

FLST WS 2009/2010 – Semantics – Exercise sheet 1

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Exercises will be discussed on Monday, January 4, 8:30 a.m.
Lecture will start 45 minutes later (9:15 a.m.)

1. Formalise the following sentences in propositional logic! (Translate basic sentences like “it rains” or “Steve comes home late” to propositional constants p, q, r)

- a. When it rains, it pours.
- b. Sam wants a dog, but Alice prefers cats.
- c. I will make the dishes if you cook.
- d. I will make the dishes only if you cook
- e. Marsha won't go out with John unless he shaves off his beard and stops drinking.
- f. The stock market advances when public confidence in the economy is rising.
- g. John and Bill are going to the movies, but not Tom.
- h. If Mary hasn't got lost or had an accident, she will be here in 5 minutes.

2. Check with the truth-table method, whether the following formulae are logically valid, contradictory, or contingent (i.e. neither valid nor contradictory)!

- a. $((p \vee \neg q) \wedge q)$
- b. $((p \wedge q) \rightarrow (p \vee r))$
- c. $(\neg p \wedge \neg(p \rightarrow q))$

4. Check with the truth-table method whether entailment holds in the following cases:

- a. $\{ (p \rightarrow \neg q), (r \rightarrow q), (\neg r \rightarrow q) \} \models \neg p$?
- b. $\{ (q \vee r), ((q \wedge r) \rightarrow s) \} \models (q \rightarrow s)$?

5. Translate the following sentences to FOL.

- a. John admires someone.
- b. John admires himself.
- c. Bill and Mary help each other.
- d. A student reads an interesting book
- e. Peter reads only interesting books.
- f. No one is loved by everyone.
- g. All but one student passed (the exam).
- h. Only Peter flunked.
- i. Exactly one student flunked.

5. Are the following formulae logically valid, contradictory (false in all model structures), or contingent (neither valid nor contradictory)?

- a. $\exists x(F(x) \wedge \neg F(x))$
- b. $(\exists x F(x) \vee \exists x \neg F(x))$
- c. $(\forall x F(x) \vee \forall x \neg F(x))$

5. Check whether entailment holds in the following cases (through semantic interpretation of the involved formulas):

- a. $\forall x F(x), G(a) \models \exists x(F(x) \wedge G(x))$
- b. $F(a), \exists x(F(x) \wedge G(x)) \models G(a)$
- c. $\forall x(F(x) \leftrightarrow \neg G(x)), Fa, Gb \models \neg a=b$