1. Study the details of the Dowling-Gallier algorithm, i.e., LeastModel($M$), formulated for positive programs.

   (a) Verify the given invariants
   
   (i) $Q \subseteq M \subseteq \text{LM}(P)$.  
   (ii) $\forall r = a \leftarrow B \in P$: $\text{count}[r] = |B \setminus (M \setminus Q)|$.  
   (iii) $\forall a \in \text{Hb}(P)$: $\exists r = a \leftarrow B \in P$: $\text{count}[r] = 0$.

   (b) Verify the measure of progress $|\text{LM}(P) \setminus M| + |Q|$.

   (c) Provide justification for the postcondition $M = \text{LM}(P)$ supposed to hold when the execution of the algorithm terminates.

2. Reconsider the principles P1-P4 employed in the definition of the lower bound LB($P, L$). Any prospects of generalizing them for cardinality rules?

3. Calculate the approximation $\text{Expand}(P, \{d\})$ for a normal logic program $P$ consisting of the following rules:

   $a \leftarrow d, \sim b$.  
   $b \leftarrow \sim a, \sim b$.  
   $b \leftarrow c, \sim d$.  
   $b \leftarrow e$.

   $c \leftarrow \sim a$.  
   $d \leftarrow a, \sim e$.  
   $e \leftarrow c, \sim e$.

4. Determine stable models using the branch&bound algorithm (no look-ahead) in order to solve the following reasoning problems.

   (a) What is the number of stable models for the normal program

   $a \leftarrow \sim b$.  
   $b \leftarrow \sim c$.  
   $c \leftarrow \sim d$.  
   $c \leftarrow \sim e$.  
   $d \leftarrow \sim a$.  
   $e \leftarrow b$.

   (b) Is $e$ true in every stable model of a normal program consisting of

   $a \leftarrow \sim b, \sim c$.  
   $b \leftarrow \sim a, \sim c$.  
   $c \leftarrow \sim a, \sim b$.  
   $d \leftarrow a, \sim c, \sim d$.  
   $d \leftarrow b, \sim a$.

   $e \leftarrow c, \sim d$.  
   $e \leftarrow d$.  

   $e \leftarrow d$. 