

ADS2021Midterm-cy&hqm

开始时间	2022/04/15 15:30:00	结束时间	2022/04/29 12:00:00	答题时长	45分钟
答卷类型	标准答案	总分	100		

判断题	得分：暂无	总分：32
1-1 In an AVL tree, it is impossible to have this situation that the balance factors of a node and both of its children are all +1.		(3分)
<input type="radio"/> T <input checked="" type="radio"/> F		
1-2 In data retrieval, the response time is more important than the relevance of the answer set.		(3分)
<input checked="" type="radio"/> T <input type="radio"/> F		
1-3 A 2-3 tree with 12 leaves may have at most 11 nonleaf nodes.		(3分)
<input type="radio"/> T <input checked="" type="radio"/> F		
1-4 In a red-black tree, the number of rotations in the DELETE operation is O(1).		(3分)
<input checked="" type="radio"/> T <input type="radio"/> F		
1-5 In skew heap algorithm, suppose we insert $n, n + 1, n - 1, n + 2, n - 2, n + 3, \dots, 1, 2n$ into an initially empty heap then perform delete min. The tree resulting from the insertions has a right path of n nodes, and the delete min takes $\Omega(n)$ time.	(5分)	
<input checked="" type="radio"/> T <input type="radio"/> F		
1-6 Making N insertions into an initally empty binomial queue takes $O(N)$ time in the worst case.		(3分)
<input checked="" type="radio"/> T <input type="radio"/> F		
1-7 For the recurrence equation $T(N) = aT(N/b) + f(N)$, if $af(N/b) = Kf(N)$ for some constant $K > 1$, then $T(N) = \Theta(f(N))$.	(3分)	
<input type="radio"/> T <input checked="" type="radio"/> F		
1-8 For one operation, if its average time bound is $O(\log N)$, then its amortized time bound must be $O(\log N)$.	(3分)	
<input type="radio"/> T <input checked="" type="radio"/> F		
1-9 The NPL of each node in a heap is supposed to be calculated from top down.	(3分)	
<input type="radio"/> T <input checked="" type="radio"/> F		
1-10 In backtracking, if different solution spaces have different sizes, start testing from the partial solution with the smallest space size would have a better chance to reduce the time cost.	(3分)	
<input checked="" type="radio"/> T <input type="radio"/> F		

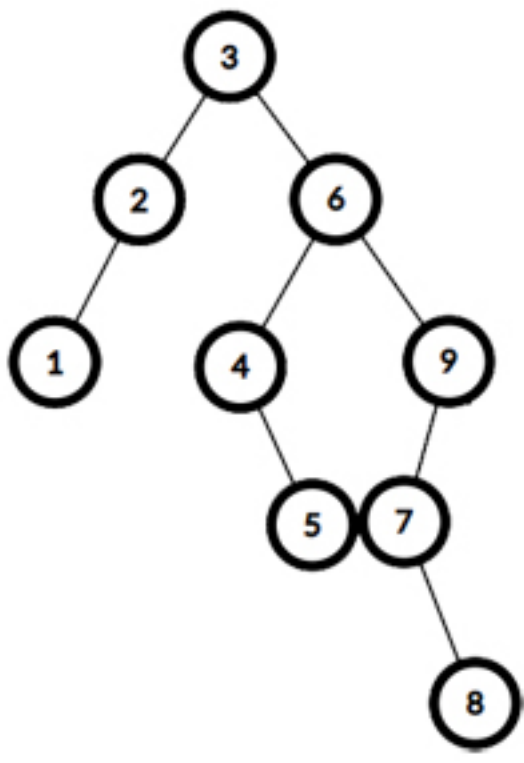
单选题	得分：暂无	总分：44
2-1 How many of the following sorting methods use(s) Divide and Conquer algorithm?	(4分)	
<div><ul style="list-style-type: none">• Heap Sort• Insertion Sort• Merge Sort• Quick Sort• Selection Sort• Shell Sort</div> <div><input checked="" type="radio"/> A. 2</div> <div><input type="radio"/> B. 3</div> <div><input type="radio"/> C. 4</div> <div><input type="radio"/> D. 5</div>		

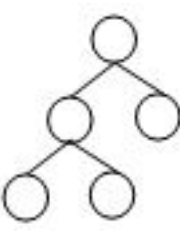
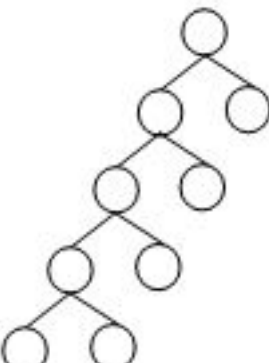
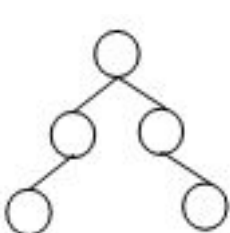
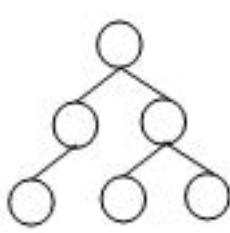
2-2 When solving the problem All-Pairs Shortest Path by Floyd method, which one of the following iterations can give us the correct answer?	(4分)	
<div><input type="radio"/> A. <pre>for(i = 0; i < N; i++) for(k = 0; k < N; k++) for(j = 0; j < N; j++) if(D[i][k] + D[k][j] < D[i][j]) D[i][j] = D[i][k] + D[k][j];</pre></div> <div><input type="radio"/> B. <pre>for(i = 0; i < N; i++) for(j = 0; j < N; j++) for(k = 0; k < N; k++) if(D[i][k] + D[k][j] < D[i][j]) D[i][j] = D[i][k] + D[k][j];</pre></div> <div><input checked="" type="radio"/> C. <pre>for(i = 0; i < N; i++) for(k = 0; k < N; k++) for(j = 0; j < N; j++) if(D[k][i] + D[i][j] < D[k][j]) D[k][j] = D[k][i] + D[i][j];</pre></div> <div><input type="radio"/> D. <pre>for(k = 0; k < N; k++) for(i = 0; i < N; i++) for(j = 0; j < N; j++) if(D[k][i] + D[i][j] < D[k][j]) D[k][j] = D[k][i] + D[i][j];</pre></div>		

2-3 Insert { 28, 12, 18, 36, 42, 30 } one by one into an initially empty AVL tree. The pre-order traversal sequence of the resulting tree is:	(5分)	
<div><input type="radio"/> A. 36, 18, 12, 30, 28, 42</div> <div><input type="radio"/> B. 12, 18, 30, 42, 36, 28</div> <div><input checked="" type="radio"/> C. 28, 18, 12, 36, 30, 42</div> <div><input type="radio"/> D. 28, 12, 18, 36, 30, 42</div>		

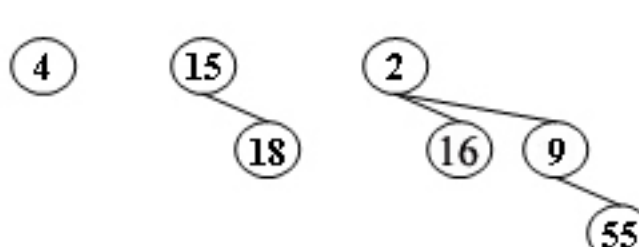
2-4 Which of the following will affect the performance of a back-tracking algorithm?	(4分)	
<div><input type="radio"/> A. number of partial solutions that satisfy the restrictions</div> <div><input type="radio"/> B. space size of each partial solution</div> <div><input type="radio"/> C. time taken to check the restrictions</div> <div><input checked="" type="radio"/> D. All of the above</div>		

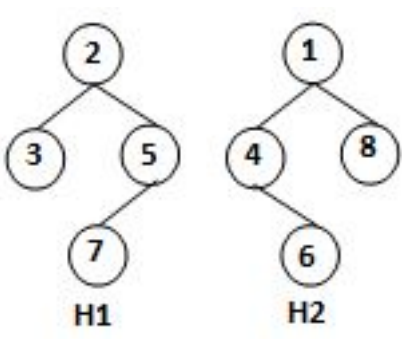
2-5 If there are 14 nodes in an AVL tree, then the maximum depth of the tree is _____. The depth of an empty tree is defined to be 0.	(4分)	
<div><input type="radio"/> A. 3</div> <div><input type="radio"/> B. 4</div> <div><input checked="" type="radio"/> C. 5</div> <div><input type="radio"/> D. 6</div>		

2-6 After deleting 7 from the given splay tree, which of the following statements about the resulting tree is impossible?	(5分)	
<div></div> <div><input type="radio"/> A. 6 is the root</div> <div><input type="radio"/> B. 8 is the root</div> <div><input type="radio"/> C. 2 and 6 are siblings</div> <div><input checked="" type="radio"/> D. 4 and 9 are siblings</div>		

2-7 Among the following trees, which one is impossible to be colored into a legal red-black tree?	(4分)	
<div><input type="radio"/> A. </div> <div><input checked="" type="radio"/> B. </div> <div><input type="radio"/> C. </div> <div><input type="radio"/> D. </div>		

2-8 There are 5000 documents in a database, where 2019 documents are related to query Q. After searching for Q in the database, search engine A retrieved 125 relevant documents and 189 irrelevant document, and search engine B retrieved 1500 relevant documents and 2300 irrelevant documents. Which of the following is correct?	(4分)	
<div><input checked="" type="radio"/> A. A is better in precision and B is better in recall.</div> <div><input type="radio"/> B. B is better in both precision and recall.</div> <div><input type="radio"/> C. B is better in precision and A is better in recall.</div> <div><input type="radio"/> D. A is better in both precision and recall.</div>		

2-9 Delete the minimum number from the given binomial queues in the following figure. Which one of the following statements must be FALSE?	(5分)	
<div></div> <div><input checked="" type="radio"/> A. 9 can never be the root of any resulting binomial tree</div> <div><input type="radio"/> B. 16 and 15 can be the children of 4</div> <div><input type="radio"/> C. if 9 is a child of 4, then 15 must be the root of B_1</div> <div><input type="radio"/> D. there are two binomial trees after deletion, which are B_1 and B_2</div>		

2-10 Merge the two leftist heaps in the following figure. Which one of the following statements is FALSE?	(5分)	
<div></div> <div><input type="radio"/> A. 5 and 3 are siblings</div> <div><input checked="" type="radio"/> B. along the right path from the root, we have 1, 2, 5, and 8</div> <div><input type="radio"/> C. 6 is the right child of 4</div> <div><input type="radio"/> D. 2 and 5 have the same NPL</div>		

程序填空题	得分：暂无	总分：24
5-1 The function <code>FindKey</code> is to check if a given <code>key</code> is in a B+ Tree with its root pointed by <code>root</code> . Return <code>true</code> if <code>key</code> is in the tree, or <code>false</code> if not. The B+ tree structure is defined as following: <pre>static int order = DEFAULT_ORDER; typedef struct BpTreeNode BpTreeNode; struct BpTreeNode { BpTreeNode** childrens; /* Pointers to childrens. This field is not used by leaf nodes. */ ElementType* keys; BpTreeNode* parent; bool isLeaf; /* 1 if this node is a leaf, or 0 if not */ int numKeys; /* This field is used to keep track of the number of valid keys. In an internal node, the number of valid pointers is always numKeys + 1. */ }; bool FindKey(BpTreeNode * const root, ElementType key){ if (root == NULL) { return false; } int i = 0; BpTreeNode * node = root; while (!node->isLeaf (6分)) { i = 0; while (i < node->numKeys) { if (key >= node->keys[i] (6分)) i++; else break; } node = node->childrens[i]; } for(i = 0; i < node->numKeys; i++){ if(node->keys[i] == key) return true; } return false; }</pre> <div>5-2 Suppose that a string of English letters is encoded into a string of numbers. To be more specific, A - Z are encoded into 0 - 25. Since it is not a prefix code, the decoded result may not be unique. For example, 1213407 can be decoded as BCBDEAH, MBDEAH, BCNEAH, BVDEAH or MNEAH. Note that 07 is not 7, hence cannot be decoded as H. The function <code>Decode</code> is supposed to return the number of different ways (modulo <code>BASE</code> to avoid overflow) we can decode <code>NumStr</code>, where <code>NumStr</code> is a string consisting of only the numbers 0 - 9. Please complete the following program.</div> <pre>int Decode(char NumStr[]) { int L, i; int dp[MAXN]; //dp[i] is the solution from NumStr[i] to the end L = strlen(NumStr); if (L==0) return 0; if (L==1) return 1; dp[L-1] = 1; if (NumStr[L-2]=='1' (NumStr[L-2]=='2' && NumStr[L-1]<'6')) dp[L-2] = 2; else dp[L-2] = 1; for (i=L-3; i>=0; i--) { if (NumStr[i]=='1' (NumStr[i]=='2' && NumStr[i+1]<'6')) dp[i] = dp[i+1]+dp[i+2] (6分); else dp[i] = dp[i+1] (6分); dp[i] %= BASE; //to avoid overflow } return dp[0]; }</pre>		