Design and Analysis of Algorithms

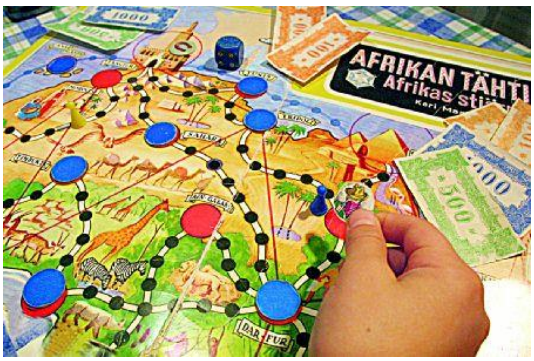
Exercises 3/8

1. Team-up with someone else in the course to solve the following task. We want to know how much time the dynamic programming algorithm for solving the partition of natural numbers takes for the parameter N=1000. Find out the answer (a) theoretically by solving the time complexity function, (b) empirically by measuring the actual processing time of real implementation. One team member solves one task, and then you jointly validate your results by comparing both theoretical and empirical solutions for three different numbers: N=1000, 2000, 3000.

2. Time complexity of the associate matrix multiplication problem depends on two tasks: to solve the optimal order of the multiplications, and to perform the multiplications. Suppose that there are k matrixes of random sizes varying in the range of [1, pN]. What is the total time complexity of the problem if **(a)** p=1, **(b)** p=log$N$, **(c)** all matrices are of the same size pN.

3. What is the time complexity of straightforward implementation of Djikstra's algorithm?

4. One must travel across Sahara Desert carrying only a single water bottle. There is a map showing the location of all water sources. One can travel k kilometres on one bottle of water. Is it possible? Can this problem be solved with dynamic programming? If yes, design algorithm. If not, give proof.



5. Compute *edit distance* between the following pairs of strings using both the recursive and the dynamic programming algorithms:

   CAT – RAT
   POINTS – TRAITS
   ALGORITHM – LOGARITHM
   AGCTAACTTAC - GCTCCTTAAAA

   Also count the time and memory requirements for each method. Does the time complexity match your observations?