If a data element requires 6 bytes and a pointer requires 3 bytes, then a standard array representation will be more space efficient than a linked list representation when the fraction of non-null elements is more than about: (D)

(A) 1/3 (B) 1/2 (C) 3/4 (D) 2/3

We use the parent pointer representation for general trees to solve (C) problem?

(A) Shortest paths (B) General tree traversal

(C) Determining if two nodes are in the same tree (D) Exact-match query

Which statement is not correct among the following four: (A)

(A) The number of empty sub-trees in a non-empty binary tree is one less than the number of nodes in the tree.

(B) The Mergesort is a stable sorting algorithm.

(C) A general tree can be transferred to a binary tree with the root having only left child.

(D) A sector is the smallest unit of allocation for a record, so all records occupy a multiple of the sector size.

Assume that we have eight records, with key values A to H, and that they are initially placed in alphabetical order. Now, consider the result of applying the following access pattern: F D F G E G F A D F G E if the list is organized by the Move-to-front heuristic, then the final list will be (B).

F G D E A B C H (B) E G F D A B C H

(C) A B F D G E C H (D) E G F A C B D H

Which queries supported by both of the hashing and tree indexing method? (D)

(A) Range queries. (B) Queries in key order

(C) Minimum or maximum queries (D). Exact-match queries

A full 8-ary tree with 100 internal nodes has _701__ leaves. (4 scores)

注：为 n*(k-1)+1; n 为内部节点个数 k 为 k 叉树。

6. (10 scores)

(a) Describe simply the main tasks of the two phases of external sorting. (4 scores)

(b). Assume that working memory is 256KB broken into blocks of 8192 bytes (there is also additional space available for I/O buffers, program variables, etc.) What is the expected size for the largest file that can be merged using replacement selection followed by two passes of multi-way merge? Explain how you got your answer. (6 scores)

(a) The task of first phase is to break the files into large initial runs by replacement selection; the second phase is to merge the runs together to form a single sorted run file.

(b) Since working memory is 256KB and the blocksize is 8KB, the working memory

holds 32 blocks. The expected runlength is 512KB, so a single pass of multiway merge forms runs of length 512KB*32=16MB. The second pass then forms a run as large as 16MB*32=512MB.

7. Assume a disk drive is configured as follows. The total storage is approximately 675M divided among 15 surfaces. Each surface has 612 tracks; there are 144 sectors/track, 512 byte/sector, and 16 sectors/cluster. The interleaving factor is 3. The disk turns at 7200rmp (8.3ms/r). The track-to-track seek time is 20 ms, and the average seek time is 80 ms. Now how long does it take to read all of the data in a 360 KB file on the disk? Assume that the file's clusters are spread randomly across the disk. A seek must be performed each time the I/O reader moves to a new track. Show your calculations. (The process of your solution is required!!!) (6cores)

Answer:

The first question is how many clusters the file requires?

A cluster holds 16*0.5K = 8K. Thus, the file requires 360/8=45clusters.

The time to read a cluster is seek time to the cluster+ latency time + (interleaf factor × rotation time).

Average seek time is defined to be 80 ms. Latency time is 0.5 *8.3,

and cluster rotation time is 3 * (16/144)*8.3.

Seek time for the total file read time is

45* (80 + 0.5 * 8.3+ 3 * (16/144)*8.3) = 3911.25

9. (11scores)

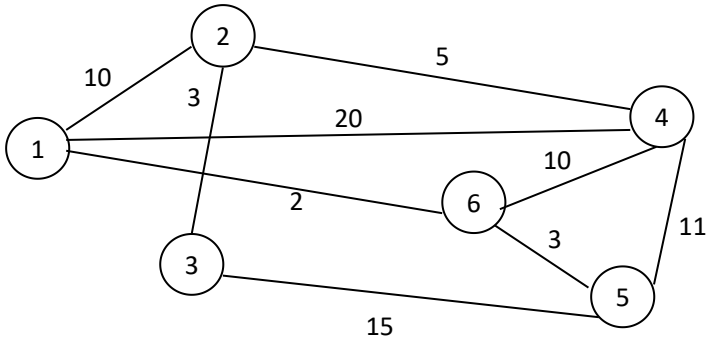

Figure 1 Example graph

(1) Draw the adjacency matrix representation and adjacency list representation for the graph of the figure-1. And if a pointer requires four bytes, a vertex label requires two bytes, and an edge weight requires two bytes, which representation requires more space for this graph? (8 scores)

(2) Show the DFS tree for the example graph, starting at Vertex 1. (3 scores)

Answer:

(1) (a) adjacency matrix (3 scores)

```
   1   2   3   4   5   6
--------------------------
1 |     10      20     2     |
```

```
2 | 10     3  5          |
3 |    3         15       |
4 | 20 5         11 10    |
5 |       15 11     3     |
6 | 2        10  3        |
-------------------------
```

(b) adjacency list: (3 scores)

1 -> 2(10) -> 4(20) -> 6(2) -> \

2 -> 1(10) -> 3(3) -> 4(5) -> \

3 -> 2(3) -> 5(15) -> \

4 -> 1(20) -> 2(5) -> 5(11) -> 6(10) -> \

5 -> 3(15) -> 4(11) -> 6(3) -> \

6 -> 1(2) -> 4(10) -> 5(3) -> \

(c) (2 scores)

Space of adjacency matrix: 2*36= 72 (bytes)

Space of adjacency list 4*6+(2+2+4) *16= 152 (bytes)

So adjacency list requires more space for this graph.

You are given a series of records whose keys are integers. The records arrive in the following order: C, S, D, T, A, M, P, I, B, W, N, G, U, R. Show the 2-3 tree that results from inserting these records. （the process of your solution is required!!!） (9 scores)

Solution：