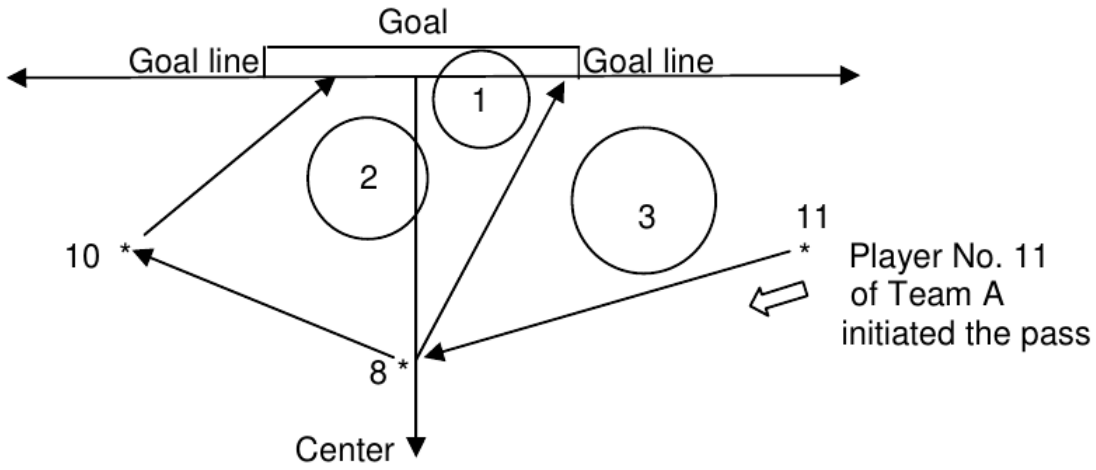
2719 Goal in World Cup

In World Cup soccer 2002 player No. 10 of Team A scored a memorable goal against Team B. The goal was scored so fast that on the spur of a moment the ball passed into the goal, through direct passes between players of Team A keeping the defenders of Team B spellbound and helpless near the goal. A reporter reported the event with a sketch depicting positions of players near the goal at that instant. The sketch was like the one shown below.



In the sketch numbers identify players of either team. The character '∗' indicates positions of attackers i.e., players of Team A. Around each defender i.e., a player of team B, there is a circle. The defender is positioned at the center of the circle. The circle or the portion of it lying on the playground demarcates the playground under the control of the defender. The radius of a circle is estimated on the basis of skill and reputation of the defender. A defender does not allow the ball to pass through the playground under his control. The defender No. 1 is the goalkeeper. The sketch illustrates the fact that player No. 11 of Team A initiated the pass and player No. 8 & 10 were in positions to score a goal.

A software firm is engaged currently in upgrading its existing software that is being used by TV commentators of soccer matches. After reading the report mentioned above the management of the firm decides to include a tool that will enable commentators to have a sketch like the one made by the reporter with a click of the mouse. Commentators can then illustrate different possibilities of the game at a given critical instant.

Assume that the project has been assigned to a team of software professionals to which you belong. You are required to write a program that identifies players of the attacking team who are in positions to score a goal.

It is assumed that the goal, if scored at all, is scored simply through a series of quick direct passes, originating from a specified player of the attacking team, to players of the same team without giving any opportunity to defenders to touch the ball. It is assumed further that positions of players of both the teams near the goalpost are known and the playground under the control of each defender is specified.

In order to represent an instant of the game near a goal consider a two dimensional coordinate system with the goal line as the y-axis. The x-axis is the line passing through the center of the playground (or the middle point of the straight line joining the feet of the two goal posts) and perpendicular to the y-axis. A player on the playground is represented by a point (α, β) where α is nonnegative. A

circle with nonzero radius or the portion of it lying on the playground represents the ground under the control of a defender. The defender is positioned at the center of the circular ground that he controls. The radius of the circle may be different for different players according to his skill and reputation. The position of a player of the attacking team is at the center of a circle with radius zero. Assume that the goal is of length 6m.

You may need certain basic results from Coordinate Geometry for your computation. A list of results is given below. The list is neither exclusive nor exhaustive. You may or may not use any of these results:

1. *The distance between two points* (h_1, k_1) *and* (h_2, k_2) *is equal to* $\sqrt{[(h_1 - h_2)^2 + (k_1 - k_2)^2]}$.
2. *The equation of the straight line passing through points* (h_1, k_1) *and* (h_2, k_2) *is* $(y - k_1) = m(x - h_1)$, *where* $m = (k_2 - k_1)/(h_2 - h_1)$.
3. *The equation of the straight line passing through* (h, k) *and perpendicular to* $y = mx + c$ *is* $(y - k) = m'(x - h)$, *where* $m' = -1/m$.
4. *The length of perpendicular from* (h, k) *on the straight line* $y = mx + c$ *is* $|(k - mh - c)|/\sqrt{(1 + m^2)}$.
5. *The equation of a circle with center* (h, k) *and radius* r *is* $(x - h)^2 + (y - k)^2 = r^2$.
6. *The straight line* $(y - k) = m(x - h) + c$ *is a tangent to the circle* $(x - h)^2 + (y - k)^2 = r$ *if* $c^2 = r^2(1 + m^2)$.

Input

The input may contain multiple test cases.

For each test case, the first line contains two integers, the test case number k and the player number n of the attacking team who initiates the passes leading to a possible goal. Each of the following lines contains input data related to a player near the goal post. The data consist of an integer p and three real numbers a, b and c. The integer p is the player number, the coordinate (a, b) is of the position of the player and c is the radius of the circular playground that the player controls. Recall that c is equal to '0' if the player is an attacker.

The entire input set terminates with an input '0 0' for k and n. The input is illustrated in sample input.

Output

For each test case the first output line gives the test case number k and the number of possibilities g of a goal. If there is no possibility of a goal g is equal to '0'.

For each possibility print in one line, a sequence of player number that begins with the player who initiates the pass and ends with the player who scores the goal. A player J appears next to a player I in the sequence if J receives a pass from I.

The output is illustrated in sample output.

Sample Input

```
1 8
8 20 -20 0
10 10 -10 0
11 20 0 0
9 11 0 0
1 0 1 2
```

```
2 5 -5 2
3 5 -1 2
2 6
8 20 -20 0
10 10 -10 0
11 20 0 0
6 10 10 0
9 11 0 0
1 0 0 2
2 5 -5 2
6 10 0 1
3 5 -1 2
5 20 -10 1
0 0
```

Sample Output

```
1 0
2 3
6
6 8 10 11
6 11
```