

QUIZ 3 FOR M325K

Name: _____
UT EID: _____

(1) Consider the predicate calculus expression

$$(\forall x (\exists y (P(x) \wedge Q(y)))) \Rightarrow (\exists y (P(y) \wedge Q(y))).$$

(a) Define what it means for a well-formed predicate calculus formula to be closed.

(b) Write this expression in negation normal form.

(2) Consider the model

Objects	True Statements	
a	$P(a)$	$Q(a)$
b	$Q(b)$	$R(b)$
c	$R(c)$	

For each of the following closed well-formed predicate calculus expressions determine its truth value in the given model.

(a) $\exists x ((P(x) \Rightarrow Q(x)) \wedge R(x))$

(b) $\forall x (Q(x) \vee R(x))$

(c) $(\exists x (P(x) \Rightarrow R(x)))$

(d) $((\exists x (P(x) \Rightarrow Q(x))) \wedge (\exists x (Q(x) \Rightarrow R(x)))) \Rightarrow (\exists x (P(x) \Rightarrow R(x)))$