# HKUST Local Programming Contest 2016

Room 4213, HKUST

11 Sept 2016

14:00 ~ 18:00

Problem Setter & Judge: Minhao JIANG

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**A. A Big News**

Time limit: 1 second
Memory limit: 64 MB

Alice hates big news.
There are n pieces of news. Alice wants to minimize the overall impression of the news. The impression of news i is ai. In each round, Alice merges two pieces of news into a big news, which can be merged with other news to become a bigger news. Merging two pieces of news with impression x and y generates a big news with impression $2\sqrt{xy}$. Alice keep merging news, and after n-1 rounds, there is only 1 piece of news left, and its impression is the overall impression of the n pieces of news.
Alice can merge the news in any order. For instance, if there are news A, B, C and D, Alice can merge A and C in round 1, and merge B and D in round 2, and then merge "big" news AC and BD in round 3. Of course, she can also choose to merge A with B, then merge AB with C, and finally merge ABC with D. What is the minimal overall impression?

Input:
There are multiple test cases. Each case begins with n, followed by n integers a1, a2, …,an.
($n \le 100$, $1 \le ai \le 10000$)

Output:
For each test case, output the minimal overall impression with three decimal digits.

Sample Input:
3
50
30
72

Sample Output:
120.000

Hint：
In the sample input, Alice merges 50 and 72 in round 1, so the last 2 pieces of news are with impression 120 and impression 30. Then the last impression is $2\sqrt{120 * 30}$ =120.

**B. Bob**

Time limit: 1 second
Memory limit: 64 MB

Bob is an experienced fighter. However, it is still very hard for him to kill all strong monsters.

There are n monsters, each with 3 important scores, namely ai, bi and ci for monster i. In the beginning, Bob's experience(or EXP for short) is d. He is going to kill the monsters one by one. Bob's EXP increases by ci after he successfully kills monster i. When Bob fights against monster i, Bob is impossible to kill it if his EXP < ai. If bi ≤ his EXP, then Bob can definitely kill it. If ai ≤ EXP < bi, then the probability that Bob can kill it is (EXP-ai)/(bi-ai). Obviously, it is guaranteed that ai < bi. If Bob fails to kill a monster, then the game is over at once.

Bob can choose any order to fight against the monsters. He wants to know in which order, he is most likely to defeat all monsters.

Input:
There are multiple test cases. Each case begins with 2 integers n and d, followed by n lines, each with 3 integers ai, bi and ci.
(n ≤ 10, 0 ≤ d, ai, bi, ci ≤ 1000)

Output:
For each test case, output the highest probability that Bob can defeat all monsters in the 1st line with the precision of 0.001, and output the order in the 2nd line. There may be multiple orders achieving the highest probability, and anyone of them is acceptable.

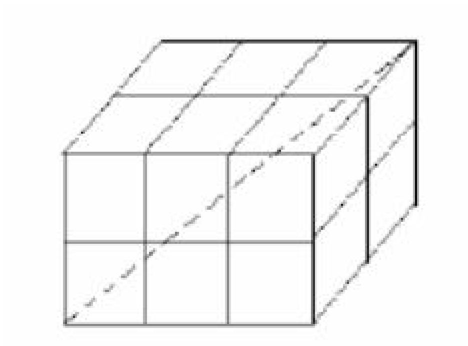
Sample Input:
3 300
350 380 100
100 200 100
440 450 100

Sample Output:
1.000
2 1 3

**C. Cube**

Time limit: 1 second
Memory limit: 64 MB

There is a large a*b*c cube formed by abc small 1*1*1 transparent cubes. If a laser beam travels along the diagonal line of the large cube, how many small cubes does it go through?



Input:
There are multiple test cases. Each case is 3 integers a, b and c. The input ends with 3 zeros. (0 < a, b, c < 10^6)

Output:
For each test case, output the number of small cubes that the beam passing through.

Sample Input:
2 2 3
3 3 3
0 0 0

Sample Output:
4
3

**D. David**

Time limit: 1 second
Memory limit: 64 MB

As a course instructor, David is dividing his students into 2 teams. Some of the the students know each other but some do not. David wants to figure out a team assignment so that every member in a team knows all other teammates. Of course, every student should be assigned to one exactly team, and each team cannot be empty. Tell David whether it is impossible to form such teams. If it is possible, David also wants the sizes of 2 teams are as similar as possible, which means to minimize | team_1_size - team_2_size |. Help David figure out the team assignment.

Input:
There are multiple test cases. Each case begins with an integers n. The students are labeled as 1, 2, …, n. In the following n lines, the i-th line contains the students that student i knows, and it is terminated by a zero.
($0 < n \le 100$)

Output:
For each test case, output "No solution" in a line if it is impossible to form the teams. Otherwise, output a solution in 2 lines. Each line begins with the number of students in the team, follows by the students' ID in the team. There may be multiple optimal solutions, and anyone of them is acceptable.

Sample Input:
```
5
2 3 5 0
1 4 5 3 0
1 2 5 0
1 2 3 0
4 3 2 1 0
3
2 0
0
0
```

Sample Output:
```
3 1 3 5
2 2 4
No solution
```

**E. Exciting**

Time limit: 1 second
Memory limit: 64 MB

Elena likes rowing, because rowing is exciting. There are n islands connected by m directed routes. Elena chooses an island to start her trip, and visits some other island(at least one), and then comes back to the starting island. Route i starts at island xi, ends at island yi, and its travelling cost is Ti hours. Elena feels excited when she visits an island for the first time. The excitement value of island i is Ei. Please plan a trip for Elena to maximize her average excitement per rowing hour. For example, if she starts at island 2, goes to island 4 through route 1, visits island 6 via route 3, and comes back to island 2 via route 5, then the average excitement is (E2+E4+E6)/(T1+T3+T5).

Input:
There are multiple test cases. Each case begins with 2 integer n and m. The following n lines are integer Ei, and the last m lines are integers xi, yi, Ti, meaning the i-th route is from island xi to yi with rowing time Ti hours. (n, Ei, Ti ≤ 1000, m ≤ 5000, 1 ≤ xi, yi ≤ n)
Output:
For each test case, output the highest average excitement with 2 decimal digits.

Sample Input:
```
5 7
30
10
10
5
10
1 2 3
2 3 2
3 4 5
3 5 2
4 5 5
5 1 3
5 2 2
```
Sample Output:
```
6.00
```

**F. Fractional**

Time limit: 1 second
Memory limit: 64 MB

Francis is writing rational numbers in binary format. But Francis can only handle the integer part and needs your help for the fractional part. Consider a rational number p/q (p and q are given in decimal system). Francis writes its fractional part as $0.a_1a_2...a_{s-1}(a_sa_{s+1}...a_{s+r})$ in binary format, where $(a_sa_{s+1}...a_{s+r})$ is the period, and $a_i$ is either 0 or 1. It means

$$p/q = x.a_1a_2...a_{s-1}a_sa_{s+1}...a_{s+r}a_sa_{s+1}...a_{s+r}a_sa_{s+1}...a_{s+r}... = x + \sum_{i=1}^{\infty} 2^{-i}a_i$$

The starting position of a period is one plus the number of digits between the decimal point and its first occurrence, i.e. s in the above example. The length of a period is the number of digits in it, i.e. r+1 in the above example.
For example, 1/10 = 0.1 in decimal system = 0.0001100110011(00110011) in binary representation. A more convenient way to write it is 1/10 = 0.0(0011), as Francis wants the period starts as early as possible and its length is as short as possible. It is also possible to write a finite rational number in this way. Another example is 1/4 = 0.25 = 0.01(0).
Given p/q, find the earliest starting position of its period and the shortest length of the period.

Input:
There are multiple test cases. Each case is a rational number written in a form of p/q.
(0 ≤ p,q < 2^31, q≠0)
Output:
For the i-th test case, output “Case #i: x,y” in a line, where x is the earliest starting position of the period of p/q, and y is the shortest length.

Sample Input:
11/10
1/4
0/10
1/7
121/1472

Sample Output:
Case #1: 2,4
Case #2: 3,1
Case #3: 1,1
Case #4: 1,3
Case #5: 7,11