國立成功大學

114學年度碩士班招生考試試題

編　號：132、139、144

系　所：電機工程學系
電腦與通信工程研究所
智慧資訊安全碩士學位學程

科　目：資料結構

日　期：0210

節　次：第 2 節

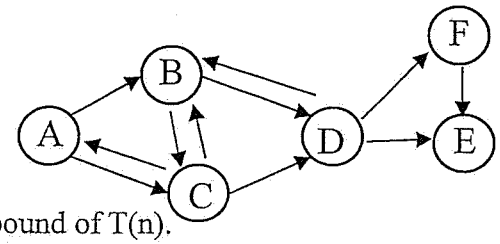
注　意：1.不可使用計算機
2.請於答案卷(卡)作答，於試題上作答，不予計分。

一、單選題（80 分，每題 5 分，答錯到扣2分）

1. A is a two dimension array, the locations of A(3, 2) and A(2, 3) are 1115 and 1207, respectively. Assume that each element occupies two addresses. Please give the location of A(5, 10).
   a) 1841
   b) 1851
   c) 1861
   d) 1871
   e) None of the above.

2. Given that the post-order traversal of a binary tree is " E F B C D A" and the in-order traversal of the same tree is "E F A C B D", please provide the resulting pre-order traversal of the tree.
   a) A F E D C B
   b) A E F D C B
   c) A F E C D B
   d) A F E B C D
   e) None of the above.

3. Given a directed graph in the following, please identify which edge would become a cross edge if we traverse the graph by the breadth first search algorithm from node C. Assume that the nodes are stored in the adjacent list according to alphabetic order. Please specify which edge forms a cross edge in the resulting breadth-first spanning tree.
   a) (F, E)
   b) (B, D)
   c) (D, B)
   d) (A, B)
   e) All of the above.



4. $T(n) = 3T(n/4) + n \log n$, Please give the tightly bound of T(n).
   a) $\theta(n)$ b) $\theta(n \log n)$ c) $\theta(n^2 \log n)$ d) $\theta(n^2)$

5. What will the array look like after a delete operation is applied on the maximum heap stored in the array?

-	75	58	67	42	55	30	29
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

a)

-	67	58	30	55	42	29	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

b)

-	67	58	55	42	30	29	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

c)

-	67	58	30	42	55	29	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

d)

-	67	58	29	42	55	30	
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]

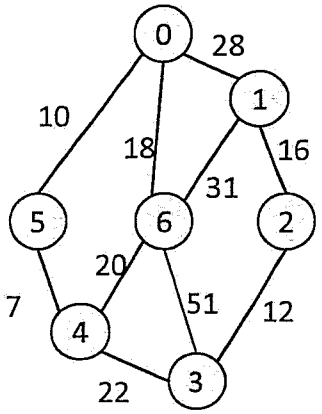
e) None of the above.

6. Please identify the incorrect descriptions.
   a) The max number of nodes in a binary tree with depth k is 2^k-1, where k ≥ 1.
   b) Using the most significant digit first (MSD) to sort multiple keys exist is simple than that using the least significant digit first (LSD).
   c) Merge sort is not a in-place sorting algorithm.
   d) The number of threads in a binary tree with n nodes is n+1.
   e) The above descriptions are correct.
7. The quick sort algorithm uses the divide and conquer technique. In each recursion, it will place a pivot of an array at the correct location and divide the array into two parts. Please identify the correct position of a pivot in the following array after the first recursion. To optimize performance, we apply the strategy of Median-of-3: median(key[left], key[middle], key[right]) to select pivot, where the index of middle = $\frac{left+right}{2}$. Then, the pivot is then swapped with the key[left].

-	75	58	67	42	55	30	29	95	3
[0]	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]

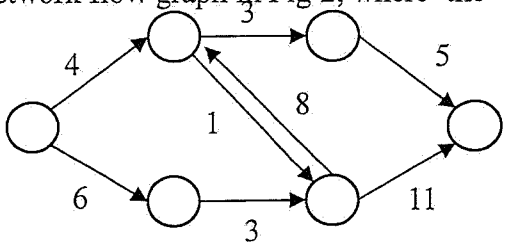
left =1, right =9

   a) key[2] b) key[4] c) key[6] d) key[8] e) None of the above
8. Prim algorithm is used to construct a minimum spanning tree T by using the data structure "set". They form a set for all nodes in the beginning and gradually merge two nodes until T is found. Please identify the first edge which form a cycle in T during the procedure and the number of sets formed at that moment.
   a) edge (3, 6) and 2 set b) edge (4, 6) and 4 set
   c) edge (0, 1) and 3 set d) edge (4, 6) and 3 set
   e) None of the above



9. Please identify the wrong descriptions in the following:
   a) Heap is suitable for a priority queue.
   b) Binary search is good for a dictionary.
   c) Binary search is faster than Heap in the insert operation.
   d) Max Heap is faster than binary serach in finding the maximum value.
   e) None of the above.
10. If Queue is implemented by the circular list, which operation requires linear time in the worst case.
   a) Find();
   b) isEmpty();
   c) Push();
   d) Pop();
   e) Noe of above.
11. Given a hash table with 11 buckets; labeled from 0 to 10. The hash function h(key)= key % 11 allocates data into a hash table. The chaining strategy is used to store data in each bucket. Please show the total number of comparisons required to store the numbers "3, 41, 15, 36, 74, 58, 91, 45, 48, 64".
   a) 20 b) 16 c) 22 d) 14 e) None of the above.
12. Continue from the problem 11, instead of chaining, we adopt open addressing to handle overflow, where each bucket has one slot. The resulting position of data is determined by h(key)= {initial position + i* h_2(key) }%11, where h_2(key) = key % 7 and i denotes the iteration of the overflow. Please show the position of 58 in the table.
   a) 7 b) 5 c) 10 d) 3 e) None of the above.

13. Please indicate the algorithm that cannot allow negative weighted edges in finding the shortest path.
    a.) Jonson's algorithm, b.) Bellman and Ford's Algorithm, c) Floyd Warshall's Algorithm, d) Dijkstra's Algorithm, e) None of above.
14) For any nonempty binary tree, T with n nodes, if n_0 is the number of leaf nodes. Please give the number of nodes in a binary tree with degree 1, in terms of n and n_0.
    a) $n-2n_0$, b) $n-2n_0-1$, c) $n-2n_0+1$, d) $n-n_0+1$, e) None of above.
15) Please give the maximum flow from S to T in the network flow graph in Fig 2, where the value associated to an edge is its capacity.
    a) 10
    b) 7
    c) 16
    d) 14
    e) None of above.



16) How many recursive calls would the call "Fibonacci(10)" generate in the following program?

```
int Fibonacci(int n) {
  if (n < 1) return 0;
  if (n < 3 ) return 1;
```

    a) 55 b) 108 c) 110 d) 20 e) None of the above

二、簡答題（20 分）

1. (10 PTs) Given a circular list (or, a singly-linked circular list) that the link field of the last node points to the first node as shown in Fig 1, please complete the code to insert a new node to the front of the list in the following:

```
template <class T>
void CircularList<T>::InsertFront(const T& e)
{
  ChainNode <T> *n = new ChainNode <T>(e);
  if (last) { // nonempty chain
    ____a)____;
    ____b)____;
  } else {
    ____c)____;
    ____d)____;
  }
}
```

```
template <class T> class Chain;

template <class T>
class ChainNode {
  friend class Chain <T>;
  private:
    T data;
    ChainNode <T> *link;
};
```

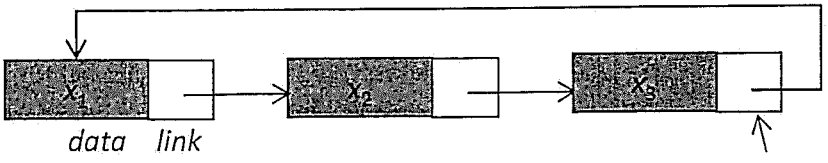


Fig. 1

2. (10 PTs) Given a graph shown in Fig 2, please answer the following questions:
   a) which are the articulation points, and
   b) the biconnected components of the graph.

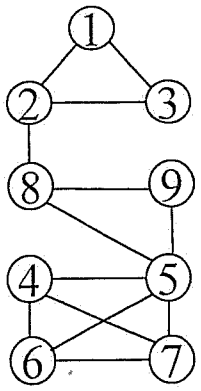


Fig. 2