Data Structures and Algorithms COMP-251 A

Problem Assignment #2

1. Algorithms for Turing Machines

Let *T*(6) be a six-state Turing machine. Design an algorithm for *T*(6) that subtracts a number *y* from a number *x*. Your algorithm should work for any numbers that are positive integers of any finite size where *x* is greater than *y*. Assume the numbers are written on the tape in *unary* notation and separated by one blank. Use the symbols *R, L, X* and - for: move right, move left, make a mark and erase a mark, respectively. Assume the machine starts in state 1 and the reader is located on the leftmost mark on the tape. The machine should go to state 0 (stop) when finished. Let your instruction units (lines of code) be *4-tuples* of the form (*a, A, B, b*) where *a* denotes the present state, *A* takes on the symbols *X* or -, *B* takes on the symbols *R* or *L* or *X* or -, and *b* denotes the next state entered.

2. Growth of Functions

Graph the functions 12n, 6n log n, n^2, n^3, and 2^n using a logarithmic scale for the x and y axes. In other words, if the function value f(n) is y, plot this as a point with x-coordinate at log n and y-coordinate at log y.

3. Big "Oh" Notation

Problem 3.5 in the Udi Manber text.

4. Minimum Spanning Trees

Let S be a set of n>2 points in the plane in general position which is the union of two non-empty sets of points B (blue) and R (red). Prove (by any method of your choice) or disprove (by any method of your choice) that the minimum distance between a blue point and a red point determines an edge in the MST(S), the *minimum spanning tree* of S. Points in general position means that no three points lie on a line.