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國立東華大學招生考試試題

招生學年度	九十八	招生類別	碩士班
系所班別	資訊工程學系		
科目	資料結構		
注意事項	本考科禁止使用掌上型計算機		

1. **(15%)** Solve the following recurrent relation under different conditions.

$$T(n)=\begin{cases} b & \text{if } n=1, \\ a\times T(n/c)+b\times n & \text{if } n>1. \end{cases}$$

(a) $a<c$ **(5%)** (b) $a=c$ **(5%)** (c) $a>c$ **(5%)**

2. **(10%)** Suppose we are given the pre-order sequence A B C D E F G H I and the in-order sequence D C E B F A H G I of the same binary tree.

(a) Draw a binary tree defined by such a pair of sequences. **(5%)**

(b) Does such a pair of sequences uniquely define a binary tree? **(5%)**

3. **(25%)** For the following AOE network $G = (V, E)$, please answer the questions below.

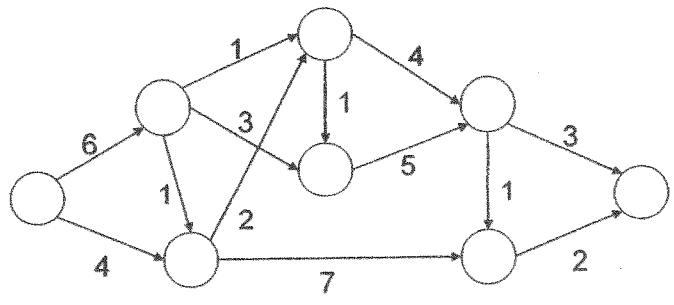
(a) Give numbers 1, 2, ..., 8 to the vertices so that for all edges $(i, j) \in E$, $i < j$. **(5%)**

(b) Obtain the early, $e()$, and late, $l()$, start times for each activity. Use the forward-backward approach. **(5%)**

(c) What is the earliest time the project can finish? **(5%)**

(d) Which activities are critical? **(5%)**

(e) Is there any single activity whose speed up would result in a reduction of the project length? **(5%)**



4. **(30%)** Given input {254, 48, 73, 199, 43, 96, 19, 51} and a hash function $h(x)=x$ mod 10, show the resulting:

(a) Hash table by use of chaining. **(4%)**

(b) Hash table using linear probing. **(4%)**

(c) Hash table using quadratic probing. **(4%)**

(d) Hash table by use of rehashing with $h_i(x)=(h_{i-1}(x)+3)$ mod 10, $i \geq 2$, where $h_1(x)=h(x)$. **(4%)**

(e) Design a hash function, which has 8 bits at input and 4 bits at output, by a bit-XOR operation. Give a figure or equation to show your design (note: the answer is not unique). **(7%)**

(f) Redo (b) by your hash function designed in (e) (note: you should transfer the input to an 8-bit vector when use your hash function). **(7%)**

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5. **(12%)** Let $A=\{a_0, a_1, \ldots, a_{n-1}\}$ be a set of n integers such that $a_i < a_{i+1}$ for $0 \le i \le (n-2)$. Let $P=\{P_0, P_1, \ldots, P_{k-1}\}$ be a k-partition of A such that $|P_i| \ge 1$ and $\max(P_i) < \min(P_{i+1})$ for $0 \le i \le k-2$, where $\max(P_i)$ and $\min(P_{i+1})$ denote the maximum and minimum element in P_i and P_{i+1}, respectively. Let $B=\{b_0, b_1, \ldots, b_{k-1}\}$ be a subset of A with $b_i < b_{i+1}$ for $0 \le i \le k-2$.

(a) Prove that there at least exists an integer i, $0 \le i \le k-1$, such that $b_i \in P_i$. **(8%)**

(b) Suppose a set $A=\{1, 2, 5, 8, 10, 12, 13, 15, 20, 22, 25, 29, 30\}$ has 13 elements. Show an example- a partition $P=\{P_0, P_1, \ldots, P_5\}$ and $B=\{b_0, b_1, \ldots, b_5\}$, and explain P and B satisfy the description in (a). **(4%)**

6. **(8%)** Disprove the following two statements.

(a) $3^n = O(2^n)$. **(4%)**

(b) $n^3 2^n + 6n^2 3^n = O(n^2 2^n)$. **(4%)**