

考試科目	程式設計與資料結構	所別	數位內容碩士學位學程	考試時間	3月15日 星期日	第4節
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可用中文或英文回答

1. (20%) True or False (Please write O (for true) or X (for false) as an answer to each of the following statements.)
- (1) "Call by reference" means that the address of a memory cell is passed to the called procedure.
  - (2) In a minimum heap, the third minimum element must be one of the two children of the root.
  - (3) Any imbalance caused by an insertion into an AVL tree can always be fixed by either a single or double rotation.
  - (4) B-tree is often used in database systems.
  - (5) Hashing techniques can be applied to cases where input keys are string type.
  - (6) When quadratic probing is used, and the hash table size is a prime, a new element can always be inserted if the hash table is at least half empty.
  - (7) The adjacency list representation is suitable for dense graph.
  - (8) A heap is a complete tree.
  - (9) There exists topological ordering for cyclic graphs.
  - (10) The minimal spanning tree of a connected graph may not visit every vertex.
2. (20%) Single Selection
- (1) What is the postfix expression for the following infix expression:  $(A+B)*C-D/E$ ?  
 (a)  $ABC*+DE-/-$   
 (b)  $AB+C*DE/-$   
 (c)  $ABCDE+*-/$   
 (d)  $AB+C*D-E/$
  - (2) Assume that the pre-order and in-order traversals of a binary tree are "ABCDEFGH" and "CBDAFEHG", respectively. What is the result of post-order traversal of this tree?  
 (a) CDBFHGEA  
 (b) CDBGHFEA  
 (c) HGFEABCD  
 (d) ABCEFGDH
  - (3) Which of the following functions grow the fastest when  $n$  becomes large?  
 (a)  $n^{300}$  (b)  $3^n$  (c)  $n \log n$  (d)  $ne^3$
  - (4) In a complete binary tree with  $n$  leaves, what is the number of internal nodes?  
 (a)  $n$  (b)  $\log n$  (c)  $n-1$  (d)  $n^2$
  - (5) Which of the following is not a characteristic of an object-oriented language?  
 (a) encapsulation (b) recursion (c) polymorphism (d) inheritance
  - (6) The worst case time complexity of searching a key in a sorted N-key linked list is  
 (a)  $O(\log N)$   
 (b)  $O(N)$   
 (c)  $O(N \log N)$   
 (d)  $O(N^2)$

備 考試 題 隨 卷 繳 交

命 題 委 員 :

( 簽 章 )

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 2. 書寫時請勿超出格外，以免印製不清。  
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(7) What is the result of executing the following IsOdd program when  $n$  is -11?

```
bool IsOdd(int n) {
    if (n==1)
        return true;
    else if (n==0)
        return false;
    else {
        n=n-2;
        IsOdd(n);
    }
}
```

- (a) true
- (b) false
- (c) arithmetic overflow
- (d) stack overflow

(8) Which of the following data, inserted in the input order, will produce a complete binary search tree?

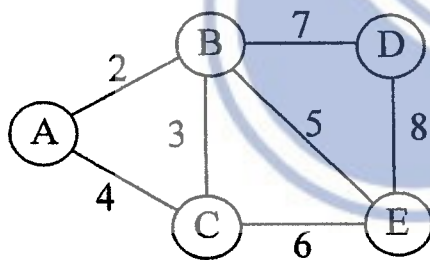
- (a) (Greg, Alan, James, John, Vivian, Lily)
- (b) (John, Vivian, Greg, Alan, Lily, James)
- (c) (Alan, Greg, James, John, Lily, Vivian)
- (d) (James, Greg, John, Alan, Lily, Vivian)

(9) What is the content of count after executing the following code segment?

```
count = 0;
for(i=1; i<=10; i=i+1)
    for(j=1; j<=i; j=j+1)
        for(k=1; k<=j; k=k+1)
            if (i==j)
                count = count + 1;
```

- (a) 1000
- (b) 100
- (c) 10
- (d) 55

(10) What is the cost of the minimal cost spanning tree for the following graph?



- (a) 17
- (b) 18
- (c) 20
- (d) 14

3. (10%) Assume the following AVL tree in array implementation,

25	18	55	14	22		60	6	16	
1	2	3	4	5	6	7	8	9	10

- (1) Please traverse the tree in post order and list the node visited.
- (2) Please show the result after inserting 4 into the tree.

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4. (6%) Given an empty minimum heap, please show the final result of inserting the following list of numbers sequentially: 11, 13, 2, 15, 7, 6, 9, 18, 4, 10

5. (10%) Please put the following keys: 69, 106, 68, 29, 118, 99 into an open addressing hash table by using the hash function of  $h(X)=(X \bmod 10)$ , and the quadratic probing function of  $F(i)=2*i^2$ .

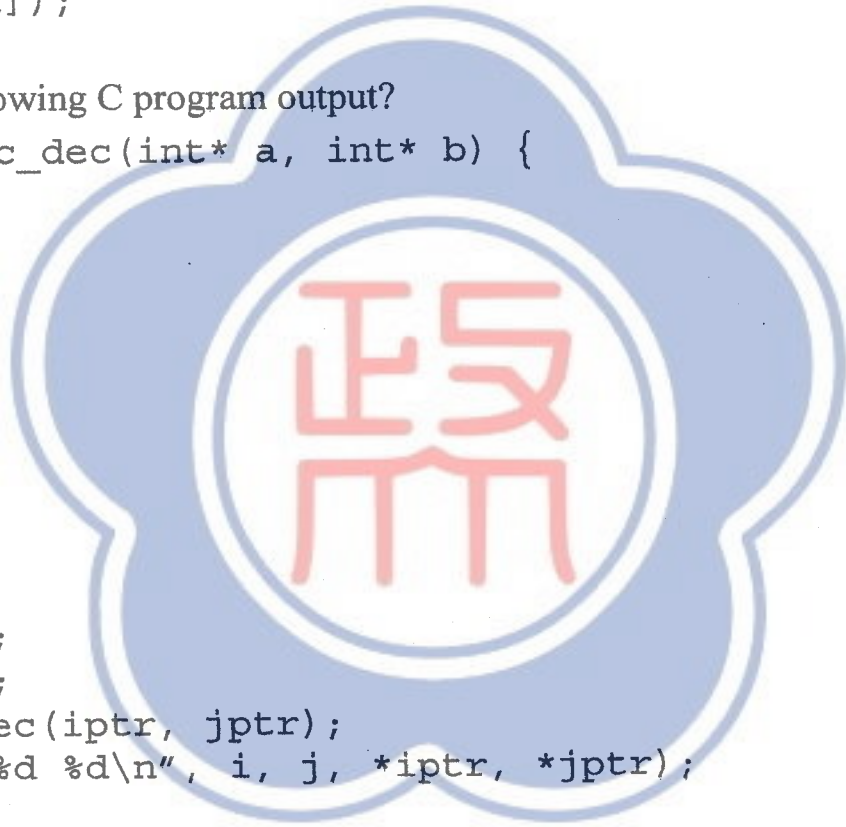
6. (5%) What does the following C code segment print?

```
char a[][10]={"abcde","fghijk"};
char *b=a[1];
char *c="pqrstuv";
c=b;
c[3]='m';
printf("%s\n",a[0]+1);
printf("%s\n",a[1]);
```

7. (5%) What does the following C program output?

```
void swap_and_inc_dec(int* a, int* b) {
    int *temp;
    temp = a;
    a = b;
    b = temp;
    *a += 1;
    *b -= 1;
}

void main() {
    int i = 10;
    int j = 5;
    int *iptr = &i;
    int *jptr = &j;
    swap_and_inc_dec(iptr, jptr);
    printf("%d %d %d %d\n", i, j, *iptr, *jptr);
}
```



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8. (10%) Given the following C program,  
 (a) please describe what the function `int digit(int n, int k)` does?  
 (b) What gets printed if the program is executed?

```
#include <stdio.h>
int digit(int n, int k) { /*n and k are all positive*/
    int i, m;
    for(i=1; i<=k; i++) {
        m=n-n/10*10;
        n=(n-m)/10;
    }
    return m;
}
main(void) {
    printf("digit(548,1)=%d\n", digit(548,1));
    printf("digit(548,2)=%d\n", digit(548,2));
    printf("digit(548,3)=%d\n", digit(548,3));
}
```

9. (14%) C Programming: Recursive function

Given the following definition of a node in a tree structure:

```
typedef struct _tree_node {
    int value;
    struct _tree_node *left;
    struct _tree_node *right;
} tree_node;
```

Please write a recursive function to search for the first node containing the target value.

```
tree_node *FindNodeInTree(tree_node *root, int target);
```

This function should return the found node or NULL if not found.

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