Alexandria University
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CSE214: Discrete Structure

Lab 3

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Set Theory

1. Lab Objective

The objective of the lab is to apply set theory principles using basic operations associated with bits and their manipulation.

2. Part I: Basic Bit Operations

Four bit operations are implemented, so the program might allow user to choose one of the following operations:

1. getBit(int number, int position): This function returns the bit value (an integer, 0 or 1) in the number at position position, according to its binary representation. The least significant bit in a number is position 0.

2. setBit(int number, int position): This function set the bit value (to be 1) in the number at position position, according to its binary representation. The least significant bit in a number is position 0 and return number after setting the bit.

3. clearBit(int number, int position): This function cleat the bit value (to be 0) in the number at position position, according to its binary representation. The least significant bit in a number is position 0 and return number after clearing the bit.

4. updateBit(int number, int position, boolean value): This function set the bit value according to value parameter which is false (0) or true (1) in the number at positionposition, according to its binary representation. The least significant bit in a number is position 0 and return number after update.

3. Part II: Sets Operations using Bits Manipulation

1. Implement a Set data structure that takes in the constructor a list of strings as a Universe (U).

The elements in the Set are subset of U. You must use bits to represent the set. The Set data structure should include the main operations:

1) Add string to the set
2) Union with another set
3) Intersection with another set
4) Complement of the set
5) Difference from another set
6) Cardinality of the set
7) Get elements of the set

2. Write a program that.

(a) Asks the user to enter a list of strings as a Universe (U)

(b) Then asks for a number of sets (that are subsets of U). The user will enter the elements in each set

(c) Then asks the user about the operations they want to perform:

1) Union of two sets
2) Intersection of two sets
3) Complement of a set
4) Difference between two sets
5) Cardinality of a set
6) Print a set

3. Used Data Structures

Map

Used to map between universal set elements and their index for easier and faster retrieval than using a loop each time.

4. Sample Runs

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid Malek } >

< S_2 = { Maha } >

Choose an operation: Get Set

Choose set: S1

Perform Operation

Result: { Ali , Khalid , Malek }

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid Malek } >

< S_2 = { Maha } >

Choose an operation: Intersection

Choose set 1: S1 Choose set 2: S2

Perform Operation

Result: { Ali , Khalid , Malek }

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Maha } >

Choose an operation: Intersection

Choose set 1: S1 Choose set 2: S2

Perform Operation

Result: ϕ

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = ϕ >

Choose an operation: Union

Choose set 1: S1 Choose set 2: S2

Perform Operation

Result: {Ali , Khalid}

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = ϕ >

Choose an operation: Intersection

Choose set 1: S1 **Choose set 2:** S2

Perform Operation

Result: ϕ

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Khalid Maha } >

Choose an operation: Complement

Choose set: S1

Perform Operation

Result: {Maha , Malek}

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Khalid Maha } >

Choose an operation: Get Set Cardi

Choose set: S1

Perform Operation

Result: 2

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Khalid Maha } >

Choose an operation: Difference

Choose set 1: S1 **Choose set 2:** S2

Perform Operation

Result: {Ali}

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Khalid Maha } >

Choose an operation: Intersection

Choose set 1: S1 **Choose set 2:** S2

Perform Operation

Result: {Khalid}

< U = { Ali Khalid Maha Malek } >

Enter number of Subsets: 2

< S_1 = { Ali Khalid } >

< S_2 = { Khalid Maha } >

Choose an operation: Union

Choose set 1: S1 **Choose set 2:** S2

Perform Operation

Result: {Ali , Khalid , Maha}