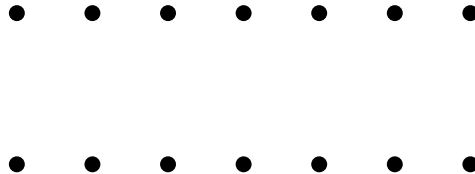


**Instructions:** The problems below are purely for you to practice. I will not collect these, but it is still a good idea to write out your solutions in full. Any of these problems or problems similar are fair game for quizzes and exams.

1. Your wardrobe consists of 5 shirts, 3 pairs of pants, and 17 bow ties. How many different outfits can you make?
2. For an interview, you must wear a tie. You own 3 regular (boring) ties and 5 (cool) bow ties. How many choices do you have for your neck-wear?
3. You realize that the interview is for clown-college, so you should probably wear both a regular tie and a bow tie. How many choices do you have now?
4. You realize that it would also be okay to wear more than two ties.
  - (a) You must select some of your ties to wear - everything is okay, from no ties up to all ties. How many choices do you have?
  - (b) If you want to wear at least one regular tie and one bow tie, but are willing to wear up to all your ties, how many choices do you have for which ties to wear?
  - (c) How many choices do you have if you wear exactly 2 of the 3 regular ties and 3 of the 5 bow ties?
  - (d) Once you have selected 2 regular and 3 bow ties, in how many orders could you put the ties on, assuming you must have one of the three bow ties on top?
5. Your Blu-ray collection consists of 9 comedies and 7 horror movies. Give an example of a question for which the answer is:
  - (a) 16.
  - (b) 63.
6. Consider all 5 letter “words” made from the letters  $a$  through  $h$ .
  - (a) How many of these words are there total?
  - (b) How many of these words contain no repeated letters?
  - (c) How many of these words (repetitions allowed) start with the sub-word “aha”?
  - (d) How many of these words (repetitions allowed) either start with “aha” or end with “bah” or both?
  - (e) How many of the words containing no repeats also do not contain the sub-word “bad” (in consecutive letters)?
7. How many 10-bit strings contain 6 or more 1's?
8. What is the coefficient of  $x^9$  in the expansion of  $(x+1)^{14} + x^3(x+2)^{15}$ ?
9. Let  $S = \{1, 2, 3, 4, 5, 6\}$ 
  - (a) How many subsets are there total?
  - (b) How many subsets contain  $\{2, 3, 5\}$  as a subset?
  - (c) How many subsets of  $S$  contain no prime numbers?
  - (d) How many subsets contain at least one odd number?
  - (e) How many doubletons (i.e., subsets of two elements) contain exactly one even number?
10. How many shortest lattice paths start at  $(3,3)$  and
  - (a) end at  $(10,10)$ ?
  - (b) end at  $(10,10)$  and pass through  $(5,7)$ ?
  - (c) end at  $(10,10)$  and avoid  $(5,7)$ ?

11. A pizza parlor offers 10 toppings.
- (a) How many 3-topping pizzas could they put on their menu? Assume double toppings are not allowed.
  - (b) How many total pizzas are possible, with between zero and ten toppings (but not double toppings) allowed?
  - (c) The pizza parlor will list the 10 toppings in two columns on their menu. How many ways can they arrange the toppings in the left column?
12. How many quadrilaterals can you draw using the dots below as vertices (corners)?



13. How many of the quadrilaterals possible in the previous problem are:
- (a) Squares?
  - (b) Rectangles?
  - (c) Parallelograms?
  - (d) Trapezoids?
14. On a business retreat, your company of 20 businessmen go golfing.
- (a) You need to divide up into foursomes (groups of 4 people): a first foursome, a second foursome, and so on. How many ways can you do this?
  - (b) After all your hard work, you realize that in fact, you want each foursome to include one of the five CEO's. How many ways can you do this?
15. How many different seating arrangements are possible for King Arthur and his 9 knights around their round table?