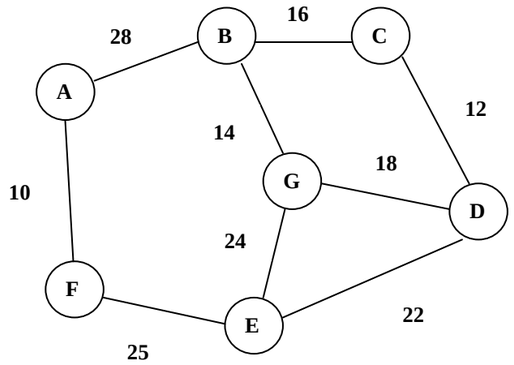
國立嘉義大學 100 學年度

資訊工程學系碩士班（甲組）招生考試試題

科目：資料結構

1. Give a weighted graph. Please write the steps of deriving minimum cost spanning trees by Kruskal's and Prim's algorithms. (20%)



2. The node structure of a linked list is defined as:

```
typedef struct Node *NodePtr;
typedef struct Node {
   NodePtr next;
   int data;};
```

Suppose there is a linked list, pointed by the pointer *p*. The linked list has at least one node. Please write an algorithm to reverse the linked list. (10%)

3. Show that quicksort's best-case running time is $\Omega(n \lg n)$. (15%)

4. What are the minimum and maximum numbers of elements in a heap of height *h*? (15%)

5. A recursive algorithm for computing the size of a tree can be:

```
int size(Node n) {
if (x == NULL) return 0;
return 1 + size(n.leftChild) + size(n.rightChild);
}
```

Please write an **iterative** algorithm for computing the size of a tree. A stack data structure with push( ) and pop( ) operations can be assumed. (10%)

6. Assume a matrix *data*[*m*][*n*] is used to store integral data. Also, assume integers in a same row or same column are in increasing order. Please (a) describe an algorithm to search an integer *num* in *data*[ ][ ]; (b) analyze time complexity of your algorithm. (10%)

1	2	3
5	6	19
7	8	20
11	12	23

7. Given an algorithm below, please determine the values in f [ ] when pat = "abcababca". Note that variable declaration is omitted in the code. (10%)

```
n = strlen(pat);
f[0] = -1;
for (j=1; j < n; j++) {
   i = f[j-1];
   while ((pat[j] != pat[i+1]) && (i >= 0))
      i = f[i];
   if (pat[j] == pat[i+1])
      f[j] = i+1;
   else f[j] = -1;
}
```

8. Prove or disapprove the following statements. (10%)

(a) $\sum_{i=0}^{n} i^3 = \Theta(n^4)$

(b) $n^3 2^3 + 6n^2 3^3 = O(n^2 2^n)$