

Backtracking, Rekursion

1) Maximale Summe

By starting at the top of the triangle below and moving to adjacent numbers on the row below, the maximum total from top to bottom is 23.

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

That is, $3 + 7 + 4 + 9 = 23$.

- Find the maximum total from top to bottom of the triangle below:

```
      75
     95 64
    17 47 82
   18 35 87 10
  20 04 82 47 65
 19 01 23 75 03 34
 88 02 77 73 07 63 67
 99 65 04 28 06 16 70 92
 41 41 26 56 83 40 80 70 33
 41 48 72 33 47 32 37 16 94 29
 53 71 44 65 25 43 91 52 97 51 14
 70 11 33 28 77 73 17 78 39 68 17 57
 91 71 52 38 17 14 91 43 58 50 27 29 48
 63 66 04 68 89 53 67 30 73 16 69 87 40 31
 04 62 98 27 23 09 70 98 73 93 38 53 60 04 23
```

NOTE: As there are only 16384 routes, it is possible to solve this problem by trying every route.

- Find the maximum total from top to bottom of the triangle in file “UE08_triangle.txt”
- (can NOT be solved using backtracking 😊)

2) Projekt Euler: Longest Collatz sequence

The following iterative sequence is defined for the set of positive integers:

$n \rightarrow n/2$ (n is even) $n \rightarrow 3n + 1$ (n is odd)

Using the rule above and starting with 13, we generate the following sequence:

$13 \rightarrow 40 \rightarrow 20 \rightarrow 10 \rightarrow 5 \rightarrow 16 \rightarrow 8 \rightarrow 4 \rightarrow 2 \rightarrow 1$

It can be seen that this sequence (starting at 13 and finishing at 1) contains 10 terms. Although it has not been proved yet (Collatz Problem), it is thought that all starting numbers finish at 1.

Which starting number, under one million, produces the longest chain?

NOTE: Once the chain starts the terms are allowed to go above one million.

3) Projekt Euler: Coin sums

In England the currency is made up of pound, £, and pence, p, and there are eight coins in general circulation:

1p , 2p , 5p , 10p , 20p , 50p , £1 (100p) and £2(200p).

It is possible to make £2 in the following way:

$1 \times £1 + 1 \times 50p + 2 \times 20p + 1 \times 5p + 1 \times 2p + 3 \times 1p$

How many different ways can £2 be made using any number of coins?