▶ **1-1　分数 1**　　　　　　　　　　　　　　　　　　　　　　　　　作者 杨欣豫　单位 浙江大学

For the recurrence equation $T(N) = aT(N/b) + f(N)$, if $af(N/b) = Kf(N)$ for some constant $K > 1$, then $T(N) = \Theta(f(N))$.

○ T　　● F

答案正确：1 分　　💡 创建提问 ↗

1-2　分数 1　　　　　　　　　　　　　　　　　　　　　　　　　作者 沈鑫　单位 浙江大学

A skew heap is a heap data structure implemented as a binary tree. Skew heaps are advantageous because of their ability to merge more quickly than balanced binary heaps. The worst case time complexities for Merge, Insert, and DeleteMin are all $O(N)$, while the amorited time complexities for Merge, Insert, and DeleteMin are all $O(logN)$.

● T　　○ F

答案正确：1 分　　💡 创建提问 ↗

1-3　分数 1　　　　　　　　　　　　　　　　　　　　　　　　　作者 陈越　单位 浙江大学

When measuring the relevancy of the answer set, if the precision is high but the recall is low, it means that most of the relevant documents are retrieved, but too many irrelevant documents are returned as well.

○ T　　● F

答案正确：1 分　　💡 创建提问 ↗

1-4　分数 1　　　　　　　　　　　　　　　　　　　　　　　　　作者 徐镜春　单位 浙江大学

For an AVL tree, the balance factors of all the non-leaf nodes are 0 iff the tree is a complete binary tree.

○ T　　● F

答案正确：1 分　　💡 创建提问 ↗

1-5　分数 1　　　　　　　　　　　　　　　　　　　　　　　　　作者 陈越　单位 浙江大学

Finding the minimum key from a splay tree will result in a tree with its root having no right subtree.

○ T　　● F

答案正确：1 分　　💡 创建提问 ↗

❮ 上一题　　　　　　　　□ 单题作答　　　　　　　　下一题 ❯

1-6 分数 1

作者 陈越 单位 浙江大学

The time bound of the FIND operation in a B+ tree containing N numbers is $O(\log N)$, no matter what the degree of the tree is.

⦿ T ○ F

答案正确: 1 分 ○ 创建提问 ⧉

1-7 分数 1

作者 陈越 单位 浙江大学

In a red-black tree, the number of internal nodes in the subtree rooted at x is no more than $2^{bh(x)} - 1$ where $bh(x)$ is the black-height of x.

○ T ⦿ F

答案正确: 1 分 ○ 创建提问 ⧉

1-8 分数 1

作者 何钦铭 单位 浙江大学

In a Turnpike Reconstruction Problem, given distance set D = { 2, 2, 4, 4, 6, 8 }, x1~x4 = (0, 2, 4, 8) is the only solution provided that x1 = 0.

○ T ⦿ F

答案正确: 1 分 ○ 创建提问 ⧉

1-9 分数 1

作者 陈越 单位 浙江大学

For a binomial queue, delete-min takes a constant time on average.

○ T ⦿ F

答案正确: 1 分 ○ 创建提问 ⧉

1-10 分数 1

作者 陈越 单位 浙江大学

If a problem can be solved by dynamic programming, it must be solved in polynomial time.

⦿ T ○ F

答案错误: 0 分 ○ 创建提问 ⧉

▶ 2-1　分数 2　　　　　　　　　　　　　　　　　　　　　　　　　　　　作者 杨欣豫　单位 浙江大学

When solving a problem with input size N by divide and conquer, if at each step, the problem is divided into 9 sub-problems and each size of these sub-problems is $N/3$, and they are conquered in $O(N^2 log N)$. Which one of the following is the closest to the overall time complexity?

- A. $O(N^2 log^2 N)$
- B. $O(N^2 log N)$
- C. $O(N^2)$
- D. $O(N^3 log N)$

答案正确：2 分　💡 创建提问 ⤢

2-2　分数 2　　　　　　　　　　　　　　　　　　　　　　　　　　　　作者 徐镜春　单位 浙江大学

Among the following groups of concepts, which group is not totally relevant to a search engine?

- A. thresholding, dynamic programming, precision
- B. word stemming, compression, recall
- C. distributed index, hashing, inverted file index
- D. stop words, posting list, dynamic indexing

答案正确：2 分　💡 创建提问 ⤢

2-3　分数 2　　　　　　　　　　　　　　　　　　　　　　　　　　　　作者 陈越　单位 浙江大学

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:
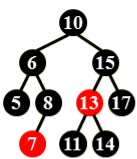
- A. 36, 18, 12, 30, 28, 42
- B. 12, 18, 30, 42, 36, 28
- C. 28, 18, 12, 36, 30, 42
- D. 28, 12, 18, 36, 30, 42

答案正确：2 分　💡 创建提问 ⤢

2-4　分数 2　　　　　　　　　　　　　　　　　　　　　　　　　　　　作者 xjc　单位 浙江大学

After deleting 10 from the red-black tree given in the figure, which one of the following statements must be FALSE?

- A. 11 is the parent of 6, and 14 is red
- B. 8 is the parent of 15, and 7 is black
- C. 11 is the parent of 15, and there are 2 red nodes in the tree
- D. 8 is the parent of 15, and there are 2 red nodes in the tree

答案错误：0 分
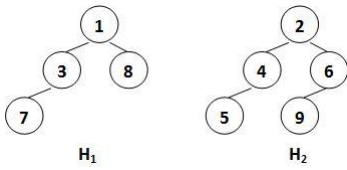
2-5　分数 2　　　　　作者 陈越　单位 浙江大学

Merge the two leftist heaps in the following figure. Which one of the following statements is FALSE?

- A. the null path length of 6 is the same as that of 2
- B. 1 is the root with 3 being its right child
- C. Along the left most path from top down, we have 1, 2, 4, and 5
- D. 6 is the left child of 2

答案错误: 0 分　💡 创建提问 ⬈

2-6　分数 2　　　　　作者 叶德仕　单位 浙江大学

A queue can be implemented by using two stacks S_A and S_B as follows:

- To enqueue x, we push x onto S_A.
- To dequeue from the queue, we pop and return the top item from S_B. However, if S_B is empty, we first fill it (and empty S_A) by popping the top item from S_A, pushing this item onto S_B, and repeat until S_A is empty.

Assuming that push and pop operations take $O(1)$ worst-case time, please select a potential function ϕ which can help us prove that enqueue and dequeue operations take $O(1)$ amortized time (when starting from an empty queue).
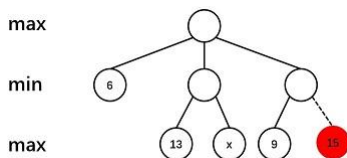
- A. $\phi = 2|S_A|$
- B. $\phi = |S_A|$
- C. $\phi = 2|S_B|$
- D. $\phi = |S_B|$

答案错误: 0 分　💡 创建提问 ⬈

2-9　分数 2　　　　　作者 冼伟钊　单位 浙江大学

Given the following game tree, the red node will be pruned with α-β pruning algorithm if and only if __.

- A. $6 \leq x \leq 13$
- B. $x \geq 13$
- C. $6 \leq x \leq 9$
- D. $x \geq 9$

答案正确: 2 分　💡 创建提问 ⬈

2-8　分数 1　　　　　作者 陈越　单位 浙江大学

Which of the following binomial trees can represent a binomial queue of size 141?

- A. $B_0\ B_2\ B_3\ B_7$
- B. $B_0\ B_2\ B_3\ B_6\ B_6$
- C. $B_0\ B_8$
- D. $B_0\ B_1\ B_4\ B_5\ B_7$

答案正确: 1 分　💡 创建提问 ⬈

2-10　分数 3　　　　　　　　　　　　　　　　　　　　　作者 陈越　单位 浙江大学

Rod-cutting Problem: Given a rod of total length N inches and a table of selling prices P_L for lengths $L = 1, 2, \cdots, M$. You are asked to find the maximum revenue R_N obtainable by cutting up the rod and selling the pieces. For example, based on the following table of prices, if we are to sell an 8-inch rod, the optimal solution is to cut it into two pieces of lengths 2 and 6, which produces revenue $R_8 = P_2 + P_6 = 5 + 17 = 22$. And if we are to sell a 3-inch rod, the best way is not to cut it at all.

Length L	1	2	3	4	5	6	7	8	9	10
Price P_L	1	5	8	9	10	17	17	20	23	28

Which one of the following statements is FALSE?

○ A.　This problem can be solved by dynamic programming

○ B.　The time complexity of this algorithm is $O(N^2)$

○ C.　If $N \le M$, we have $R_N = \max\{P_N, \max_{1 \le i < N}\{R_i + R_{N-i}\}\}$

◉ D.　If $N > M$, we have $R_N = \max_{1 \le i < N}\{R_i + R_{N-M}\}$

答案正确：3 分　　♀ 创建提问 ⬈

2-11　分数 2　　　　　　　　　　　　　　　　　　　　　作者 叶德仕　单位 浙江大学

In dynamic programming, we derive a recurrence relation for the solution to one subproblem in terms of solutions to other subproblems. To turn this relation into a bottom up dynamic programming algorithm, we need an order to fill in the solution cells in a table, such that all needed subproblems are solved before solving a subproblem. Among the following relations, which one is impossible to be computed?

○ A.　$A(i, j) = min(A(i-1, j), A(i, j-1), A(i-1, j-1))$

○ B.　$A(i, j) = F(A(min\{i, j\} - 1, min\{i, j\} - 1), A(max\{i, j\} - 1, max\{i, j\} - 1))$

◉ C.　$A(i, j) = F(A(i, j-1), A(i-1, j-1), A(i-1, j+1))$

○ D.　$A(i, j) = F(A(i-2, j-2), A(i+2, j+2))$

答案错误：0 分　　♀ 创建提问 ⬈

▶ **5-1** Inverted Pairs 分数 10   作者 叶梓成   单位 浙江大学

In a permutation A, if there exists a pair of numbers A_i and A_j satisfied $i < j$ and $A_i > A_j$, then A_i and A_j are called an inverted pair.

Giving a permutation of N，please find the number of the inverted pairs in it.

Hint:The function $work(l, r)$ returns the number of inverted pairs in $A_l A_{l+1}...A_r$ and makes $A_l A_{l+1}...A_r$ being sorted in increasing order.

```
#include <algorithm>
#include <cstdio>
using namespace std;
const int N = 100010;
int tmp[N], a[N];
long long work(int l, int r) {
    if (l == r)
        return 0;
    int mid = (l + r) >> 1;
    long long res = 0;
    res += work(l, mid);
    res +=   worl(mid+1, r)     2 分 ;
    int t1 = l, t2 = mid + 1, tt = l;
    while   (tt <= r)           2 分 {
        if (a[t1] < a[t2])
            tmp[tt++] = a[t1++];
        else {
            res +=   1          3 分 ;
            tmp[tt++] = a[t2++];
        }
    }
    while (t1 <= mid)
        tmp[tt++] = a[t1++];
    while (t2 <= r)
        tmp[tt++] = a[t2++];
    for (int i = l; i <= r; i++)
        a[i] = tmp[i]           2 分 ;
    return res;
}
int main()
{
    int n;
    scanf("%d", &n);
    for(int i = 1; i <= n; i++)
        scanf("%d", &a[i]);
    printf("%lld\n",   work(1, n)     1 分 );
    return 0;
}
```

部分正确: 3 分

< 上一题   ☐ 单题作答   下一题 >

5-2 Sum of N-Narcissistic Number 分数 10

作者 刘明锐 单位 浙江大学

An n-digit number that is the sum of the n-th powers of its digits is called an n-narcissistic number. For example, 153 is a 3-narcissistic number since $153 = 1^3 + 5^3 + 3^3$, and 1634 is a 4-narcissistic number since $1634 = 1^4 + 6^4 + 3^4 + 4^4$.

Please complete the following program that prints the sum of all n-narcissistic numbers.

```cpp
#include <cstdio>
long long cost[10], ans;
int cnt[10], t[10], n;
void dfs(int rest, int now, long long current) {
    if (rest == 0) {
        long long temp = current;
        for (int i = 0; i < 10; i++)
            t[i] = 0;
        while (temp > 0) {
            ++t[temp % 10];
            temp /= 10;
        }
        bool flag = 1;
        for (int i = 0; i < 10; i++)
            if (cnt[i] != t[i]) {
                flag = 0;
                break;
            }
        if (flag) {
            ans++              2 分 ;
        }
        return;
    }
    if ( now == n            2 分 ) {
        return;
    }
    for (cnt[now] = 0; cnt[now] <= rest; cnt[now]++)
        dfs(rest - cnt[now], now + 1, current + cost[cnt[now]]+   2 分 );
    cnt[now]        2 分  = 0;
}
int main()
{
    scanf("%d", &n);
    for (int i = 0; i < 10; i++) {
        cost[i] = 1;
        for (int j = 0; j < n; j++)
            cost[i] *= i;
    }
    dfs( n, 0, 0             2 分 );
    printf("%lld\n",ans);
    return 0;
}
```

部分正确: 4 分