

# 淡江大學 98 學年度碩士班招生考試試題

103

系別：資訊管理學系

科目：資 料 結 構

本試題共 2 頁，5 大題

1. (20%)
  - (a) (10%) What is the difference in concern between data structures and databases?  
Why is the binary search tree in data structure not directly used in databases?
  - (b) (10%) Radix sort is said to have a linear time complexity which is the best among all known sorting algorithms. List 2 main factors which restrict its use.

2. (20%)
  - (a) (15%) Please fill in the average time complexity which can be  $1$ ,  $\log(n)$ ,  $n$ ,  $n \log(n)$ ,  $n^2$ ,  $n^2 \log(n)$ , or  $n^3$  for the operations and containers in the following table. Assume  $n$  is the size of the container and each operation is implemented with lowest possible time complexity.

container \ operation	add	remove	get
Unsorted array list	1	$n$	$n$
Unsorted linked list			
Sorted array list			
Sorted linked list			
Hash table			
Binary search tree			

Note that the operations in concern include  
 add: adds an element to the container;  
 remove: removes an element from the container if it is in the container;  
 get: retrieves an element from the container if it is in the container.

- (b) (1%) From the table above, which container has the best performance?
  - (c) (4%) For the container in (b), list 2 main factors which restrict its use?
3. (20%) Suppose that a linear data structure like an array or a linked list is used to implement such special containers as stacks and queues. It is possible to insert and remove data for both containers in a constant time. For each of the following containers, give the best methodology for implementation with minimal efforts.
  - (a) Array-based stack      (b) Linked-list-based stack
  - (c) Array-based queue      (d) Linked-list-based queue

Hint: You must correctly mention one of the following methodologies in each answer. Head In Head Out(HIHO), Head In Tail Out(HITO), Tail In Head Out(TIHO), Tail In Tail Out (TITO), Circular HIHO, Circular HITO, Circular TIHO, or Circular TITO where head/tail refers to the location of operation at head/tail of the base array or base linked list; in/out refers to the insert/remove operation; and circular refers to use of the circular array or the circular linked list.

本試題雙面印製

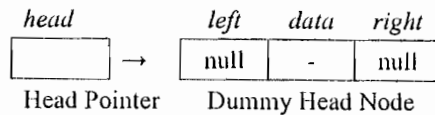
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4. (20%) Suppose that a doubly-linked list with a dummy head node is used for storing a list of integers. Each node contains the 3 fields: *left* link, *data*, and *right* link. The dummy head node contains a *left* link which points to the last data node of the list and a *right* link which points to the first data node of the list. An initial empty list will look like this.



- (a) (5%) Please fill in the following pseudo code to insert a node of 3.
- ```
n ← new node(); n.left ← ____; n.data ← ____; n.right ← ____;
head.right ← ____; head.left ← ____;
```
- (b) (5%) Based on (a), fill in the pseudo code to insert from head a node of 5.
- ```
n ← new node(); n.left ← ____; n.data ← ____; n.right ← ____;
head.right.left ← ____; head.right ← ____;
```
- (c) (5%) Write the recursive pseudo code to print the list from tail to head.
- (d) (5%) Write the pseudo code to remove the last data node of the list.
5. (20%) Suppose that an array-based min heap is used to implement a priority queue. For the min heap, what relations must be satisfied regarding
- (a) (4%) the positions of a parent and its left and right children;
- (b) (4%) the values of a parent and its left and right children.

Assume the array of a min heap has positions (Pos) and values (Val) as follows.

Pos	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Val	2	5	3	15	9	7	20	16	25	14	12	11	9	23	27

- (c) (4%) Draw the binary tree diagram of the min heap.
- (d) (4%) Based on (c), draw the new diagram after removal of the minimum value.
- (e) (4%) Based on (d), draw the new diagram after replacement of the value 5 with 13.

(The End)