

1. Consider the q -valuation q defined by:

- Domain = {Romeo, Juliet, Benedick, Beatrice}
- $m \Rightarrow Romeo$
 $n \Rightarrow Juliet$
- $F \Rightarrow \{Romeo, Benedick\}$
 $G \Rightarrow \{Juliet, Beatrice\}$
 $L \Rightarrow \{\langle Romeo, Juliet \rangle, \langle Juliet, Romeo \rangle, \langle Benedick, Beatrice \rangle, \langle Beatrice, Benedick \rangle, \langle Benedick, Benedick \rangle\}$

Determine the truth values of the following *wffs* with respect to q :

- $\exists x L mx$
- $(\exists x L mx \supset L mn)$
- $\forall x (Gx \supset \exists y L xy)$
- $\exists x (Fx \wedge \forall y (Gy \supset L xy))$

2. Determine if the following arguments in **QL** are q -valid by constructing appropriate **QL** "truth trees". (This means each step involves the assignment of T to a *wff*; and each step must be justified by a **QL** *semantic* rule Q1-Q7, or a semantic result V1-V5, and *not* a **QL** formal tree rule.) For non- q -valid arguments, construct an explicit countermodel.

- $\forall x (Fx \supset Gx) \therefore \forall x (Gx \supset Fx)$
- $\forall x (Fx \supset Gx) \therefore \forall x (\neg Gx \supset \neg Fx)$

3. Show that the *wff* $\forall x ((Fx \wedge Gx) \supset (Fx \vee Gx))$ is a q -logical truth by constructing an appropriate **QL** "truth tree". (This means each step involves the assignment of T to a *wff*; and each step must be justified by a **QL** *semantic* rule Q1-Q7, or a semantic result V1-V5, and *not* a **QL** formal tree rule.)