**Lab 07-Set Operations**

**Objective**

Solving exercises from the textbook in chapter 2.1 & 2.2

**Current Lab Learning Outcomes (LLO)**

By completion of the lab, the students should be able to:

1. will understand set theory.

2. will be able to solve shorter/easier or longer / harder problems given in the textbook

**Lab Requirements**

Students allowed using their lecture notes in the lab in order to solve the exercises.

**Lab Assessment**

1- Divide students to groups and let them to solve the given example.

2- Discuss the answers with the groups and write on board the optimal solution.

**Lab Description**

1. List the members of these sets.

a) {x | x is a real number such that x2 = 1}

b) {x | x is a positive integer less than 12}

c) {x | x is the square of an integer and x < 100}

d) {x | x is an integer such that x2 = 2}

1. For each of these pairs of sets, determine whether the first is a subset of the second, the second is a subset of the first,or neither is a subset of the other.

**a)** the set of airline flights from NewYork to New Delhi, the set of nonstop airline flights from New York to New Delhi

**b)** the set of people who speak English, the set of people who speak Chinese

**c)** the set of flying squirrels, the set of living creatures that can fly

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

**a)** {*x* ∈ **R** | *x* is an integer greater than 1}

**b)** {*x* ∈ **R** | *x* is the square of an integer}

**c)** {2*,*{2}} **d)** {{2}*,*{{2}}}**e)** {{2}*,*{2*,*{2}}} **f )** {{{2}}}

1. Find the truth set of each of these predicates where the domain is the set of integers.

**a)** *P(x)*: *x*2 *<* 3 **b)** *Q(x)*: *x*2 *> x* **c)** *R(x)*: 2*x* + 1 = 0

1. Let *A* be the set of students who live within one mile of school and let *B* be the set of students who walk to classes. Describe the students in each of these sets.

**a)** *A* ∩ *B* **b)** *A* ∪ *B* **c)** *A* − *B* **d)** *B* − *A*

1. Determine whether each of these statements is true or false.

**a)** 0 ∈ ∅ **b)** ∅ ∈ {0} **c)** {0} ⊂ ∅ **d)** ∅ ⊂ {0}

**e)** {0} ∈ {0} **f )** {0} ⊂ {0} **g)** {∅} ⊆ {∅}

1. What is the cardinality of each of these sets?
   1. {*a*} **b)** {{*a*}} **c)** {*a,* {*a*}} **d)** {*a,* {*a*}*,* {*a,* {*a*}}}
2. Find the power set of the sets where *a* and *b* are distinct elements
   1. {*a, b*} b) {∅*,* {∅}}
3. How many elements does each of these sets have where *a* and *b* are distinct elements?

**a)** *P(*{*a, b,* {*a, b*}}*)* **b)** *P(*{∅*, a,* {*a*}*,* {{*a*}}}*)* **c)** *P(P(*∅*))*

1. Let *A* = {*a, b, c, d*} and *B* = {*y, z*}. Find
   1. *A* × *B*. **b)** *B* × *A*.
2. What is the Cartesian product *A* × *B* × *C*, where *A* is the set of all airlines and *B* and *C* are both the set of all cities in the United States? Give an example of how this Cartesian product can be used.
3. Let *A* = {*a, b, c, d, e*} and *B* = {*a, b, c, d, e, f, g, h*}.Find
   1. **a)** *A* ∪ *B*. **b)** *A* ∩ *B*. **c)** *A* − *B*. **d)** *B* − *A*.
4. Let *A* = {0*,* 2*,* 4*,* 6*,* 8*,* 10}, *B* = {0*,* 1*,* 2*,* 3*,* 4*,* 5*,* 6}, Find |A∪B|. find the minimum and maximum number of elements in A∪B
5. Show that if *A*, *B*, and *C* are sets, then =*A* ∪ *B* ∪ *C*
   1. by showing each side is a subset of the other side.
   2. using a membership table.
6. Let *A*, *B*, and *C* be sets. Show that

**a)** *(A* ∪ *B)* ⊆ *(A* ∪ *B* ∪ *C)*. **b)** *(B* − *A)* ∪ *(C* − *A)* = *(B* ∪ *C)* − *A*.

1. Draw the Venn diagrams for each of these combinations of the sets *A*, *B*, and *C*.
   1. **a)** *A* ∩ *(B* − *C)* **b)** *(A* ∩ *B)* ∪ *(A* ∩ *C) *
2. Show that if A is a subset of a universal set U, then

**a)** *A* ⊕ *A* = ∅. **b)** *A*⊕∅ = *A*. **c)** *A* ⊕ *U* = **. **d)** **= *U*.

1. Draw a Venn diagram that shows the following sample space and events:

*S*: all the integers from 1 to 30 *P*: prime numbers

*M*: multiples of 3 *F*: factors of 30