

## T-61.5060 EXERCISE 1/2005

In T3 on 28 September 2005 at 12 o'clock.

1. Study the UCI KDD repository at <http://kdd.ics.uci.edu/>, download a data set, and familiarize yourself with it.
2. Let  $X$  be a random variable, and denote by  $D^2(X)$  the variance of  $X$ , defined by  $D^2(X) = E((X - (EX))^2)$ . Derive the equation  $D^2(X) = E(X^2) - (EX)^2$ .
3. Fibonacci numbers are defined by equations  $F(1) = F(2) = 1$  and  $F(i) = F(i - 1) + F(i - 2)$  for  $i > 2$ . Write recursive and iterative algorithms for computing  $F(n)$ , and express their running times using the  $O$  notation.
4. Denote by  $\mathcal{P}(U)$  the collection of all subsets of a finite set  $U$ . Compute the expected size of a random element of  $\mathcal{P}(U)$ .
5. Given two random sets from  $\mathcal{P}(U)$ , what is the expected size of their intersection?
6. An antichain in  $\mathcal{P}(U)$  is a subset  $\mathcal{C} \subseteq \mathcal{P}(U)$  such that for all  $X, Y \in \mathcal{C}$  we have  $X \not\subseteq Y$ . What is the size of the largest antichain in  $\mathcal{P}(U)$ ?