

5.1 The Basics of Counting

Product Rule

Suppose a procedure can be broken into a sequence of two tasks. If there are n_1 ways to do first task and for each of these n_1 ways, there are n_2 ways to do second task, then there are $n_1 n_2$ ways to do procedure.

Sum Rule

If a task can be done either in one of n_1 ways or in one of n_2 ways, where none of the set of n_1 ways is the same as any of the set of n_2 ways, then there are $n_1 + n_2$ ways to do the task.

$$|A_1 \times A_2 \times \dots \times A_m| = |A_1| \cdot |A_2| \cdot \dots \cdot |A_m|$$

$$|A_1 \cup A_2 \cup \dots \cup A_m| = |A_1| + |A_2| + \dots + |A_m|$$

A_i is a set and $|A_i|$ = number of elements in that set

note:

$$|A_1 \cap A_2| = |A_1| + |A_2| - |A_1 \cup A_2|$$

Ex1 How many different

pizzas can I order if I want three toppings out of 18 possible toppings?

S.1 (cont)

Ex 4 (a) How many functions are there from A to B , $\exists |A|=m$ and $|B|=n$?

(b) How many one-to-one functions are there?

EX 5 Suppose either a student from my Math 1010 class or a student from my Math 2200 class is chosen for a committee. My Math 1010 class has 95 students and M2200 has 21 students. How many choices are there?

5.1 (cont)

Ex 2 A test contains 100 true/false questions. How many different ways can a student answer the questions on the test, if answers can be left blank?

Ex 3 There are four major autoroutes from Boston to Detroit & six from Detroit to LA. How many major auto routes are there from Boston to LA (via Detroit)?

5.1 (cont)

Ex 6 Each user on a computer system has a password which is 8 to 10 characters long. Each password must contain at least ~~one~~ one digit. It can also include ^{only} lower case letters. How many possible passwords are there?