

99 questions/90 to 94

From HaskellWiki

< 99 questions

This is part of Ninety-Nine Haskell Problems, based on Ninety-Nine Prolog Problems (<https://prof.ti.bfh.ch/hew1/informatik3/prolog/p-99/>) .

If you want to work on one of these, put your name in the block so we know someone's working on it. Then, change n in your block to the appropriate problem number, and fill in the <Problem description>, <example in Haskell>, <solution in haskell> and <description of implementation> fields.

1 Miscellaneous problems

2 Problem 90

(**) Eight queens problem

This is a classical problem in computer science. The objective is to place eight queens on a chessboard so that no two queens are attacking each other; i.e., no two queens are in the same row, the same column, or on the same diagonal.

Hint: Represent the positions of the queens as a list of numbers 1..N. Example: [4,2,7,3,6,8,5,1] means that the queen in the first column is in row 4, the queen in the second column is in row 2, etc. Use the generate-and-test paradigm.

Example in Haskell:

```
> length (queens 8)
92
> head (queens 8)
[1,5,8,6,3,7,2,4]
```

Solutions

3 Problem 91

(**) Knight's tour

Another famous problem is this one: How can a knight jump on an $N \times N$ chessboard in such a way that it visits every square exactly once? A set of solutions is given on the [The_Knights_Tour](#) page.

Hints: Represent the squares by pairs of their coordinates of the form X/Y , where both X and Y are integers between 1 and N . (Note that $'/'$ is just a convenient functor, not division!) Define the relation $\text{jump}(N, X/Y, U/V)$ to express the fact that a knight can jump from X/Y to U/V on a $N \times N$ chessboard. And finally, represent the solution of our problem as a list of $N \times N$ knight positions (the knight's tour).

There are two variants of this problem:

1. find a tour ending at a particular square
2. find a circular tour, ending a knight's jump from the start (clearly it doesn't matter where you start, so choose (1,1))

Example in Haskell:

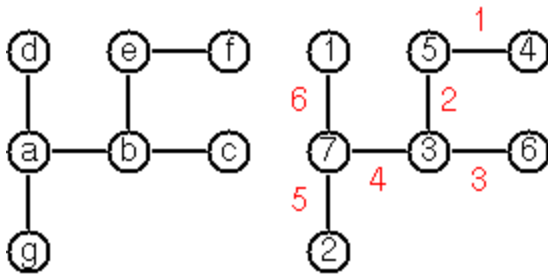
```
Knights> head $ knightsTo 8 (1,1)
[(2,7),(3,5),(5,6),(4,8),(3,6),(4,4),(6,5),(4,6),
(5,4),(7,5),(6,3),(5,5),(4,3),(2,4),(1,6),(2,8),
(4,7),(6,8),(8,7),(6,6),(4,5),(6,4),(5,2),(7,1),
(8,3),(6,2),(8,1),(7,3),(8,5),(7,7),(5,8),(3,7),
(1,8),(2,6),(3,4),(1,5),(2,3),(3,1),(1,2),(3,3),
(1,4),(2,2),(4,1),(5,3),(7,4),(8,2),(6,1),(4,2),
(2,1),(1,3),(2,5),(1,7),(3,8),(5,7),(7,8),(8,6),
(6,7),(8,8),(7,6),(8,4),(7,2),(5,1),(3,2),(1,1)]
Knights> head $ closedKnights 8
[(1,1),(3,2),(1,3),(2,1),(3,3),(5,4),(6,6),(4,5),
(2,6),(1,8),(3,7),(5,8),(4,6),(2,5),(4,4),(5,6),
(6,4),(8,5),(7,7),(6,5),(5,3),(6,1),(4,2),(6,3),
(8,2),(7,4),(5,5),(3,4),(1,5),(2,7),(4,8),(3,6),
(1,7),(3,8),(5,7),(7,8),(8,6),(6,7),(8,8),(7,6),
(8,4),(7,2),(5,1),(4,3),(3,5),(1,4),(2,2),(4,1),
(6,2),(8,1),(7,3),(5,2),(7,1),(8,3),(7,5),(8,7),
(6,8),(4,7),(2,8),(1,6),(2,4),(1,2),(3,1),(2,3)]
```

Solutions

4 Problem 92

(***) Von Koch's conjecture

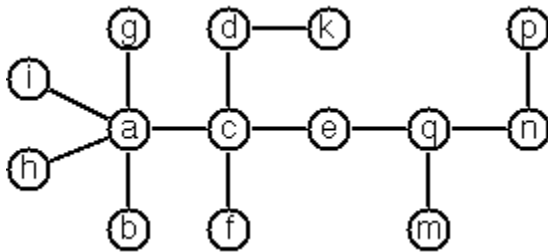
Several years ago I met a mathematician who was intrigued by a problem for which he didn't know a solution. His name was Von Koch, and I don't know whether the problem has been solved since.



Anyway the puzzle goes like this: Given a tree with N nodes (and hence $N-1$ edges). Find a way to enumerate the nodes from 1 to N and, accordingly, the edges from 1 to $N-1$ in such a way, that for each edge K the difference of its node numbers equals to K . The conjecture is that this is always possible.

For small trees the problem is easy to solve by hand. However, for larger trees, and 14 is already very large, it is extremely difficult to find a solution. And remember, we don't know for sure whether there is always a solution!

Write a predicate that calculates a numbering scheme for a given tree. What is the solution for the larger tree pictured below?



Example in Haskell:

```
> head $ vonKoch [(1,6),(2,6),(3,6),(4,6),(5,6),(5,7),(5,8),(8,9),(5,10),(10,11),(11,12),(11,
[6,7,8,9,3,4,10,11,5,12,2,13,14,1]
```

Solutions

5 Problem 93

(***) An arithmetic puzzle

Given a list of integer numbers, find a correct way of inserting arithmetic signs (operators) such that the result is a correct equation. Example: With the list of numbers $[2,3,5,7,11]$ we can form the equations $2-3+5+7 = 11$ or $2 = (3*5+7)/11$ (and ten others!).

Division should be interpreted as operating on rationals, and division by zero

should be avoided.

Example in Haskell:

```
P93> mapM_ putStrLn $ puzzle [2,3,5,7,11]
2 = 3-(5+7-11)
2 = 3-5-(7-11)
2 = 3-(5+7)+11
2 = 3-5-7+11
2 = (3*5+7)/11
2*(3-5) = 7-11
2-(3-(5+7)) = 11
2-(3-5-7) = 11
2-(3-5)+7 = 11
2-3+5+7 = 11
```

The other two solutions alluded to in the problem description are dropped by the Haskell solution as trivial variants:

```
2 = 3-(5+(7-11))
2-3+(5+7) = 11
```

Solutions

6 Problem 94

(***) Generate K-regular simple graphs with N nodes

In a K-regular graph all nodes have a degree of K; i.e. the number of edges incident in each node is K. How many (non-isomorphic!) 3-regular graphs with 6 nodes are there?

Sample results (<https://prof.ti.bfh.ch/hew1/informatik3/prolog/p-99/p94.txt>)

Example in Haskell:

```
length $ regular 6 3
2
```

Solutions

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