

重庆大学《算法分析与设计》课程试卷

☒ A 卷

☐ B 卷

2012~2013 学年 第二学期

开课学院：计算机学院 课程号：18016435 考试日期：2013-06-25

考试方式：☐ 开卷 ☒ 闭卷 ☐ 其他 考试时间：120 分钟

| 题 号 | A | B | C | D | E | F | G | H | I | J | 总 分 |
|-----|---|---|---|---|---|---|---|---|---|---|-----|
| 得 分 | | | | | | | | | | | |

注：答案须填写在试题页后的答案纸上，用英文或中文解答。

- A. (20 points)
- (1) With substitution(替换法), prove that the asymptotic complexity of $T(n) = T(n/2) + \Theta(n)$ comes to $\Theta(n \log n)$.
- (2) For the polynomial $f(n) = 3n^3 + 2^n + 3^n + 6n^4 + 79$, what is the tight bound (Θ)? And explain your answer briefly(简要地).
- B. (25 points) Given an array $A = \langle 4, 8, 1, 3, 7, 9, 20, 21, 13 \rangle$, try to employ the heapsort to sort all integers in A. Note that the heapsort consists of two steps: max-heap building (最大堆构成) and sorting(排序).
- (1) In a binary heap, what is the index of the k -th element's PARENT? What is the index of the k -th element's LEFT child?
- (2) Draw the initial state(初始状态) of the heap.
- (3) Draw the final state(最终状态) of the heap after max-heap building.
- (4) Count the exact number of swapping(交换) between two nodes (integers) in the heap during the max-heap building.
- (5) What is the asymptotic(渐进的) computational complexity of the heapsort? Give a brief explanation(简要的说明).
- C. (10 points) In activity selection problem, suppose that instead of selecting(不选择) the first activity to finish, we always select(选择) the last activity to start(最后开始的活动) that

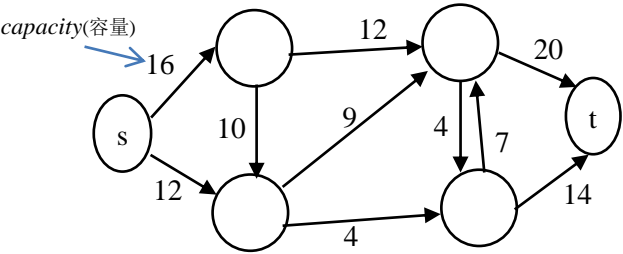
is compatible with all previously selected activities. Describe how this approach is a greedy algorithm, and prove that it yields(输出) an optimal solution(最优解).

D. (20 points) For input sequence $X_{[1..m]}$ and $Y_{[1..n]}$, we define $c[i,j]$ = length of Longest Common Sequence of $X_{[1..i]}$ and $Y_{[1..j]}$; By using methodology of Dynamic Programming, we got $c[i,j]$'s recursive formula(递推表达式):

$$c[i,j] = \begin{cases} 0 & i = 0 \text{ or } j = 0 \\ & i,j > 0 \text{ and } x_i = y_j \\ & i,j > 0 \text{ and } x_i \neq y_j \end{cases}$$

- (1) Fill out(填写) the above formula.
- (2) Give a memoized version(备忘录方法) of DP algorithm to compute $c[m,n]$ in $O(mn)$ time. The algorithm should be given in pseudo code(伪代码) or any popular programming language(c, java, c# etc).

E. (25 points) Work out the maximum flow(最大流) of the next flow network using Edmond-Karp algorithm (通过 BFS 找出增广路径). That is, at each iteration(每次循环), draw the residual network(残值网络) induced by the current flow network, find a shortest path (最短路径) from source s to sink t by a breadth-first search (BFS) in the residual network, then augment(增加) the flows of each edge on the path.



命题人：罗辛

组题人：陈波

审题人：李佳

命题时间：2013-06-21

教务处制