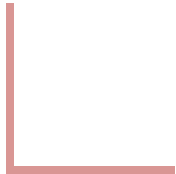# Mathematical Foundations for Computer Applications

The Rules of Sum and Product

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Mathematical Foundations for Computer Applications
Problems-- Mixed Sum and Product

1. There are 5 Chinese books, 7 English books, 10 French books How many ways to choose two books of different languages from them ?

 5 * 7 + 5 * 10 + 7 * 10 = 155 ways

Problems-- Mixed Sum and Product

2. A boy lives at X and wants to go to School at Z. From his home X he has to first reach Y and then Y to Z. He may go X to Y by either 3 bus routes or 2 train routes. From there, he can either choose 4 bus routes or 5 train routes to reach Z. How many ways are there to go from X to Z?

From X to Y,   3+2=5 ways (Rule of Sum).

From Y to Z 4+5=9 ways (Rule of Sum).

 Hence from X to Z 5×9=45 ways (Rule of Product).

Problems-- Mixed Sum and Product

3. Each user on a computer system has a password, which is six to eight characters long, where each character is an uppercase letter or a digit. Each password must contain at least one digit. How many possible passwords are there?

Let P be the total number of passwords

Let P6, P7, and P8 be the passwords of length 6, 7, and 8.

● By the sum rule P = P6 + P7 +P8.

Problems-- Mixed Sum and Product

● To find each of P6, P7, and P8

Find the number of passwords of the specified length composed of letters and digits and subtract the number composed only of letters.

We find that: P6 = 36^6 − 26^6 ==1,867,866,560.

P7 = 36^7 − 26^7 = 70,332,353,920.

P8 = 36^8 − 26^8 = 2,612,282,842,880.

Consequently, P = P6 + P7 +P8 = 2,684,483,063,360.

Principle of inclusion–exclusion

- **THE SUBTRACTION RULE** If a task can be done in either $n1$ ways or $n2$ ways, then the number of ways to do the task is $n1 + n2$ minus the number of ways to do the task that are common to the two different ways.

- The subtraction rule is also known as the **principle of inclusion–exclusion**

$|A1 \cup A2| = |A1| + |A2| - |A1 \cap A2|.$

Mathematical Foundations for Computer Applications
Principle of inclusion–exclusion

1.A computer company receives 350 applications from computer graduates for a job planning a line of newWeb servers. Suppose that 220 of these applicants majored in computer science, 147 majored in business, and 51 majored both in computer science and in business. How many of these applicants majored neither in computer science nor in business?

- $|A1 \cup A2| = |A1| + |A2| - |A1 \cap A2| = 220 + 147 - 51 = 316.$

- **350 − 316 = 34 of the applicants majored neither in computer science nor in business.**

THANK YOU

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