Birla Institute of Technology & Science, Pilani
2nd Semester 2016-17 - CS F211 – Data Structures and Algorithms

Lab 8 – 14th March
Topics – Hashtables with open addressing

Problem 1

Design and implement ADT SmallSet by treating a single *unsigned int* word as a bit vector and the positions as members of the universe:

- Let N be *sizeof(unsigned int)*. Then any subset of the universal set U = { 0, 1, ... , N-1 } can be represented as a bit vector of size N (which in turn can be stored as an *int* word.)
- Given S $\subseteq$ U, for any j $\in$ U, (j $\in$ S) iff (j^{th} bit (counting 0 as the LSB) of S is 1)
- Adding j to S can be implemented as setting j^{th} bit to 1; deleting as setting it to 0.

Obtaining j^{th} bit of an *int* in C can be achieved by masking the vector with a bit pattern and testing it: i.e. (S & B_j) iff (j^{th} bit of S is 1) where B_j is all 0s except the j^{th} bit.
B_j can be obtained by left-shifting *((unsigned int) 1)* j times.

Implement typical set operations *union*, *intersect*, and *difference* for this SmallSet ADT. You can use the following table for designing your functions.

Key	Function	Input Format	Description
0	readData	0 N X Y A_1 A_2 A_3 .. A_x B_1 B_2 B_3 .. B_y	N represents the size of U (taken as input for convenience). X and Y represent the sizes of two sets of A & B respectively. You shall need to read two sets (A & B) of integers, separated by a new line. Each set contains values with space separation. Represent A and B in the form of SmallSet ADT described above.
1	Union	1	Perform union operation on A and B (C = A ∪ B) and print C. You may sort C in ascending order first before printing.
2	Intersection	2	Perform intersection operation on A and B (C = A ∩ B) and print C. You may sort C in ascending order first before printing.
3	Difference	3	Perform difference operation on A and B (C = A - B) and print C. You may sort C in ascending order first before printing.

Sample input and output

Sample Input	Sample Output
0 32 5 6 2 4 15 7 24 9 16 15 10 20 21 1 2 3	2 4 7 9 10 15 16 20 21 24 15 2 4 7 24