

PY1003: Introduction to Logic
Example Class 7

Interpretations, Many-place predicates

(A) Translate the following sentences into the language of predicate logic. Provide a translation key.

- (i) Mary loves William, but no-one loves Paul.
- (ii) Frank and Felicity are married, but not to each other.
- (iii) Brutus killed someone and someone killed Caesar
- (iv) If everyone likes London, then someone likes London.
- (v) If Leuchars is closer to St Andrews than to Dundee, then it is in Fife.
- (vi) Bill knows all of the rules of logic.

(B) Determine whether or not the following sets of sentences are consistent. Use a truth tree to justify your answers. If a set is consistent, exhibit a model.

- (i) {William loves Mary. Mary is loved by no-one who is Greek. William is Greek.}
- (ii) {Some of the students are tall. Some of the students wear glasses. None of the tall students wear glasses.}
- (iii) {Everyone who likes Mary also likes Jean. At least one person likes Mary. At least one person does not like Jean}
- (iv) {Everyone likes Mary, but Mary does not like herself.}

(C) Determine whether or not the following arguments are valid. If the argument is invalid, explicitly exhibit a counterexample.

- (i) $\forall xFx, \exists xGx \vdash \forall x(Fx \wedge Gx)$
- (ii) $\exists xLax \vdash \exists xLxa$
- (iii) $\forall x(Lxa \rightarrow Lxb), \exists xLxa \vdash \exists xLxb$
- (iv) $\forall x(Px \vee Qx), \forall xRx \vdash \forall x(Px \wedge Rx)$
- (v) $\exists x(Px \wedge Qxab), \forall y(Py \rightarrow Ry) \vdash \exists x(Rx \wedge Qxab)$