Amsterdam University College

Logic, Information flow and Argumentation

Homework exercises, Week 6, part b (due Tuesday 20 March).

1. Using the diagrammatic method presented in class, decide whether the following syllogisms are valid or not.

   (a) $$\begin{array}{l} \text{All students are poor} \\ \text{All poor people are hungry} \\ \hline \text{Some student is hungry} \end{array}$$

   (b) $$\begin{array}{l} \text{All students are poor} \\ \text{All students are clever} \\ \hline \text{Some clever person is poor} \end{array}$$

   (c) $$\begin{array}{l} \text{All students are clever} \\ \text{Some teacher is clever} \\ \hline \text{Some student is a teacher} \end{array}$$

   (d) $$\begin{array}{l} \text{Some easy things are fun} \\ \text{All logic exercises are easy} \\ \hline \text{Some logic exercises are fun} \end{array}$$

   (e) $$\begin{array}{l} \text{No woman has been president} \\ \text{Some president has lived in the White House} \\ \hline \text{Some woman has not lived in the White House} \end{array}$$

2. Translate the following sentences into predicate logic (stating the translation you use precisely).

   (a) John sleeps.

   (b) Mary is doing a logic exercise.

(c) John sleeps but Mary doesn't.

(d) If John is working, Mary is also working.

(e) It is not the case that both Mary and John are students.

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(f) Everybody is sleeping.

(g) Everybody likes Mary.

(h) Something is flying around.

(i) John saw somebody.

(j) John gave something to Mary.

3. Free and bound variables

   For each of the following formulas, indicate:

   (a) Whether it is a negation, a conjunction, a disjunction, an implication, a universal formula, or an existential formula (this refers to the main logical expression: connective or quantifier);

   (b) the scope of the quantifiers;

   (c) the free occurrences of variables;

   (d) whether it is a open or closed.

   (e) i. $\exists x(Axy \wedge Bx)$

      ii. $\exists x Axy \wedge Bx$

      iii. $\exists x \exists y Axy \rightarrow Bx$

      iv. $\exists x(\exists y Axy \rightarrow Bx)$

      v. $\neg\exists x \exists y Axy \rightarrow Bx$

      vi. $\forall x \neg \exists y Axy$

      vii. $\neg Bx \rightarrow (\neg\forall y(\neg Axy \vee Bx) \rightarrow Cy)$

      viii. $\exists x(Axy \vee By)$

      ix. $\exists x Axx \vee \exists y By$

      x. $\exists x(\exists y Axy \vee By)$

      xi. $\forall x \forall y((Axy \wedge By) \rightarrow \exists w Cxw)$

      xii. $\forall x(\forall y Ayx \rightarrow By)$

      xiii. $\forall x \forall y Ayy \rightarrow Bx$