EXERCISE 1: Is $\forall x \forall y (\exists z (R(y, z) \land R(z, x)) \rightarrow R(y, x))$ logically equivalent to $\forall x \forall y \forall z ((R(y, z) \land R(z, x)) \rightarrow R(y, x))$?

Is it logically equivalent to $\forall x \forall y \forall z ((R(x, y) \land R(y, z)) \rightarrow R(x, z))$, and/or to $\forall x \forall y \forall z ((R(y, z) \land R(z, x)) \rightarrow R(x, y))$?

Provide proofs or counter examples.

EXERCISE 2 = Problem 9.1, [BBJ], p. 112

EXERCISE 3 = Problem 9.2, [BBJ], p. 112

EXERCISE 4 = Problem 9.3, [BBJ], p. 113

EXERCISE 5 = Problems 10.2, [BBJ], p. 123

EXERCISE 6 = Problem 10.3, [BBJ], p. 123

EXERCISE 7 = Problem 10.4, [BBJ], p. 123

EXERCISE 8 = Problem 10.5, [BBJ], p. 123

EXERCISE 9 = Problem 10.7, [BBJ], p. 124

EXERCISE 10 = Problem 10.8, [BBJ], p. 124

EXERCISE 11 = Problem 10.12 [BBJ], p. 124

EXERCISE 12 = Problem 10.14 [BBJ], p. 124