

CISC 301
Homework 4
Due on Thursday, October 13, 2004
No Late Submissions

1. ($5 + 5 + 5 = 15$ points) Exercise 45 (page 49) of the textbook. Give a brief and clear explanation for your answers for each of the three parts.

2. ($7 \times 5 = 35$ points)

For each of the formulae below give a structure that satisfies it and a structure that makes the formula false.

- a. $F_1 = \forall x \forall y (P(x, y) \rightarrow \exists z (P(x, z) \wedge P(z, y)))$.
- b. $F_2 = [\forall x P(x) \rightarrow \forall x Q(x)] \rightarrow \forall x [P(x) \rightarrow Q(x)]$.
- c. $F_3 = \forall x \forall y \exists z P(x, y, z) \rightarrow \forall x \forall y P(x, y, f(x, y))$.
- d. $F_4 = [\forall x \forall y \forall z ((P(x, y) \wedge P(y, z)) \rightarrow P(x, z)) \wedge \forall x \neg P(x, x)] \rightarrow \exists x \forall y \neg P(x, y)$
- e. $F_5 = [\exists x P(x) \leftrightarrow \exists x Q(x)] \rightarrow [\forall x P(x) \leftrightarrow \forall x Q(x)]$