大同大學 100 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

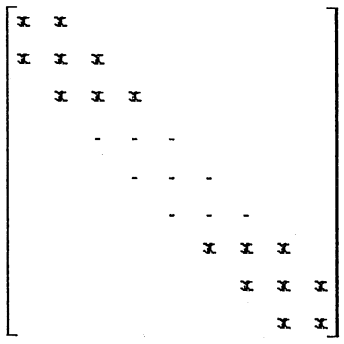
Part I

1. Modify the following depth-first algorithm to determine if a graph is connected or not: (10%)

```
void depthFirst (Graph G)
{
    Mark all vertices in G as unvisited.
    Create a stack S.
    While (there are unvisited vertices)
    {
        Push an unvisited vertex onto S.
        While (S not empty)
        {
            v = Pop S
            Mark v as visited
            Push onto S all the vertices adjacent to v that have not been visited and are not currently in S.
        }}}
```

2. Consider the version of quicksort where the leftmost element of the array is used as the pivot. What is the performance of the algorithm on a sorted array of size N? Please explain your answer. (10%)

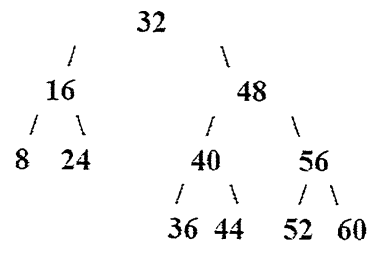
3. Assume that A is an $n \times n$ tridiagonal matrix as illustrated below.
   i How many nonzero elements are there in A? (3%)
   ii If the nonzero elements of A are stored in an one-dimensional array B in row major order, with A[0][0] stored in B[0], construct an algorithm that determines the location in A from a location in B. (7%)



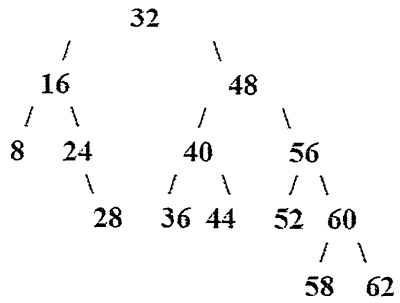
4. Suppose that a sparse matrix is represented in a one-dimensional array, in which each cell of the array is a structure of type ***entry*** with three fields: row, col, and value, denoting the value of a nonzero entry in the matrix at position (row, col). Cell 0 of the array holds the numbers of rows and columns and nonzero entries of the matrix. Assuming that in the array, the nonzero entries of a sparse matrix are sorted by row and within each row by column, write a function ***Add(entry a[], entry b[], entry total[])*** to perform addition on two sparse matrices ***a*** and ***b*** and return the sum in matrix ***total***. If addition is not possible, simply print an error message and return. (10%)

5.

(i) Insert 46 into the following AVL tree and show the resulting tree. (5%)



(ii) Delete 8 from the following AVL tree and show the resulting tree. (5%)



<背面繼續>

大同大學 100 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

<接前頁>

Part II

1. (10%) Convert decimal +46 and +29 to binary, using the signed-2's-complement representation and enough digits to accommodate the numbers. Then perform the binary equivalent of (+29) + (-49), (-29) + (+49), and (-29) + (-49). Convert the answers back to decimal and verify that they are correct.
2. (4%) Is $\overline{A} + A \cdot B = \overline{A} + B$? Prove your answer by algebra manipulation.
3. (6%) Show how to configure each of the following two-input devices as an inverter:
   (a) Two input NAND; (b) Two input NOR; (c) Two input exclusive OR.
4. (10%) A logic function $F(A, B, C, D) = \overline{B} \cdot (C \cdot D + \overline{C}) + C \cdot \overline{D} \cdot (\overline{A + B} + A \cdot B)$.
   (a) $F(A, B, C, D) = \Sigma(?)$?
   (b) Simplify $F(A, B, C, D)$ by Karnaugh map.
5. (5%) Describe the differences between a Mealy Machine and a Moore Machine.
6. (15%) Using J-K flip-flops to design a 3-bit synchronous binary up counter.
   (a) Show the state table of this counter.
   (b) Find the input equations of each flip-flop.
   (c) Draw the circuit of this counter.