

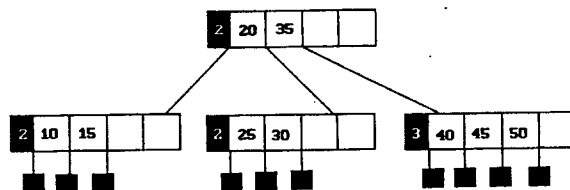
國立臺灣科技大學  
九十三學年度碩士班考試試題

系所組別：資訊管理系甲組  
科 目：資料結構

【本試卷共 6 大題，滿分計 100 分。】

1. Consider general tree structures where every node has an arbitrary number of children.
  - (1) Design an efficient data structure for representing the tree. (10%)
  - (2) State an algorithm which traverses the tree from the root in depth first order. (10%)
  
2. Let triple  $\langle x, y, z \rangle$  represent that there is a directed edge pointed from node  $x$  to node  $y$  with weight  $z$ . There is a directed graph with 8 nodes numbered from 0 to 7 and 12 arcs, where the 12 directed edges are  $\langle 1, 0, 3 \rangle$ ,  $\langle 2, 0, 10 \rangle$ ,  $\langle 2, 1, 8 \rangle$ ,  $\langle 3, 2, 12 \rangle$ ,  $\langle 4, 0, 27 \rangle$ ,  $\langle 4, 3, 15 \rangle$ ,  $\langle 4, 5, 3 \rangle$ ,  $\langle 5, 3, 10 \rangle$ ,  $\langle 5, 6, 9 \rangle$ ,  $\langle 5, 7, 14 \rangle$ ,  $\langle 6, 7, 10 \rangle$ ,  $\langle 7, 0, 3 \rangle$ . Use the Dijkstra algorithm to find the shortest paths from node 4 to all other nodes. Show the contents of the shortest distance array in each step of the Dijkstra algorithm, where initially the data is stored in the distance array as follows: (15%)
 

|            |       |          |          |    |   |   |          |          |
|------------|-------|----------|----------|----|---|---|----------|----------|
| distance   | 0     | 1        | 2        | 3  | 4 | 5 | 6        | 7        |
| initially  | 27    | $\infty$ | $\infty$ | 15 | 0 | 3 | $\infty$ | $\infty$ |
| vertex (x) | ..... |          |          |    |   |   |          |          |
  
3. State the main spirit of dynamic programming method. Give an example to explain it. (15%)
  
4. Given an order 5 B-tree as shown. Do the following questions:
  - (1) Insert the keys 62, 5, 85, 75, in order into the B-tree. Show the new tree after the insertion. (10%)
  - (2) Delete the keys 45, 40, 10, 25 from the B-tree of question (a) (the B-tree after the insertion). Show the final B-tree. (10%)



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5. A trie is an index structure that is particularly useful when the keys vary in length.

(1) Draw the trie obtained for the following data:

*Amiot, Avenger, Avro, Heinkel, HellDiver, Macchi,  
Marauder, Mustang, SpitFire, Sykhai*

Sample the keys left to right one character at a time. (5%)

(2) Using single character sampling, obtain a trie, for the above data, with the fewest number of levels. (5%)

(3) Obtain a trie, for the above data, with the following sampling technique:

$\text{sample}(x, i) = x_{n-i}$ , for any key  $x = x_0x_1 \dots x_{n-1}$ ; note that  $x_0$  is the first character of key  $x$ ,  $x_1$  is the second character of  $x$  etc. (5%)

6. A *deap* is double-end heap that supports the double-ended priority queue operations of insert, delete min, and delete max.

(1) Give the exact *definition* of a *deap*. (5%)

(2) For the 12 element deap as shown, draw the resultant deap after we insert 4 into the deap. (10%)

