
21. You have 15 blue, 15 red, and 15 green jolly ranchers in a bag. you reach in and pull some out without looking. you have two friends and yourself wanting a red jolly rancher. what is the least number of jolly ranchers you need to pull out in order to be sure that you have three of the red ones?
22. Eight points are plotted onto a piece of paper such that they create a circle. How many unique triangles can be formed using the points of the circle?
23. There is a flower club of 50 members. There are 3 top flowers sold: Daisies, lilies, and roses. 12 members bought daisies, 15 bought lilies, and 14 bought roses. 6 members bought both daisies and lilies. 8 bought both lilies and roses. 6 bought daisies and roses. 5 bought all 3 types of flowers. Let D be members who bought daisies and let L be members who bought lilies and let R be members who bought roses. Make a Venn diagram. Fill in the 8 regions in the Venn diagram.
24. I'm going to plant five rose bushes, three tulip plants, six iris plants, and four daffodils in a row in my garden. How many distinguishable orderings can I arrange them in?
25. How much wood does a woodchuck chuck,(in a year) if a woodchuck would chuck a bundle of wood equal to the date, each day. (i.e. 6 bundles on the 6th etc.) Given: 30 days has September, April, June and November. All the rest have 3, except February's great with 28.
26. Suppose you want to package a box of chocolates from See's containing 12 pieces as a birthday gift for your mother. Of the various selections, your mother only likes 4 types. How many different selections of 12 pieces can you make?
27. Due to lacking participation, an election is set so that all the candidates will hold an office. There will be one president, one vice president, three secretaries, five senators, and ten representatives. How many ways are there of organizing the 20 participants in these offices?
28. This is it! To win the ultimate mega jackpot (worth \$60,000,000!!!) you must randomly draw from a bucket the two number balls you need: 4 and 29! What is the probability you'd draw the numbers 4 and 29 assuming you know that the bucket holds 50 balls and that there are two 4 balls and one 29 ball?