



## Introduction to Computing for the Social Sciences Theory Exercise Sheet 3

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### Exercise 1: Hash tables

When building a hash table, you are given the following sequence of inputs:

6, 0, 2, 12, 3, 11, 10, 1, 14, 9

Your hash function is  $f(x) = (2 \cdot x + 3) \bmod m$ , where  $m$  is the size of the hash table. Consider a hash table with  $m=8$  and separate chaining. Show the final state of the table after filling it with the above sequence.

### Exercise 2: Binary Search Trees

a) based on the below list, show the steps of the execution of binary search to find the element with key=33.

10 33 19 26 27 31 34 35 42 44

b) Construct a Binary Search Tree (BST) by adding the numbers in the indicated order: 4, 6, 2, 1, 3, 10, 12. You only need to draw the final BST after all the numbers have been added.

c) Show how the resulting BST of the previous step can be changed to have lower depth on its nodes

d) Show how to remove element 10 from the resulting BST of the previous step.

### Exercise 3: Linked lists

a) Write the pseudocode of a procedure to find all the instances of an element containing number 31 in a doubly linked list. Return those instances as a single-linked list.

b) Write the list of 2.a as a doubly linked list. Show how your pseudocode finds 31 in that list.