491 KNOWLEDGE REPRESENTATION

Tutorial Exercise

Stable models ('Answer sets')

The examples in questions 2 and 3 are the same as appeared on a previous sheet ('Stratified databases') for which you have already computed the iterated fixpoint ('ABW') semantics.

Question 1   Find stable models (if any) of the following:

(a) $p \leftarrow$ not q
      $r \leftarrow q$

(b) $p \leftarrow$ not q
      $r \leftarrow q$
      r

(c) $p \leftarrow$ not q
      $q \leftarrow$ not p
      $r \leftarrow q$
      r

(d) p
      $r \leftarrow p$, not q
      $q \leftarrow p$, not r
      $s \leftarrow r$, not s

(e) $p \leftarrow$ not q
      $q \leftarrow$ not r
      $r \leftarrow$ not p

Question 2   Consider the following database DB about policemen:

$$\text{takes\_bribes}(x) \leftarrow \text{detective}(x), \text{not honest}(x)$$
$$\text{honest}(x) \leftarrow \text{policeman}(x), \text{not rich}(x)$$
$$\text{policeman}(x) \leftarrow \text{detective}(x)$$
$$\text{policeman}(\text{Eric})$$
$$\text{detective}(\text{Frank})$$
$$\text{rich}(\text{Frank})$$

Eric and Frank are constants, and x is a variable.

(a)   (Re-)construct a supported minimal model for DB using iterated fixpoints ('ABW')

(b)   Check that the model in part (a) is stable.

Question 3

(a)   Consider the following database DB1:

$$\text{strong}(x) \leftarrow \text{big}(x), \text{not weak}(x)$$
$$\text{strong}(x) \leftarrow \text{small}(x), \text{muscular}(x), \text{not weak}(x)$$
$$\text{weak}(x) \leftarrow \text{not muscular}(x)$$
$$\text{small}(\text{Bill}) \qquad \text{big}(\text{Mary})$$
$$\text{muscular}(\text{Bill})$$

Bill and Mary are constants, and x is a variable.

  i) Construct the iterated fixpoint model for database DB1.

  ii) Check that your answer is a stable model for DB1.

(b)   Consider the following database DB2:

$$\text{strong}(x) \leftarrow \text{big}(x), \text{not weak}(x)$$
$$\text{strong}(x) \leftarrow \text{small}(x), \text{muscular}(x), \text{not weak}(x)$$
$$\text{weak}(x) \leftarrow \text{small}(x), \text{not strong}(x)$$
$$\text{small}(\text{Bill}) \qquad \text{big}(\text{Mary})$$
$$\text{muscular}(\text{Bill})$$

Is Bill strong or weak according to the stable model semantics?

Is Mary strong or weak according to the stable model semantics?

(You can either do this question by generating all possible models and then checking each in turn for stability. Or see if you can think of some shortcuts. You only need to look at supported interpretations, for example. Or use the three facts about Bill and Mary to generate the relevant ground instances of clauses rather than writing out all of them. You can also use these facts to simplify the clauses. A systematic method ('splitting sets') will be presented later.)

Question 4   Complete the outline proofs of the Theorem on p3 of the lecture notes.