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## Holes and Patches

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### Problem Description

You have a client who presents the following problem.

She has a factory in which one of the tasks is the processing of sheets to be mended. A sheet may have any number of holes that need repair. If a sheet cannot be repaired it is rejected and thrown away. A sheet is repaired by putting patches over holes. The patches are circular and are all of a particular diameter, although the supplier of patches occasionally supplies a different size. Multiple holes may be covered with the same patch, but no two patches may overlap, because the sheet will get too uneven. There must also always be a 1 mm free area on the patch around the rim, or the patch will not stick properly.

The client has a machine that will 'read' a sheet and plot exactly where the holes are and she can give you a file with the data for a number of sheets with plots of their holes. The first line of a datafile contains the words "Sheet Size" followed by the  $x, y$  dimensions of the sheets (in centimetres), the next line contains the words "Patch Size" followed by the patch size in centimetres. The first line for each sheet contains the words "Positions of holes". Each subsequent line in the datafile indicates an  $x, y$  coordinate of a hole, plus the diameter of that hole in centimeters. At the end of the data for each sheet the word "END" appears on a separate line. The file may contain multiple sheets.

Example file for a single sheet:

```
Sheet Size 200 100
Patch Size 5
Positions of holes
5.13      2.56      0.01
8.17      4.66      1
2.25      5.75      0.3
6.68      3.83      0.5
8.09      1.65      1
1.41      3.10      0.8
7.10      6.17      1
3.42      1.16      0.3
END
```

**Task**

Write a program that will read an input file in the above format and that will determine for each sheet whether it can be repaired. It can be repaired if all holes can be covered with patches of the size given without overlapping patches and leaving 1 mm free on each perimeter of each patch. If repair is possible, output a list of  $x, y$  coordinates indicating the centre of each patch used to cover holes.

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**Relates to Objectives**

1.1 1.2 1.3 1.4 2.1 2.2 2.7 2.9 3.2 3.4 3.5 4.2 4.3 4.5

( Group)