國立高雄應用科技大學

105 學年度研究所碩士班招生考試

資訊工程系碩士班

資料結構

注意：a. 本試題共 10 題，每題配分如標示，共 100 分。
b. 作答時不必抄題，不必按題號順序，但須標明題號。
c. 考生作答前請詳閱答案卷之考生注意事項。
d. 中英作答皆可。

1. (10%)
   (i) Convert the following expression into postfix form. (no detail needed)
   ((5 – 1) / 2) * (8 – 3) + 6
   (ii) Then use a stack to evaluate your postfix form. (detail needed)

2. (15%) Recursive Depth-First-Search of an undirected graph.
   (i) (10%) Complete the following recursive C function.

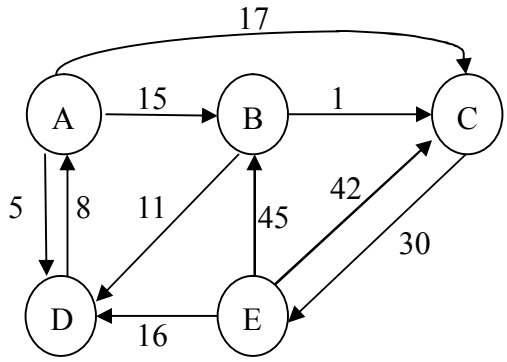
```
/* graph[5][5] is the adjacency matrix of an undirected graph G = (V, E).
   graph[v][w] = graph[w][v] = 1 if (v, w) ∈ E;
   graph[v][w] = graph[w][v] = 0 otherwise.
   The following is a depth first search of G beginning at v.
*/
visited[5] = {FALSE, FALSE, FALSE, FALSE, FALSE};
void dfs (int v) {
   int w;
   visited[ v] = TRUE;
   printf("%3d", v);

   for( w = 0 ; w < 5 ; w++)
      if(_____ && _____)
         dfs( w );
}
```

   (ii.) (5%) In the above program, what data structure can be used to replace recursion? Briefly explain how.

3. (5%) Draw the binary tree whose post-order sequence is D C E B I H G J F A and whose in-order sequence is C D B E A G H I F J.

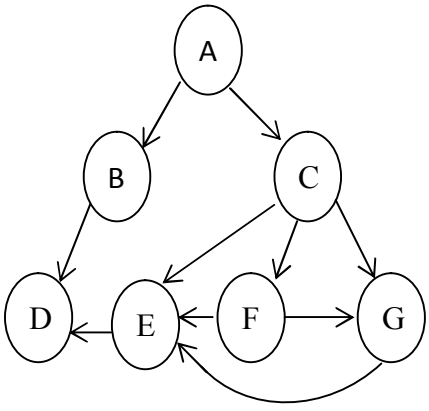
4. (10%) Use the Dijkstra's algorithm to find all the shortest paths with node E being the source. The set S contains nodes to which shortest path is known, and distance[X] means the shortest distance to X through nodes in S.



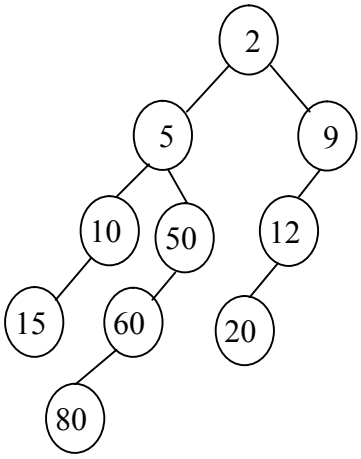
Explain why node D is being picked into S after node E. And finish the following table.

S	distance[A]	distance[B]	distance[C]	distance[D]
{ E }	∞	45	42	16
{ E, D}	24			

5. (15%) In the following directed graph, starts with node A, find
   (i) an order that satisfies bfs order but not topological order.
   (ii) an order that satisfies topological order but not bfs order.
   (iii) an order that satisfies both bfs order and topological order.

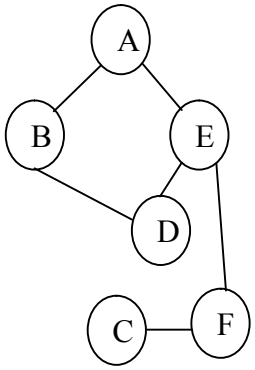


6. (5%) Pop (delete) the min from the following min-leftist-tree, and draw the resulting tree. Detail needed.

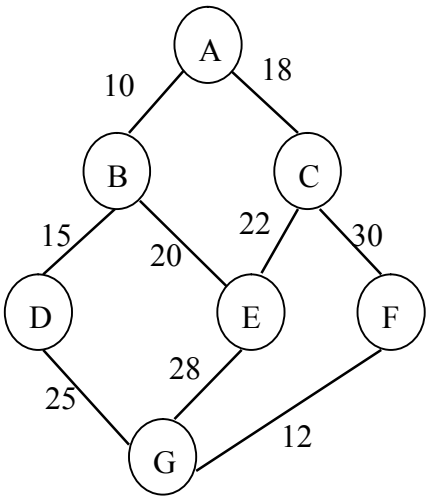


7. (10%)　A hash table has 10 buckets. Assume the hash function maps “acos” to bucket 1, “atoi” to bucket 3, “char” to bucket 2, “define” to bucket 2, “exp” to bucket 4, “ceil” to bucket 5. If we insert these data into the table according to the above order, overflow would occur.
   (i)　Use linear probing to handle the overflow. (draw the hash table)
   (ii)　Use chaining to handle the overflow. (draw the hash table)

8. (10%)
   (i)　Find all articulation points in the following graph.
   (ii)　Move one edge (or equivalently, delete one edge and add a new edge) to make the graph biconnected.

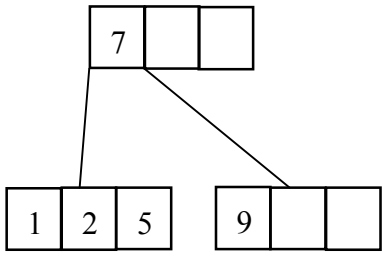


9. (10%) We know that Kruskal's, Prim's, and Sollin's Algorithm can be used to find the minimum-cost spanning tree (MST) of a graph. Choose two from the above three algorithms, and find the MST of the following graph. Make sure the two algorithms of your choice output the same MST. (detail needed)



10. (10%)

(i) Delete 7 from the following 2-3-4 tree.



(ii) Insert 3 into the following 2-3-4 tree.