

1 Problem

Take the number 192 and multiply it by each of 1, 2, and 3:

$$192 \times 1 = 192 \quad 192 \times 2 = 384 \quad 192 \times 3 = 576$$

By concatenating each product we get the 1 to 9 pandigital, 192384576. We will call 192384576 the concatenated product of 192 and (1,2,3)

The same can be achieved by starting with 9 and multiplying by 1, 2, 3, 4, and 5, giving the pandigital, 918273645, which is the concatenated product of 9 and (1,2,3,4,5).

What is the largest 1 to 9 pandigital 9-digit number that can be formed as the concatenated product of an integer with $(1, 2, \dots, n)$ where $n > 1$?

2 Solution

```
import Data.List
import qualified Data.Map as Map
import Data.Maybe
import System.Environment

-- Generates the 'String' concatenated products of an 'Integer' and a list
concatProduct :: Integral a => a -> [a] -> a
concatProduct x ys = fromIntegral (read pr :: Integer)
  where pr = (concat $ map (\z -> show (x * z)) ys)

class Digital a where
  isPandigital :: a -> Bool

instance Digital Integer where
  isPandigital a = (sort o show) a == "123456789"

instance Digital Pair where
  isPandigital pr = digs == "123456789"
    where (x, y) = (xx pr, yy pr)
          digs = sort $ (sort o concat) $ map (show o (x*)) [1..y]

-- As per the question's criteria
data Pair = Pair
  { xx :: Integer
  , yy :: Integer
  } deriving (Show, Eq, Ord, Read)

main = do
  let cps = (maximum $ concat $ map (\x -> (filter (isPandigital) $ map (\z -> (concatProduct x [1..z])) [1..
  putStrLn $ "The maximum nine-digit concatenated product is " ++ (show cps) ++ "."
```

3 Result

```
runhaskell problem38.lhs
```

The maximum nine-digit concatenated product is 932718654.