

**CS 278**  
**Lab 5: Set operations**  
**Due on Thursday 10-4-2018 by 11:30pm**

Let A and B be subsets of the universal set  $U = \{1, 2, 3, 4, \dots, 20\}$ .

Write a program that does the following.

- 1) It prompts the user to input two integer sets A and B, each of size at most 20. Each set must be stored in an array.
- 2) Then, it evaluates and prints out the result of the following:
  - a) The union of A and B,  $A \cup B$ . Make sure that the result does not contain duplicate elements.
  - b) The intersection of A and B,  $A \cap B$ .
  - c) The difference of B minus A,  $B - A$ .
  - d) The complement of A,  $\bar{A}$ .
  - e) The Cartesian product of A and B,  $A \times B$ .
  - f) Is  $A = B$ ?
  - g) Is  $A \subseteq B$ ?
  - h) Do A and B form a partition of the universal set U?

**Dialog with the user may look like the following:**

*Please enter the size of A: 4*

*Please enter A: 1 2 3 4*

*Please enter the size of B: 3*

*Please enter B: 1 2 5*

*The union of A and B is: 1 2 3 4 5*

*The intersection of A and B is: 1 2*

*The difference of B minus A is: 5*

*The complement of A is: 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20*

*The Cartesian product of A and B is: (1,1) (1,2) (1,5) (2,1) (2,2) (2,5) (3,1) (3,2) (3,5) (4,1) (4,2) (4,5)*

*A is not equal to B*

*A is not a subset of B*

*A and B do not form a partition of U*

**Note:**

You may assume that the user enters sets A and B without duplicates.

If  $A \cup B$  is empty then print out that “*The union of A and B is: empty*”

If  $A \cap B$  is empty then print out that “*The intersection of A and B is: empty*”

If  $B - A$  is empty then print out that “*The difference of B minus A is: empty*”

If  $\bar{A}$  is empty then print out that “*The complement of A is: empty*”

If  $A \times B$  is empty then print out that “*The Cartesian product of A and B is: empty*”

The empty set is a subset of any set. In particular, the empty set is a subset of the empty set.

Your program must work correctly in all cases, including cases when A is empty, B is empty, or both A and B are empty.

**Implementation details:**

You must use arrays to represent sets A and B. The use of the language (Java, Python, etc.) collection classes with built-in methods for set operations is not allowed.