

### Tutorial Exact Algorithms

The problem  $k$ -XSAT is defined as:

Input: A formula  $F$  in CNF, an integer  $k$ .

Question: Is there an assignment to the variables of  $F$ , such that

a) each clause is exactly satisfied, and

b) exactly  $k$  variables are set to *true*

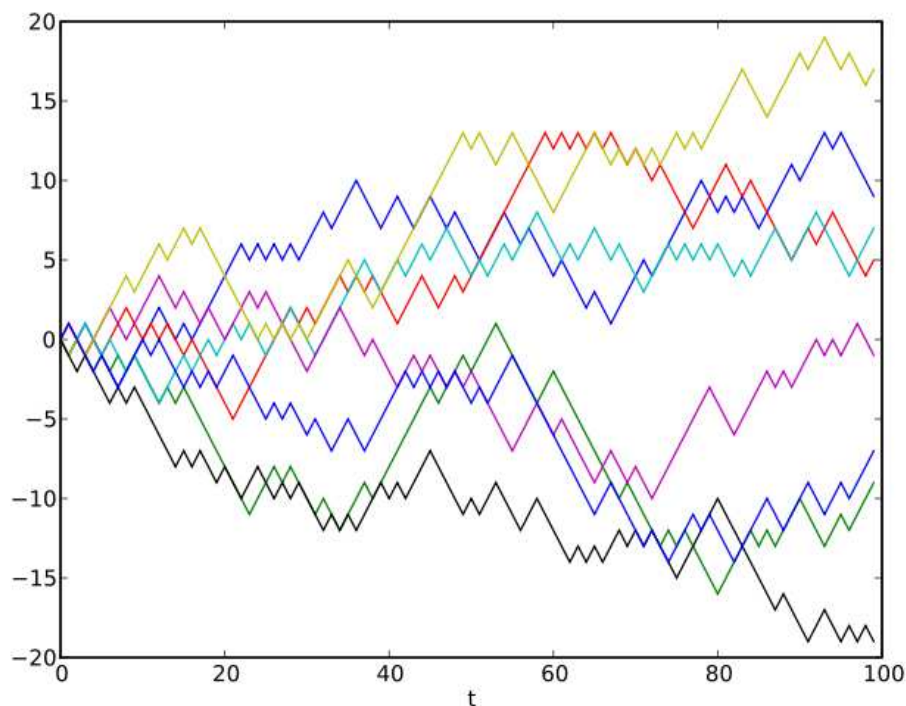
The problem  $k$ -MONOTONE-XSAT is the restriction of  $k$ -XSAT to *monotone* formulas, where each variable occurs positively only.

#### Exercise T17

Prove  $IS \leq_p k$ -MONOTONE XSAT and  $k$ -XSAT  $\leq_p k$ -MONOTONE-XSAT.

#### Exercise T18

A drunken sailor is in the pub and needs to go home. Since he's drunk, he cannot control the direction properly, and thus with each step forward he *randomly* stumbles one step to the left or one step to the right. Assuming a starting position of 0, and an offset of  $+1/-1$  for each step, what is the expected position of the drunken sailor after  $n$  steps? If his ship is at a fixed position  $k$  at distance  $n$ , what is the probability that the sailor reaches his ship?



**Homework Assignment H17 (10 Points)**

Prove that  $k$ -MONOTONE-XSAT  $\leq_p$   $k$ -PARTITION.

**Homework Assignment H18 (10 Points)**

List all possible 3-exchange local search transformations for the TRAVELING SALES PERSON problem.

Recall that the 2-exchange operation for TSP was defined as follows: Given a Hamiltonian tour  $T$ , take two edges  $\{a, b\}$  and  $\{c, d\}$  in the tour, where  $a, b, c, d$  are distinct nodes, and replace them by the edges  $\{a, d\}$  and  $\{b, c\}$ .