Pentominoes

A pentomino is a plane figure obtained by connecting five squares together edge to edge. Two such figures that differ only by reflection or rotation are considered the same – with this convention, there are 12 distinct pentominoes. Many puzzles have been proposed using pentominoes and in this étude you will explore some of them.

Unlike previous études, this one is incremental. You should not proceed with the second part until the first part is marked as complete.

Task A

Design and describe a data structure for representing pentominoes. The intended use is to solve puzzles whose basic form is "place pentominoes according to certain criteria in a certain region". While the classic puzzles are to tile a 5×12 rectangle or an 8×8 square with four cells removed with non-overlapping pentominoes, your data structure should be flexible enough to accommodate (at least) the various alternative puzzles that you will need to solve in Task B.

You should submit both code and accompanying text justifying your choices (such text *could* be as comment in code, but since pictures are likely to be useful it's probably better to have it as a second document).

Task B

Write a program that takes as input (from `stdin`) a sequence of puzzles formatted as follows: each puzzle consists of a sequence of non-empty lines all of the same length consisting of the characters `.` and `*`, and puzzles are separated from one another by a single blank line.

For each puzzle the program should either solve it (treating `.`'s as spaces to be filled and `*`'s as spaces that are not to be filled) or identify that no solution is possible. A solution consists of a tiling of the region using pentominoes (but not necessarily all of them). To represent a solution simply echo back the original puzzle with `.`'s replaced by the identifying letter of the piece that covers them (using the Conway encoding from `O` through `Z`). If there is no solution simply print `No solution`. Solutions for separate puzzles should also be separated by blank lines.

Each group will also be given individualised special tasks that use the pentomino pieces after you have submitted your data structure.

(2 points, Group)