1. Investigate the complexity of exact inference in general Bayesian networks.
   Prove that any instance of the 3-SAT problem
   \[
   \text{Is the given set of 3-literal clauses } C \text{ satisfiable?}
   \]
   can be reduced to exact inference in a Bayesian network \(N(C)\) constructed to represent the particular problem instance \(C\).
   This indicates that exact inference in Bayesian networks is NP-hard.
   (R&N, Exercise 14.8.a)

2. Consider the problem of generating a random sample from a specified distribution on a single variable. You can assume that a random number generator available that returns a random number uniformly distributed between 0 and 1.
   (a) Let \(X\) be a discrete variable with \(P(X = x_i) = p_i\) for \(i \in \{1, \ldots, k\}\).
       The cumulative distribution of \(X\) gives the probability that \(X \in \{x_1, \ldots, x_j\}\) for each possible \(j\). Explain how to calculate the cumulative distribution in \(O(k)\) time and how to generate a single sample of \(X\) from it.
       Can the latter be done in less than \(O(k)\) time?
   (b) Now suppose that we want to generate \(N\) samples of \(X\) where \(N \gg k\).
       Explain how to do this with an expected runtime per sample that is constant (i.e., independent of \(k\)).
   (R&N, Exercise 14.9.ab)