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HS 2012
Exercise Sheet ACM Week III

Algorithms Lab

Exercise 2 – *Place the Beasts*

The professors of the ETH have a secret place where they keep new exams. No one knows what the size of that place really is. Some say that it is 4×4, others say that it is $\mathbf{100 \times 100}$. It can't be bigger because there is simply not enough space in the catacombs beneath the ETH main building. The rooms in this secret place are all square shaped and of unit length and width. So a 4×4 place has 16 rooms as shown in figure 1.

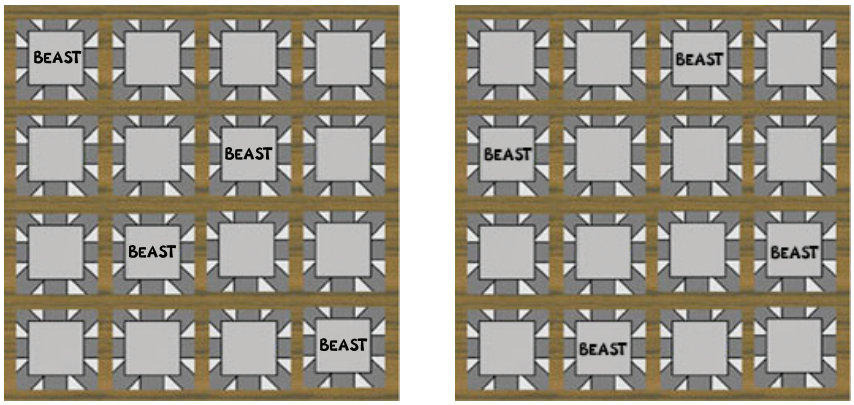
A $n \times n$ place has therefore n^2 rooms, and n evil beasts are used to look after the $n \times n$ sized secret place, such that no student who finds the secret entrance to the catacombs will ever exit them again.

In figure 1 below, each second largest square denotes a room. The gray square inside each room indicates free space where the evil beasts live or exams are kept. The outgoing tunnels (dark gray in color) are the only connection between the rooms. The tunnels are, as you can see, designed in such a way that only the beasts on the same row, same column, or same diagonal can see each other.

In figure 1(a) beast $(1, 1)$ and beast $(4, 4)$, as well as beast $(3, 2)$ and beast $(2, 3)$, can see each other thru the available tunnels. (Coordinate (3,2) denotes the 2nd column in the 3rd row; rows and columns are counted starting from 1.)

The professors have to place the evil beasts in such a way that no beast can see any other beast (like shown in figure 1(b)), otherwise they would immediately start to kill each other. (This is also the reason why they are called *evil* beasts!)

Please help the professors to place the beasts in such a valid way.



(a) **(b)**

Figure 1: (a) an invalid beast placement, (b) a valid one

Input The first line of the input file will contain an integer giving the number $c < 20$ of test cases following.

The remaining input file will contain an integer per case indicating the value of n. (The length of one side of the secret place). In order to get 50 points, you may assume that $1 \leq n \leq 30$, and for full points remember that $1 \leq n \leq 100$.

Output As it is obvious that only one beast can be placed in each column. For each input instance you will have to print a line of n integers.

The integers will be separated by a single space. These integers denote the row within the corresponding column you have placed the beast at.

For the valid configuration of beasts in figure 1 (b) you would have to print the line "`2 4 1 3`" as in column 1 the guard is placed on row 2, in column 2 the guard is placed on row 4, and so on.

There can be multiple solutions. Any good solution will be accepted.
If n beasts cannot be placed in the secret place without killing each other print "Impossible" in a single line.

Sample Input

```
3
4
8
10
```

Sample Output

```
2 4 1 3
4 6 8 2 7 1 3 5
2 4 6 8 10 1 3 5 7 9
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