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HW # 5

Let  $U$  be a universe containing people and songs. Let  $L$  be a language with the following predicates:

$C(p,s)$  — Predicate. Person  $p$  composed song  $s$ .

$L(p,s)$  — Predicate. Person  $p$  likes song  $s$ .

$S(p,s)$  — Predicate. Person  $p$  sings song  $s$ .

$M(s)$  — Predicate. Song  $s$  is in a major key.

Constants:  $A$ —Amy.  $B$ —Barry.  $D$ —David.  $Y$ —Yesterday (the Beatles song)

A. Amy and Barry both sing "Yesterday".

$$S(A, Y) \wedge S(B, Y)$$

B. Amy does not sing any songs that Barry wrote.

$$\forall_s C(B,s) \Rightarrow \neg S(A,s)$$

C. David does sing some songs that Barry wrote.

$$\exists_s S(D,s) \wedge C(B,s)$$

D. David likes all the songs that Amy and Barry both sing.

$$\forall_s S(A,s) \wedge S(B,s) \Rightarrow L(D,s)$$

E. Barry has not written any songs in a major key.

$$\forall_s C(B,s) \Rightarrow \neg M(s)$$

F. There is someone who dislikes "Yesterday".

$$\exists_p \neg L(p, Y)$$

G. There is someone who dislikes all the songs that David wrote.

$$\exists_p \forall_s C(D,s) \Rightarrow \neg L(p, s)$$

H. There is a songwriter who has written some songs, but not any that Amy likes.

$$\exists p \forall s C(p,s) \Rightarrow \neg L(A, s)$$

I. If a person dislikes "Yesterday" then the only songs they like are those they wrote themselves.

$$\forall p,s \neg L(p,Y) \wedge L(p, s) \Rightarrow C(p,s)$$