

## 2020/04/08 Algorithm Homework

Note: When the exercise asks you to “design an algorithm for...,” it always means that “designs an EFFICIENT algorithm for ... and ANALYZES your algorithm and write pseudo code”. You should keep this in mind when writing solutions.

1. [CLRS 3<sup>rd</sup>] Exercise 15.2-1
2. A mathematical expression is given without parentheses. Design an algorithm to parenthesize the expression such that the value of the expression is maximized. For example, consider the expression:  $2+7\times 5$ . There are two ways to parenthesize the expression  $2+(7\times 5) = 37$  and  $(2+7)\times 5 = 45$ , so in this case, your algorithm should output the second expression. Here, you may assume the given expressions contain only 3 kinds of binary operators ‘+’, ‘-’, and ‘ $\times$ ’.

3. [CLRS 3<sup>rd</sup>] Exercise 15.3-1

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RECURSIVE-MATRIX-CHAIN( $p, i, j$ )
1  if  $i == j$ 
2      return 0
3   $m[i, j] = \infty$ 
4  for  $k = i$  to  $j - 1$ 
5       $q = \text{RECURSIVE-MATRIX-CHAIN}(p, i, k)$ 
        +  $\text{RECURSIVE-MATRIX-CHAIN}(p, k + 1, j)$ 
        +  $p_{i-1}p_kp_j$ 
6      if  $q < m[i, j]$ 
7           $m[i, j] = q$ 
8  return  $m[i, j]$ 
```

4. [CLRS 3<sup>rd</sup>] Exercise 15.4-5
5. [CLRS 3<sup>rd</sup>] Problem 15-5 Edit distance(要寫Code)
6. Find out all LCS of 《BADBCBA》 and 《ABACDBC》
7. String Alignment(要寫Code)

Let  $\sigma$  be an alphabet set,  $\beta$  denote the blank character in  $\sigma$ , and a measure function  $F: \sigma \times \sigma \rightarrow \mathbf{R}$ . Where  $F$  is defined as followings, for any  $x$  and  $y$  in  $\sigma$ ,  $F(x, y) < 0$  if  $x \neq y$  and  $F(x, y) > 0$  if  $x = y$ ; whereas  $F(\beta, \beta) = -\infty$ . Given  $X$  and  $Y$  be two strings of  $\sigma^*$ , let  $X'$  and  $Y'$  denote two new strings made by inserting some  $\beta$  into  $X$  and  $Y$  respectively. The similarity of  $X$  and  $Y$  is defined by measuring the maximal value of  $\sum_{a_i \in X', b_i \in Y'} F(a_i, b_i)$  among all possible  $X'$  and  $Y'$ .

- (a) Design an algorithm to find the similarity of  $X$  and  $Y$ .
- (b) Design an algorithm that describe where the blank characters are inserted to get the similarity.