

銘傳大學九十一學年度轉學生招生考試

八月四日 第三節

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資料結構 試題

Question 1. (10 points) Using big-O notation, give the running times of the following operations (in the worst case). Assume the data structure has n items. Must use big-O notation correctly.

- searching in a linked list
- searching in an ordered array
- searching in a binary search tree (not necessarily balanced)
- deleting the min element from a min-heap.
- Finding the minimum element in an AVL tree.

Question 2. (5 points) List the following sorting algorithms by their average speed, from fast to slow; bubbleSort, insertionSort, quickSort, ShellSort.

Question 3. (20 points) Match each of the given sorting algorithms with one or more of the given characteristics. Write as many letters as apply in the blank to the left of the name of the sorting method.

_____ insertion sort	A. linear extra space
_____ selection sort	B. optimal average running time
_____ heapsort	C. linear best-case running time
_____ bubblesort	D. quadratic worst-case running time.
_____ mergesort	E. linear for nearly-ordered files.
_____ quicksort	F. optimal worst-case running time
_____ shellsort	G. quadratic best-case running time.

Question 4. (15 points) A mysterious program

Here is a mysterious program. Write down the output. Assume that malloc always succeeds.

```

#include <stdio.h>
#include <stdlib.h>
struct mystery{
    int x;
    struct mystery *elbow;
};
int main(int argc, char**argv)
{
    int i ;
    struct mystery *m;
    struct mystery *z;

    m = 0;
    for (i = 0; i <10; i++){
        z = malloc (sizeof(*z));
        z->elbow = m;
        m = z;
        m -> x = i;
    }
    for (i = 0; i <10; i++){
        z = m;
        printf( "%d\n" , z->x)
        m = m -> elbow;
        free(z);
    }
    return 0;
}

```

Question 5.

- (a) (3 points) why not use a hash function like $h_2(v) = v \bmod 97$ for the second hash function in double hashing?
- (b) (7 points) using the hash functions $h_1(x) = x \bmod 11$ and $h_2(x) = 1 + x \bmod 9$, show the result of inserting the keys 31 41 59 26 53 58 97 into an initially empty table of size 11 using double hashing.

Question 6. (15 points) insert the following elements (in the order) into the following structures

A F E D C B G H I

- (a) B-tree (order 3)
- (b) AVL tree
- (c) red-black tree (Denote red links by extra-thick lines.)

Question 7. (5 points) what is the largest key that could be at the bottom level of a max-heap built from the keys 1 through 64?

Question 8. (5 points) which of the following does not represent a heap-ordered complete binary tree? Circle your answer.

	1	2	3	4	5	6	7
A	G	F	E	D	C	B	A
B	G	F	E	A	B	C	D
C	G	D	F	A	C	B	E
D	G	F	D	A	C	E	B
E	G	E	F	A	C	B	D
F	G	E	F	A	B	D	C

Question 9. (15 points) Write function circularcount that returns the number of nodes in a circularly-linked list.

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