

# Brualdi Chapter 2

1-27

## Section 2.4

### Definition

A *set* is an unordered collection of distinct objects.

### Definition

A *multiset* is an unordered collection of not necessarily distinct objects.

Given a multiset  $S$  and an element  $x \in S$ , the *repetition number* of  $x$  is the number of times that  $x$  appears in  $S$ .

## Theorem

Let  $S$  be a multiset with objects of  $k$  distinct types, and with repetition numbers  $n_1, \dots, n_k$ . Let  $|S| = n = n_1 + \dots + n_k$ . Then the number of permutations of  $S$  is

$$\frac{n!}{n_1! \dots n_k!}.$$

# Example

How many permutations are there of the letters  
ILLINOIS?

# Example

How many permutations are there of the set

$$\underbrace{\{0, \dots, 0\}}_{n-k}, \underbrace{\{1, \dots, 1\}}_k\}?$$

## Section 2.5

### Theorem

*Let  $S$  be a multiset consisting of  $k$  types of objects, each with infinite repetition number. Then the number of combinations of  $r$  objects from  $S$  is*

$$\binom{k + r - 1}{r}.$$

# Example

Suppose a store sells seven different kinds of pizza. In how many ways can Alice buy 12 slices of pizza?