

銘傳大學八十八學年度資訊管理研究所碩士班招生考試

第三節

資料結構 試題

1. The following statements are supposed to interchange the nodes immediately following the one pointed to by  $p$ , as in the accompanying diagram. The auxiliary pointer  $q$  is uninitialized at the start.

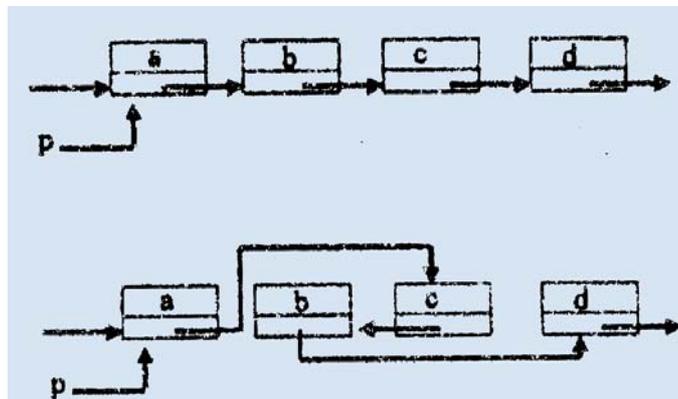
1.  $p \rightarrow \text{next} = q$ ;
2.  $p \rightarrow \text{next} \rightarrow \text{next} = p \rightarrow \text{next} \rightarrow \text{next} \rightarrow \text{next}$ ;
3.  $q = p \rightarrow \text{next} \rightarrow \text{next}$ ;
4.  $q \rightarrow \text{next} = p \rightarrow \text{next}$ ;

Unfortunately, the statements aren't in the right order.

- (a) (5 points) Which of the following orders is correct?

1,3,2,4    2,4,1,3    3,2,1,4    3,2,4,1    4,1,2,3

- (b) (5 points) There are 24 ways to arrange these statements. Are there any correct orders in addition to the correct one in the preceding list?



2. (5 points) Suppose the minimum degree  $t$  for a B-Tree is 4. What is the maximum number of keys this tree can have? What is the minimum number of keys this tree can have? For any internal node, what is the maximum number of children it can have? For any internal node, what is the minimum number of children it can have?
3. (a) (5 points) Show the AVL tree that results if integer keys 17, 8, 29, 20, 27, 13, 28 are inserted, in that order into an initially empty AVL tree.
- (b) (5 points) Show the successive trees that result when the tree in part (a) then has the elements deleted in the order in which they were inserted,

beginning with 17.

4. (5 points) If a graph has the form of a binary tree, do depth-first traversals correspond in any way to preorder, inorder, or postorder traversals?
5. (5 points) Write a function to determine if a given binary tree is a binary search tree.
6. (5 points) Each of the following series of records consists of a primary key and a secondary keys. Show the inverted list for this collection of records.

5 Homonymy

8 Hyponymy

2 Homonymy

6 Simile

10 metaphor

1 polysemy

3 hyponymy

9 homonymy

7 metaphor

4 polysemy

7. (30 points) Short Answers

(a) An algorithm has an efficient  $O(n^2 |\sin(n)|)$ . Is it any better than  $O(n^2)$  for large integer  $n$ ? Explain why, or why not.

(b) For a circular queue implemented by a linked list, it is necessary to maintain a pointer to only one queue node - which one: the front or rear? Justify your answer, using a drawing to help.

(c) Is heap sort always better than quick sort? If not, when not?

(d) In the following statement true or false?: "in any network with four or more nodes and no two edges having equal weights, the three edges with the smallest weights among all edges will always be part of the minimum spanning tree." If false, provide a counterexample.

(e) Explain how hashing could be used to implement a variation of a keyed collection in which keys were not unique.

(f) Is minimum spanning tree unique? If false, provide a counterexample.

8. (5 points) Suppose that the following strings arrive for insertion into a trie index: CARTER, HERNANDEZ, HEKRMAN, HERMANSKI,

HERSCHEL, HALL, CARSON, CARSWELL, CARSEN Draw the trie index.

9. (10 points) What search strategy would you use for each of the following application? Justify your choices of strategy in a short essay.

(a) The information to be maintained is the card catalog of a library. Frequent additions to and deletions from this catalog are made by the library. Additionally, users frequently search for the data associated with a given book's key. However, the library rarely prints an ordered listing of all its holdings; ordering the data is therefore not to be considered a high priority.

(b) You are writing a program that maintains the lists of passengers on flights for an airline company. Passengers are frequently added to these lists. Moreover, passengers quite often cancel flight plans and wants alphabetized listings of the passengers on a given flight and often needs to search for a particular passenger by name when inquiries are received from individuals.

10. (5 points) You are to sort an array in a program in which the following considerations are to be taken into account. First, there is a large amount of data to be sorted. The amount of data to be sorted is so large that frequent  $O(n^2)$  run times will prove unsatisfactory. The amount of data will also make it impossible to use a large amount of overhead data (for instance, stack space) to make the sort efficient in its run time because the overhead data would potentially take up space needed by the array. Second you are told that the array to be sorted is often nearly in order to start with. For each of the six sorting methods would be appropriate for this application and, in a brief statement, explain why your answer is correct.

- (a) Insertion sort
- (b) Selection sort
- (c) Shell sort
- (d) Quick sort
- (e) Radix sort
- (f) Merge sort

11. (5%) What is the main difference between a regular B-tree and a B+-tree.

12. (5%) For each of the two questions below, either draw the tree from the

traversals or explain why the traversals cannot be of the same tree.

- (a) b d e i g a c f h --inorder  
    b e i d c h f a g --postorder
- (b) i f e h a b c d g --preorder  
    h c a f i d e g b --inorder

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