Week 02 Participation Assignment Part 01

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Contents

1 Part 01

Suppose the domain of the propositional function $P(x, y)$ consists of pairs x and y, where x is 1, 2, or 3 and y is 1, 2, or 3. Write out these propositions using disjunctions and conjunctions.

1.1 a)

$$\forall x \forall y P(x, y)$$

$$\begin{aligned} &\forall x \forall y P(x, y) \\ &\qquad \equiv P(1,1) \wedge P(1,2) \wedge P(1,3) \\ &\qquad \wedge P(2,1) \wedge P(2,2) \wedge P(2,3) \\ &\qquad \wedge P(3,1) \wedge P(3,2) \wedge P(3,3) \end{aligned}$$

1.2 b)

$$\exists x \exists y P(x, y)$$

$$\begin{aligned} &\exists x \exists y P(x, y) \\ &\qquad \equiv P(1,1) \vee P(1,2) \vee P(1,3) \\ &\qquad \vee P(2,1) \vee P(2,2) \vee P(2,3) \\ &\qquad \vee P(3,1) \vee P(3,2) \vee P(3,3) \end{aligned}$$

1.3 c)

$$\exists x \forall y P(x, y)$$

$$\begin{aligned} &\exists x \forall y P(x, y) \\ &\qquad \equiv (P(1,1) \wedge P(1,2) \wedge P(1,3)) \\ &\qquad \vee (P(2,1) \wedge P(2,2) \wedge P(2,3)) \\ &\qquad \vee (P(3,1) \wedge P(3,2) \wedge P(3,3)) \end{aligned}$$

1.4 d)

$$\forall y \exists x P(x, y)$$

$$\begin{aligned}
&\forall y \exists x P(x, y) \\
&\qquad \equiv (P(1,1) \vee P(2,1) \vee P(3,1)) \\
&\qquad \wedge (P(1,2) \vee P(2,2) \vee P(3,2)) \\
&\qquad \wedge (P(1,3) \vee P(2,3) \vee P(3,3))
\end{aligned}$$