大同大學 104 學年度研究所碩士班入學考試試題

考試科目：計算機概論　　所別：資訊工程研究所　　

註：本次考試 不可以參考自己的書籍及筆記； 不可以使用字典； 不可以使用計算器。

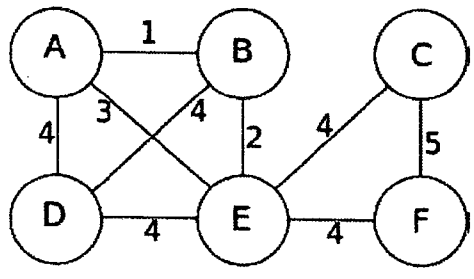
Part I (資料結構)

1. Given the **graph** on the right, do the following as requested.

   (a) (5 points) Represent the graph with the **adjacency list** representation.

   (b) (5 points) Do **BFS** on the graph and show the visited vertices **in order** (按拜訪先後順序) if the starting vertex is **C**.

   (c) (5 points) Do **DFS** on the graph and show the visited vertices **in order** (按拜訪先後順序) if the starting vertex is **C**.



   (d) (5 points) Find and draw two **minimum spanning trees (MSTs)** from the graph. Note, the second MST should contain at least **two edges** that are not in the first MST.

2. Draw the 7-item hash table resulting from hashing the keys, { 7, 15, 23, 13, 14, 8, 21 }, using the hash function, $h(k) = k \bmod 7$, and assuming collisions are handled by

   (a) (5 points) separate chaining;　　(b) (5 points) linear probing.

3. (a) (5 points) Find the range of `n` so that `f(n)` will return the correct result.

   (b) (5 points) What will `g(1, 17, 7)` return?

```
int f(int n)
{
   switch(n)
   {  case 0: case 1: case 2:
         return n + 1;
      default:
         return f(n-1) * f(n-3);
   }
}
```

```
int g(int a, int b, int n)
{
   int c = ( a + b) / 2;

   if ( c * c <= n )
      return c;
   else
      return g(a, c-1, n);
}
```

4. (a) (5 points) Quicksort and mergesort are both divide-and-conquer algorithms having divide, conquer, and combine steps. However, the behaviors and hence the complexities of the two algorithms in the **divide** step and the **combine** step are quite different. Compare and discuss the differences of the two algorithms in each of the two steps.

   (b) (5 points) What are the **best** case, **average** case, and **worst** case time complexities (i.e., **O(1)**, **O(lg*n*)**, **O(*n*)**, **O(*n*lg*n*)**, or **O(n^2)**) of quicksort?

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Part 2: 基本數位邏輯

5. What does a binary pattern represent is according to the coding system. For example, the **4-bit** binary pattern 1010 represents 10, -5 and -6 in binary, 1's complement and 2's complement, respectively.
   (a) (8 points) What does the **8-bit** binary pattern 10000110 represent in following coding system?
   (i) binary number　(ii) 1'complement　(iii) 2'complement　(iv) BCD
   (b) (2 points) What does the **7-bit** binary pattern 1001011 represent in ASCII code?
   (Hint: 'A' is 1000001, 'a' is 1100001, and '0' is 0110000)

6. According to Boolean Algebra answer the following questions.
   (a) (5 points) Write out the DeMorgan theorem and show them.
   (b) (5 points) Show that the NOT, AND and OR gates can be replaced with NAND gates.

7. Given a logic function, $F(A,B,C,D)=\overline{B}\,\overline{C}\,D+B\,D+\overline{A}\,B\,\overline{D}$
   (a) (5 points) Rewrite the given function in the form $F(A,B,C,D)=\sum(\cdots)$.
   (b) (5 points) Find the **minimal** expression in sum-of-production form.
   (c) (5 points) Draw the **minimal** circuit (using all NAND without NOT gates.)

8. Design a single-input and single-output Moore-type synchronous FSM to detect 110 continually.
   (a) (5 points) What is the minimal state diagram?
   (b) (3 points) What is the minimal state table?
   (c) (2 points) What is the state-assigned table?
   (d) (5 points) What is the circuit implemented with D flip-flops?