

SPRING 2002: **COT 6405** ANALYSIS OF ALGORITHMS
 [HOMEWORK 3; DUE MAR 7 IN MY OFFICE BEFORE CLASS]

Problems

- 20 [Problem 14-1] Suppose that we wish to keep track of a **point of maximum overlap** in a set of intervals – a point that has the largest number of intervals in the database overlapping it.
- (a) Show that there will always be a point of maximum overlap which is an endpoint of one of the segments.
- (b) Design a data structure that efficiently supports the operations INTERVAL-INSERT, INTERVAL-DELETE, and FIND-POM, which returns a point of maximum overlap. (*Hint*: Keep a red-black tree of all endpoints. Associate a value of +1 with each left endpoint, and a value of −1 for each right endpoint. Augment each node of the tree with some extra information to maintain the point of maximum overlap.)

21 Find an optimal parenthesization of a matrix-chain product whose sequence of dimensions are $\langle 5, 10, 3, 12, 5, 50, 6 \rangle$. [Problem 15.2-1]

22 Determine an LCS of $\langle 1, 0, 0, 1, 0, 1, 0, 1 \rangle$ and $\langle 0, 1, 0, 1, 1, 0, 1, 1, 0 \rangle$. [Problem 15.4-1]

23 [Problem 15.5-2] Determine the cost and structure of an optimal binary search tree for a set of $n = 7$ keys with the following probabilities:

i	0	1	2	3	4	5	6	7
p_i		0.04	0.06	0.08	0.02	0.10	0.12	0.14
q_i	0.06	0.06	0.06	0.06	0.05	0.05	0.05	0.05

24 Professor Apollo suggests that a faster algorithm to solve the optimal triangulation problem might exist for the special case in which the weight of a triangle is its area. Is the professor’s intuition accurate? (Hint: very easy.)

25 [Problem 16.3-2] What is an optimal Huffman code for the following set of frequencies, based on the first 8 Fibonacci numbers?

$$a : 1 \quad b : 1 \quad c : 2 \quad d : 3 \quad e : 5 \quad f : 8 \quad g : 13 \quad h : 21$$

26 Solve any one of the following problems from your text: **(a)** Problem 15-1 (Bitonic euclidean traveling-salesperson problem), **(b)** Problem 15-3 (Edit distance), or **(c)** Problem 15-5 (Viterbi algorithm). [Note: For those of you with old editions of the text, you may consider looking at the new edition since it has more details on these problems.]