Advanced Analysis of Algorithms

K. Subramani, LCSEE, West Virginia University

October 22, 2013

1. Optimal binary search trees.
   (a) Let key_i have search probability p_i. Let c_i be the number of comparisons to find key_i. Then we want to minimize $\sum_{i=1}^{n} c_i \cdot p_i$.
   (b) The binary search tree problem. Give one simple two node example from book.
   (c) Brute-force running time.
   (d) Formulation of recurrence.
   (e) Running time and space complexities. Focus on $O(n^4)$.
2. Traveling Salesman problem.
   (a) Input representation.
   (b) Hamilton tour.
   (c) Example from book, Figure 3.16.
   (d) Brute-force.
   (e) Define $D[v_i][A]$. Use book for some examples.
   (f) The general recurrence is given by:

$$\begin{aligned} D[v_i][A] &= \min_{j:v_j \in A}(W[i][j] + D[v_j][A - \{v_i, v_j\}, \text{ if } A \neq \emptyset \\ &= W[i][1], \text{ if } A = \emptyset \end{aligned}$$

   (g) The entry of interest if $A[v_1][\{v_2, v_3, \ldots, v_n\}]$.
   (h) Copy salient parts of the algorithm from book.
   (i) Analysis.
   (j) $T(n) = \sum_{k=1}^{n-2}(n-1-k) \cdot k \cdot \binom{n-1}{k}$.
   (k) How to keep track of the optimal tour.