

國立中正大學

113 學年度碩士班招生考試

試題

[第 2 節]

科目名稱	計算機概論(含程式設計)
系所組別	資訊工程學系-乙組

—作答注意事項—

※作答前請先核對「試題」、「試卷」與「准考證」之系所組別、科目名稱是否相符。

1. 預備鈴響時即可入場，但至考試開始鈴響前，不得翻閱試題，並不得書寫、畫記、作答。
2. 考試開始鈴響時，即可開始作答；考試結束鈴響畢，應即停止作答。
3. 入場後於考試開始 40 分鐘內不得離場。
4. 全部答題均須在試卷（答案卷）作答區內完成。
5. 試卷作答限用藍色或黑色筆（含鉛筆）書寫。
6. 試題須隨試卷繳還。

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科目名稱：計算機概論(含程式設計)

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系所組別：資訊工程學系-乙組

Multiple Choice (50%):

Please **choose the best one** and **explain why** among the four choices for each question. Five points will be given for each correct answer.

1. (5%) What will be output for the following code?

```
#include <iostream>
using namespace std;
int i = 0;
ostream & funct (ostream &a) {
    a << (i++); return a; }
int main() {
    funct(cout) << funct; return 0;
}
```

- (a) 01 (b) 12 (c) Nothing due to compilation error: variable funct is not defined.
(d) Nothing due to compilation error: no such manipulator.

2. (5%) Which statement is **false** for C++?

- (a) For input streams, character flows will come from the keyboard or files.
(b) It is good to use inheritance if two classes have a “has a” class relation.
(c) Inheritance is good for defining each subset in the general class.
(d) Streams are specialized objects that deliver program input and output.

3. (5%) What will be output for the following code?

```
#include <iostream>
using namespace std;
class B{
public:
    virtual ~B(){ cout << "b"; }
};
class D: public B{
public:
    ~D() { cout << "d"; }
};
int main(){
    B* tmp = new D; delete tmp; return 0;
}
```

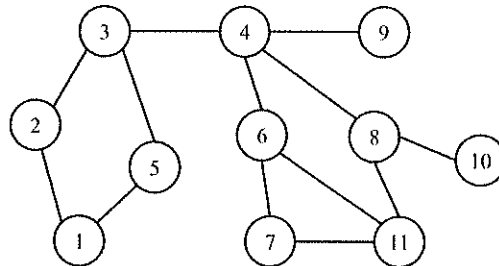
- (a) b (b) d (c) db (d) bd

4. (5%) Which statement is **false** for the following code?

```
#include <iostream>
#include <vector>
#include <stack>
using namespace std;
int main() {
    stack < int, vector<int> > s;
    for (int i = 0; i < 5; i++)
        s.push(i);
    while (! s.empty()) {
        cout << s.top(); s.pop();
    }
    return 0;
}
```

- (a) The output is 43210. (b) The code will lead to a compilation error.
 (c) `vector<int>` is the underlying container. (d) It is allowed to replace `vector<int>` with `list<int>`.

5. (5%) Given the following graph, please choose the edges in the spanning tree constructed by DFS. Note that the starting node is node 1, and the node with a smaller ID will be visited first if there is a tie.



- (a) (1, 2), (2, 3), (3, 4), (3, 5), (4, 6), (4, 9), (6, 7), (7, 11), (8, 10), (8, 11)
 (b) (1, 2), (1, 5), (2, 3), (3, 4), (4, 6), (4, 8), (4, 9), (6, 7), (6, 11), (8, 10)
 (c) (1, 5), (2, 3), (3, 5), (3, 4), (4, 8), (4, 9), (6, 7), (7, 11), (8, 10), (8, 11)
 (d) None of them

6. (5%) Which statement is **false**?

- (a) The update of a loser tree is faster than that of a winner tree.
 (b) Merge sort has a lower worst-case time complexity than selection sort.
 (c) In most cases, prime numbers are good divisors for implementing a division-based hash function.
 (d) Every binary tree can be uniquely defined by its pre-order and post-order sequences.

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7. (5%) Which statement is **true**?

- (a) The lower bound of worst-case time complexity of any sorting algorithm is $\Omega(n \log n)$.
- (b) A heap can be used to implement a binary search tree.
- (c) A bi-connected graph is a connected graph that has two articulation points.
- (d) The maximum number of nodes in an AVL tree of depth 5 is 31.

8. (5%) Which statement is **false**?

- (a) Converting a BST into an AVL tree can be done in $O(n)$ time.
- (b) In an AVL tree, every subtree is also an AVL tree.
- (c) In a balanced BST such as AVL or red-black tree, finding the element with the second smallest key requires $\theta(n)$ time.
- (d) The height of an AVL tree with n nodes is $\theta(\log n)$.

9. (5%) What will we get after heapifying the integer array {30, 10, 45, 25, 60, 15, 35, 5} to a Max Heap?

Note that we use the bottom-up method that runs in $O(n)$ time.

- (a) {5, 10, 15, 25, 30, 35, 45, 60} (b) {60, 45, 35, 30, 25, 15, 10, 5}
- (c) {60, 45, 35, 10, 25, 15, 30, 5} (d) {60, 30, 45, 25, 10, 15, 35, 5}

10. (5%) What will be output for the following code?

```
#include <iostream>
using namespace std;
int main() {
    int i = 0, n = 4092;
    for(int j=n; j>0; j=j&(j-1), i++);
    printf("%d", i);
}
```

- (a) 10 (b) 11 (c) 12 (d) 0123456789

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Short Answer Questions (50%):

11. (20%)

- (a) (5%) Find the two's complement representation for the number **-93**, assuming it is represented as a 16-bit number. Write the value in hexadecimal.
- (b) (5%) Convert the binary value **100010101.0101** to base ten.
- (c) (5%) Convert the base ten number **812** to base four.
- (d) (5%) Convert the base ten number **15.375** to binary value.

12. (20%) Data dependence among program statements affects the feasibility of parallelizing these statements.

- (a) (4%) What is flow dependence?
- (b) (4%) What is anti-dependence?
- (c) (12%) Consider the following C code snippet. Please analyze the data dependence relationship between S1 and S2.

```
int m, i;  
m = func();  
for (i=2; i<20; i++) {  
    A[i+m] = B[i] + 100;    /* S1 */  
    C[i] = A[i] - 5;        /* S2 */  
}
```

13. (10%) Consider the following **NFA** (Nondeterministic Finite Automata) over {a, b}.

- (a) (3%) Which of the following three input strings are accepted by the NFA?

ababb, bab, bb

- (b) (7%) What is the ϵ -closure of the set of states {7}?

