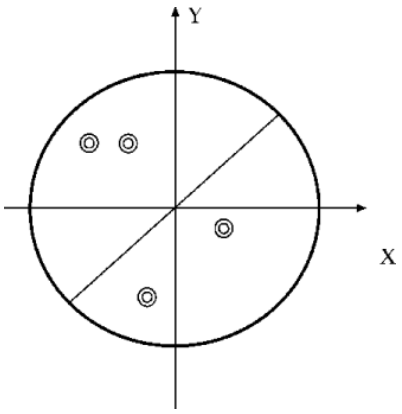
L3/M1, 2005–2006

Algorithmique effective – TD 4
Un peu de géométrie

1 La cerise sur le gâteau

Exercice 1
Birthday Cake. PC : 111305 ; UVa : 10167.
Lucy and Lily are twins. Today is their birthday, so Mother buys them a birthday cake. There are $2N$ cherries on the cake, where $1 \leq N \leq 50$. Mother wants to cut the cake into two halves with a single straight-line cut through the center so each twin gets both the same amount of cake and the same number of cherries. Can you help her ?



The cake has a radius of 100 and its center is located at $(0, 0)$. The coordinates of each cherry are given by two integers (x, y). You must give the line in the form $Ax + By = 0$, where both A and B are integers in $[-500, 500]$. Cherries are not allowed to lie on the cutline. There is at least one solution for each data set.

Input
The input file contains several test cases. The first line of each case contains the integer N. This is followed by $2N$ lines, where each line contains the (x, y) location of a cherry with one space between them. The input ends with $N = 0$.

Output
For each test case, print a line containing A and B with a space between them. If there are many solutions, any one will suffice.

Sample Input

```
2
-20 20
-30 20
-10 -50
10 -5
0
```

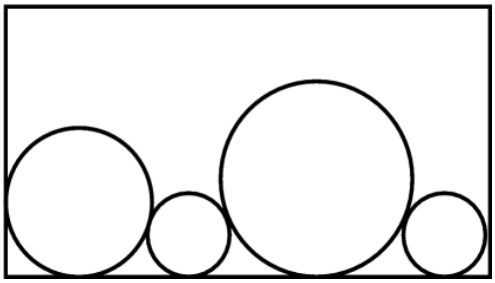
Sample Output

```
0 1
```

2 Ranger le camembert dans le frigo

Exercice 2
How Big is It ? PC : 111308 ; UVa : 10012.
Ian is going to California and has to pack his things, including his collection of circles. Given a set of circles, your program must find the smallest rectangular box they fit in.

All circles must touch the bottom of the box. The figure below shows an acceptable packing for a set of circles, although it may not be the optimal packing for these particular circles. In an ideal packing, each circle should touch at least one other circle, but you probably figured that out.



Input
The first line of input contains a single positive decimal integer n, $n \leq 50$. This indicates the number of test cases to follow. The subsequent n lines each contain a series of numbers separated by spaces. The first number on each of these lines is a positive integer m, $m \leq 8$, which indicates how many other numbers appear on that line. The next m numbers on the line are the radii of the circles which must be packed in a single box. These numbers need not be integers.

Output
For each test case, your program must output the size of the smallest rectangle which can pack the circles. Each case should be output on a separate line by itself, with three places after the decimal point. Do not output leading zeroes unless the number is less than 1, e.g., 0.543.

Sample Input

```
3
3 2.0 1.0 2.0
4 2.0 2.0 2.0 2.0
3 2.0 1.0 4.0
```

Sample Output

```
9.657
16.000
12.657
```

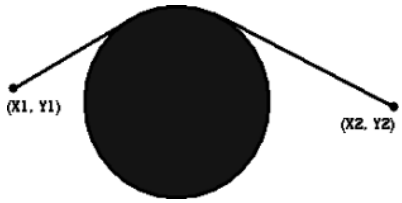
3 Cordialement

Exercice 3
Rope Crisis in Ropeland ! PC : 111302 ; UVa : 10180
Rope-pulling (also known as tug of war) is a very popular game in Ropeland, just

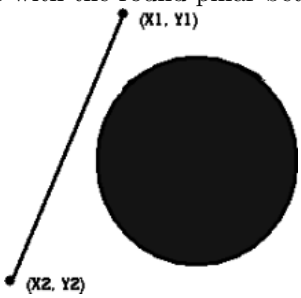
like cricket is in Bangladesh. Two groups of players hold different ends of a rope and pull. The group that snatches the rope from the other group is declared winner.

Due to a rope shortage, the king of the country has declared that groups will not be allowed to buy longer ropes than they require.

Rope-pulling takes place in a large room, which contains a large round pillar of a certain radius. If two groups are on the opposite side of the pillar, their pulled rope cannot be a straight line. Given the position of the two groups, find out the minimum length of rope required to start rope-pulling. You can assume that a point represents the position of each group.



Two groups with the round pillar between them.



Two groups unaffected by the pillar.

Input

The first line of the input file contains an integer N giving the number of input cases. Then follow N lines, each containing five numbers X_1, Y_1, X_2, Y_2, and R, where (X_1, Y_1) and (X_2, Y_2) are the coordinates of the two groups and $R > 0$ is the radius of the pillar.

The center of the pillar is always at the origin, and you may assume that neither team starts in the circle. All input values except for N are floating point numbers, and all have absolute value $\leq 10,000$.

Output

For each input set, output a floating point number on a new line rounded to the third digit after the decimal point denoting the minimum length of rope required.

Sample Input

```
2
1 1 -1 -1 1
1 1 -1 1 1
```

Sample Output

```
3.571
2.000
```

4 Dessert

En DM pour la prochaine fois...
Exercice 4
Couplage maximum.
Coder l'algorithme polynomial de recherche d'un couplage de poids maximum dans un graphe biparti pondéré. On suppose que le graphe biparti est complet et équilibré et que les poids sont entiers. Le graphe sera donné par la matrice des poids.
Comparer avec le Branch & Bound du DM 2.