

# Homework Assignment 3

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## 1 Section-2.1 Sets

### 1.1 Problem 1

List the members of these sets.

- a)  $[x|x \text{ is a real number such that } x^2 = 1]$
- b)  $[x|x \text{ is a positive integer less than } 12]$
- c)  $[x|x \text{ is the square of an integer and } x < 100]$
- d)  $[x|x \text{ is an integer such that } x^2 = 2]$

### 1.2 Problem 1 Solution

The Member Sets are as follows:

- a)  $x = [-1, 1]$
- b)  $x = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11]$
- c)  $x = [0, 1, 4, 9, 16, 25, 36, 49, 64, 81]$
- d) no solution

**1.3 Problem 2**

Use set builder notation to give a description of each of these sets.

- a)  $[0, 3, 6, 9, 12]$
- b)  $[3, 2, 1, 0, 1, 2, 3]$
- c)  $[m, n, o, p]$

**1.4 Problem 2 Solution**

Set Builder Notation solutions are as follows:

- a)
- b)
- c)

**1.5 Problem 5**

Determine whether each of these pairs of sets are equal.

- a)  $[1, 3, 3, 3, 5, 5, 5, 5, 5]$  and  $[5, 3, 1]$
- b)  $[[1]]$  and  $[1, [1]]$
- c)  $[\emptyset]$  and  $\emptyset$

**1.6 Problem 5 Solution**

- a)  $[1, 3, 3, 3, 5, 5, 5, 5, 5]$  and  $[5, 3, 1]$  are equal.
- b)  $[[1]]$  and  $[1, [1]]$  are not equal.

- c)  $[\emptyset]$  and  $\emptyset$  are not equal.

### 1.7 Problem 6

Suppose that  $A = [2, 4, 6]$ ,  $B = [2, 6]$ ,  $C = [4, 6]$ , and  $D = [4, 6, 8]$ . Determine which of these sets are subsets of which other of these sets.

### 1.8 Problem 6 Solution

$B = [2, 6]$  is a subset of  $A = [2, 4, 6]$

$C = [4, 6]$  is a subset of  $A = [2, 4, 6]$ , and,  $D = [4, 6, 8]$

### 1.9 Problem 7

For each of the following sets, determine whether 2 is an element of that set.

- a)  $[x \in R | x \text{ is an integer greater than } 1]$
- b)  $[x \in R | x \text{ is the square of an integer}]$
- c)  $[2, [2]]$
- d)  $[[2], [[2]]]$
- e)  $[[2], [2, [2]]]$
- f)  $[[[2]]]$

### 1.10 Problem 7 Solution

- a)  $1 < 2$ , therefore 2 is an element of the set.
- b) The square root of 2 is not an integer, therefore 2 is not an element of the set.
- c) 2 is an element of the set.
- d) 2 is not an element of the set.
- e) 2 is not an element of the set.
- f) 2 is not an element of the set.

**1.11 Problem 11**

Determine whether each of these statements is true or false.

- a)  $x \in [x]$
- b)  $[x] \subset [x]$
- c)  $[x] \in [x]$
- d)  $[x] \in [[x]]$
- e)  $\emptyset \subset [x]$
- f)  $\emptyset \in [x]$

**1.12 Problem 11 Solution**

- a)  $x \in [x]$  is true,  $x$  is an element within the set.
- b)  $[x] \subset [x]$  is true, every set is a subset within itself.
- c)  $[x] \in [x]$  is false, a set can not belong to itself.
- d)  $[x] \in [[x]]$  is true, as the set exists within the set.
- e)  $\emptyset \subset [x]$  is true, every set possesses within it an empty set.
- f)  $\emptyset \in [x]$  is false, an empty set can not be considered an element of a set.

**1.13 Problem 12**

Use a Venn Diagram to illustrate the subset of odd integers in the set of all positive integers not exceeding 10.

**1.14 Problem 12 Solution**

- a)

**1.15 Problem 14**

Use a Venn diagram to illustrate the relationship  $A \subset B$  and  $B \subset C$ .

**1.16 Problem 14 Solution**

- a)

**1.17 Problem 18**

Find two sets  $A$  and  $B$  such that  $A \in B$  and  $A \subset B$ .

**1.18 Problem 18 Solution**

$A = \emptyset$

If  $B = [\emptyset, [\emptyset]]$ , then  $A \in B$  and  $A \subset B$

**1.19 Problem 20**

What is the cardinality of each of these sets?

- a)  $\emptyset$
- b)  $[\emptyset]$
- c)  $[\emptyset, [\emptyset]]$
- d)  $[\emptyset, [\emptyset], [\emptyset], [\emptyset]]$

**1.20 Problem 20 Solution**

- a) The cardinality of  $\emptyset$  is  $|\emptyset| = 0$
- b) The cardinality of  $[\emptyset]$  is  $|[\emptyset]| = 1$
- c) The cardinality of  $[\emptyset, [\emptyset]]$  is  $|[\emptyset, [\emptyset]]| = 2$
- d) The cardinality of  $[\emptyset, [\emptyset], [\emptyset], [\emptyset]]$  is  $|[\emptyset, [\emptyset], [\emptyset], [\emptyset]]| = 3$

**1.21 Problem 21**

Find the power set of each of these sets, where  $a$  and  $b$  are distinct elements.

- a)  $[a]$
- b)  $[a, b]$
- c)  $[\emptyset, [\emptyset]]$

**1.22 Problem 21 Solution**

- a) The Power Set of  $[a]$  is  $[\emptyset, [a]]$
- b) The Power Set of  $[a, b]$  is  $[\emptyset, [a], [b], [a, b]]$
- c) The Power Set of  $[\emptyset, [\emptyset]]$  is  $[\emptyset, [\emptyset], [[\emptyset]], [\emptyset, [\emptyset]]]$

**1.23 Problem 27**

Let  $A = [a, b, c, d]$  and  $B = [y, z]$ ; Find:

- a)  $A \times B$
- b)  $B \times A$

**1.24 Problem 27 Solution**

- a)  $A \times B = [(a, y), (b, y), (c, y), (d, y), (a, z), (b, z), (c, z), (d, z)]$
- b)  $B \times A = [(y, a), (y, b), (y, c), (y, d), (z, a), (z, b), (z, c), (z, d)]$