國立成功大學 107 學年度碩士班招生考試試題

系　　所：資訊管理研究所

考試科目：計算機概論　　考試日期：0206，節次：2

※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

A-1 Which descriptions about "statements" are accurate? Select all that apply, and then correct the wrong ones for obtaining the full points. 20 points in total (each description counts two points)

[1] A block is a compound statement.
[2] Most calculations are performed in assignment statements.
[3] In a control statement, having a loop within a loop is known as recursion.
[4] If the condition is false, the statement in the body of the `if` statement is executed.
[5] A `for` statement can always be used to replace a `while` statement, and vice versa.
[6] A `switch` statement can be used as a double-selection structure.
[7] In a `do...while` statement, the body of the loop will execute at least once.
[8] `break` and `continue` statements alter the flow of control.
[9] `continue` statements exit from the loop in which they're embedded.
[10] In a valid `enum` statement, the constants are variables.

A-2 Which descriptions about "deep learning" are accurate? Select all that apply, and then correct the wrong ones for obtaining the full points. 20 points in total (each description counts two points)

[1] A type of algorithms.
[2] Requires being hard coded.
[3] Used in machine learning.
[4] A subset of representation learning.
[5] Multi-layer patterns learned by computers.
[6] Having flexible and scalable frameworks.
[7] Training neural networks takes time and money.
[8] Not as managers expected when making decisions.
[9] Compared to human experts, it has not produced superior results.
[10] Advancing the field of artificial intelligence is questionable.

A-3 How distributing computing can be applied in artificial intelligence? (10 points)

B1. [20%] True or False, and EXPLAIN

Circle T or F for each of the following statements to indicate whether the statement is true or false, respectively. If the statement is correct, **briefly state why**. If the statement is wrong, **explain why or give a counter example**. Answers **without reasons** will get **AT MOST 1** point.

(a) [4%] (T , F) Given n integers with values in the range $[-10^{20}, 10^{20}n]$, sorting them in nondecreasing order can be done in $\Theta(n)$ time.

(b) [4%] (T , F) If your computer has the IP address 128.96.10.123, and the subnet mask is set to 255.255.0.0, your computer will connect directly to all computers whose IP address starts with 128.96.10.

(c) [4%] (T , F) When we input d=50, then this expression `d > 100 && d < 100 || d != 50` should give the same result as `d != 50 && d > 100 || d < 100`

(d) [4%] (T , F) Given the following code:

```
public int F(int a, int b)
{   if ((a%b)==0) then return b;
    else return F(b, a%b);    }
```

Then, F(17,3) returns 1, and F(3,9) returns 9.

(d) [4%] (T , F) If we use an n x n adjacency matrix to store an undirected simple graph G=(N,A) of n nodes and $m<n^2$ arcs , to find the longest length takes $\Omega(n^2)$ time.

B2. [10%] Given a directed connected graph $G=(N,A)$ with $n=|N|$ nodes and $m=|A|$ arcs, where each arc $(i,j)\in A$ has a positive length c_{ij} and $C=\max_{(i,j)\in A}\{c_{ij}\}$. Suppose we use two adjacency list $AO(i)$ and $AI(i)$ to store all the outgoing arcs $(i,j)\in A$ and incoming arcs $(j,i)\in A$ associated with node $i\in N$. Answer the following questions:

(a) [5%] Suppose calculating a 1-ALL shortest path (i.e., a shortest path spanning tree rooted at a node) takes $S(n,m,C)$ time. Explain how to calculate a shortest cycle (i.e., a cycle whose length is the shortest) that passes through a node $i\in N$ in $S(n,m,C)$ time.

(b) [5%] Explain how to identify a maximum spanning tree in $O(m\log n)$ time.

<尚有 B3.B4 兩題於下一頁>

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B3. [15%] The following program finds the common elements in two different integer arrays (fibArray and primeArray) and stores them in another array called commonArray. At the end of the program, it prints out how many common elements there are. There are **five** bugs in the code. Identify them and then fix them.

```
1  int main() {
2    int fibArray[] = { 1, 2, 3, 5, 8, 13, 21, 34, 55, 89 };
3    int primeArray[] = { 2, 3, 5, 7, 11, 13, 17, 19, 23, 29 };
4    int commonArray[];
5    int i, j;
6    for ( i = 0; i < 10; ++i ) {
7       for ( j = 0; j < 10; ++j ) {
8          if (fibArray[i] = primeArray[j]) {
9             commonArray[j] = primeArray[j];
10             ++n;}
11      }
12   }
13   printf("The total number of common elements is %n\n", n);
14   return 0;}
```

B4. [5%] Solve the following recurrence relation with full history:

$$T(n) = n + \sum_{i=1}^{n-1} T(i),\ T(1) = 1$$