

SET THEORY

Lesson 4

Basic Concepts

4.1-What is a Set?

4.1 - Problem 1:

Each element in **A** are different. Therefore, it is a set.

4.1 - Problem 2:

Because the element 1 occurs more than once, **A** is not a set. To make **A** a set, delete one of the elements 1: $\mathbf{A} = \{5,2,1\}$ is NOW a set.

4.1 - Problem 3:

This set contains four elements. Each element is made up of two letters. For example the element (h,h) is one such element of the set. But h and t are not elements of this set. Therefore, each element is distinct and **A** is a set.

4.2 - When are Two Sets Equal?

4.2 - Problem 1:

The elements of the two sets are the same even though they are in different order. Remember order does not matter. Therefore, the two sets are equal.

4.2 - Problem 2:

The element (a,b) in the set on the left is not the same as (b,a) in the set on the right. Therefore, these sets are different.

4.3 - What is an Empty Set?

4.3 - Problem 1:

No one can be born both in two separate countries.

4.3 - Problem 2:

There several species of birds that cannot fly.

Supplementary Problems

This set contains three elements: 1,3, {1,3}. The element {1,3} is a set in itself and therefore different from the elements 1 and 3.

2.

A is a set since it contains the empty set ϕ as an element.

3.

The elements of this set are 1,2, {1,2,3}. Therefore, this set contains three elements.

4.

$A = \{ \{1,2\}, \{3\}, \{1,3,5\}, \phi \}$ is an example of such a set. Each element is also a set: {1,2} is a set containing two elements, {3} is a set containing only one element, {1,3,5} is a set containing three elements and finally the empty set ϕ is the set that contains no elements.

5.

Since {3,4,5} is a set, $\{3, 4, 5\} = \{5, 4, 3\}$.

Therefore, $\{1, 2, \{3, 4, 5\}\} = \{1, 2, \{5, 4, 3\}\}$

6.

►a.

The set 'All numbers greater than 3 or less than 0' contains all the numbers greater than 3 along with all the numbers less than zero. The set is not empty.

►b.

The set 'All numbers greater than 3 and less than 0' is an empty set since there are no numbers that are both greater than 3 and less than 0. The set is empty.

►c.

The set 'All number greater than 3 and less than 4' contains an infinite number of numbers. The set is not empty.

►d.

The set 'All students majoring in English and studying math' contains students that are majoring in English and at the same time studying math. The set is not empty.

►e

The set 'All people born in China and Japan' is an empty set since no one can be born in two different countries. The set is empty.

►f.

The set 'All people born in China or Japan' is not empty since it includes people born in China as well as those born in Japan. The set is not empty.

7.

►a.

The set $\{a,b,c,\{a\}\}$ contains the elements $a, b, c, \{c\}$ and therefore has 4 elements.

►b.

The set $\{\{a,b,c\}\}$ only contains one element the set $\{a,b,c\}$.

►c.

The set $\{a,b,\{a\},\{a,b\},\{a,b,c\},c\}$ contains the elements: $a, b, \{a\}, \{a,b\}, \{a,b,c\}, c$. Therefore there are 6 elements.

►d.

The set $\{\{a,\{a\},b,\{b,c\},ab\}\}$ contains the only 1 element $\{a,\{a\},b,\{b,c\},ab\}$

►e.

The set $\{\{\phi\}\}$ contains only the one set $\{\phi\}$. Therefore it has only 1 element.

►f.

The set $\{\{\{\phi\}, \phi\}, \phi\}$ contains the two elements $\{\{\phi\}, \phi\}, \phi$

8.

►a.

Yes The set contains 2 elements: the letter a and a set containing the element a .

►b.

Yes. The set contains 5 elements: the elements a,b,c , the set containing a,b and the set containing $\{a,b,c\}$

►c.

No. Since $\{a,b,c,d\}$ and $\{a,c,b,d\}$ are sets, they are the same. Therefore, the element are not distinct.