Principles of Knowledge Representation and Reasoning
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Exercise Sheet 6
Due: June 10, 2008

Exercise 6.1 (Minimal Model Reasoning, 4 marks)
Prove the theorem on embedding B-minimal model reasoning into propositional
default logic (chap. 7, slide 6):
Let $A$ be a set of atomic propositions. Let $\Phi$ be a set of propositional formulae
on $A$, and $B \subseteq A$.
Then $\Phi \models_B \psi$ if and only if $\psi$ follows from $\langle D, W \rangle$ skeptically, where
\[
D = \left\{ \frac{\neg b}{b} \mid b \in B \right\} \quad \text{and} \quad W = \Phi.
\]

Exercise 6.2 (Nonmonotonic Logic Programs, 4 marks)
Consider the following undirected graph:

![Graph Image]

(a) State a logic program whose answer sets are the maximal independent sets
of the graph. Is your program stratified?

(b) Add an additional rule to your program that enforces vertex $v_3$ to be in
the answer set. Is your new program stratified? If not, reformulate it as
a (non-trivial) stratified program. A possible partition is for example:
\[
P_1 = \{ \text{in}(v3). \}
\]
\[
P_2 = \{ \text{in}(v2) :- \text{not in}(v3)., \text{in}(v5) :- \text{not in}(v3)., \\
\text{in}(v6) :- \text{not in}(v3). \}
\]
\[
P_3 = \{ \text{in}(v1) :- \text{not in}(v2)., \\
\text{in}(v4) :- \text{not in}(v2), \text{not in}(v5). \}
\]
Exercise 6.3 (Cumulative Logic, 2 marks)

Prove that system C implies the Modus Ponens in the Consequence (MPC) rule:

\[
\frac{\alpha \vdash \beta \rightarrow \gamma \quad \alpha \vdash \beta}{\alpha \vdash \gamma}
\]

In your proof, you may use the defined derivation rules of system C as well as the derived rules Supraclassicality, Equivalence, and And.