一、单项选择题（本大题共 15 小题，每小题 2 分，共 30 分）

提示：在每小题列出的四个备选项中只有一个是符合题目要求的，请将其代码填写在下表中。错选、多选或未选均无分。

1. Assume a sequence list as 1,2,3,4,5,6 passes a stack, an impossible output sequence list is _____ .

A. 2,4,3,5,1,6 B.3,2,5,6,4,1 C.1,5,4,6,2,3 D.4,5,3,6,2,1

2. The addresses which store Linked List _____.

A. must be sequential B. must be partly sequential

C. must be no sequential D. can be sequential or discontiguous

3. If the Binary Tree T2 is transformed from the Tree T1, then the postorder of T1 is the _____of T2.

A. preorder B. inorder C. postorder D. level order

4. The_____ case is worst for quicksort.

A. the data which will be sorted is too larger.

B. there are many same item in the data which will be sorted .

C. the data will be sorted is out of order

D. the data will be sorted is already in a sequential order.

5. The output from scanning a minimum heap with level traversal algorithm_____.

A. must be an ascending sequence.

B. must be descending sequence

C. must have a minimum item at the head position.

D. must have a minimum item at the rear position.

6. Assume the preorder of binary tree T is ABEGFCDH, the inorder is EGBFADHC, then the postorder will be_____.

A. GEFBHDCA B. EGFBDHCA C. GEFBDHCA D. GEBFDHCA

7. _____has the highest growth rate in the following terms.

A. $\log_2(n)$ B. $2n^2+3n^3$ C. $n\log_2(n)$ D. 2^{10}

8. Which linear list is better to get the elements for a given index and insert or delete in the last location? _____

A. doubly circularly linked list B. doubly linked list C. array D. singly circularly linked list

9. Which one is a heap? _____

A. 80,44,56,29,16,23,18,7 B. 80,56,44,7,29,23,18,16

C. 80,56,29,16,23,44,18,7 D. 80,44,56,7,23,29,18,16

10. An arithmetic expression (a+b)/c-d*e can be changed to the postfix expression _____

A. abc+/de*- B. ab+c/-de* C. ab+c/de*- D. ab+c/de-*

11. Which one is right about binary tree? _____

A. A binary tree has two degrees

B. The degree of a binary tree can be less than two

C. There is at least one node whose degree is two in a binary tree

D. Each node of a binary tree has two degrees

12. In the binary search, the linear list is required _____

A. array structure

B. array structure or linked list structure

C. array structure and the elements are sorted

D. linked list structure and the elements are sorted

13. Which sorting algorithm is of efficiency O(nlog$_2$n)? _____

A. bubble sort B. quick sort C. straight insertion sort D. selection sort

14. Suppose that an ordered linear list contains n=31 nodes, the binary search is applied to the list, the maximum times in searching is_____

A. 4 B. 5 C. 2^5-1 D. 2^4-1

15. How many binary trees in different forms can at most be built by three nodes?_____

A. 4 B. 5 C. 6 D. 7

二、判断题（本大题共 5 小题，每小题 1 分，共 5 分）

提示：正确打✓，错误打×，将其结果填写在下表中。

1. The abstract data type is encapsulation of data and algorithms. ( )
2. Data can be inserted and deleted at any position in stacks and queues. ( )
3. The leading bits of each code are unique, that is, no code is the prefix of any other code, we call it prefix encoding. ( )
4. There must be 2e nodes in the adjacency list of the undirected graph with e edges. ( )
5. Binary search is better than sequential search in any array to find a given node. ( )

三、名词解释题（本大题共 2 小题，每小题 4 分，共 8 分）提示：对题目名词进行解释，英文缩写的需要给出全称并解释。

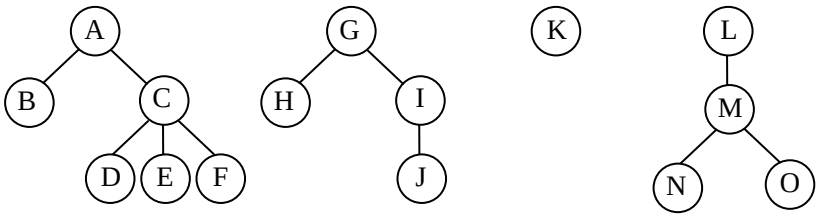
1. external sorting

2. ADT

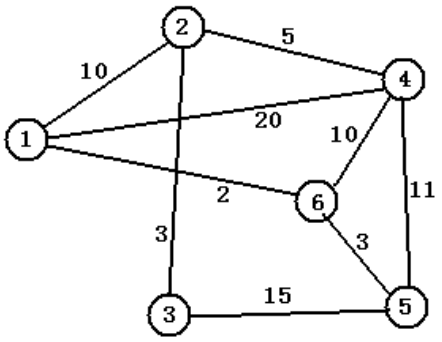
四、应用题（本大题共 4 小题，每小题 8 分，共 32 分）。

提示：有求解过程的要尽量给出解题步骤，只有最终答案会酌情扣分。

1. Write down the pre-order and post-order traversal of the forest below, and draw the binary-tree of this forest.



2. List the order in which the edges of the following graph are visited when running Prim's MST algorithm starting at Vertex 3. Show the final MST.



3. Given an array containing the elements {71, 80, 66, 59, 82, 25, 94, 69}. Show the initial max heap, and array after each swap during first pass of heapsort.

4. You are given a series of records whose keys are numbers. The records arrive in the following order: 23, 77, 27, 71, 12, 66, 55, 46, 19, 90, 68, 36, 86, 80, 59, 30. Show the 2-3 tree that results from inserting these records.

五、编程、设计及分析题（本大题共 2 小题，第 1 小题 10 分，第 2 小题 15 分，共 25 分）。

提示：题目给出了一个程序设计要求，请按照要求写出源程序代码，如果源程序代码中出现语法错误或逻辑错误，则酌情扣分。

1. The data elements are stored in a singly-linked list. Write a selection sort algorithm based on singly-linked list.

2. Write a recursive function named printRange that, given the pointer to the root to a BST, a low key value, and a high key value, prints in sorted order all records whose key values fall between the two given keys. Function printRange should visit as few nodes in the BST as possible.