

Q 1.

Write the meaning of these sentences in first order logic. You may ignore temporal and aspectual semantics for the moment.

- (1) a. No one speaks French. (Note: you can take *speak French* as a single lexical item. But, if you like, try to take the two words separately.)
b. No one speaks French or Arabic.
c. Every student is happy.
d. Every student is happy and tired.
e. Every student is happy, and every student is tired.
f. Every student is happy or tired.
g. Every student is happy, or every student is tired.

Solution:

- (2) a. $\neg \exists x.sf'(x)$
Decomposing *speak French*:
 $\neg \exists y.speak'(y, French')$
b. $\neg \exists x.sf'(x) \vee sa'(x)$
No one speaks French and Arabic:
 $\neg \exists x.sf'(x) \wedge sa'(x)$
c. $\forall x.student'(x) \rightarrow happy'(x)$
d. $\forall x.student'(x) \rightarrow happy'(x) \wedge tired'(x)$
e. $(\forall x.student'(x) \rightarrow happy'(x)) \wedge (\forall x.student'(x) \rightarrow tired'(x))$
f. $\forall x.student'(x) \rightarrow happy'(x) \vee tired'(x)$
g. $(\forall x.student'(x) \rightarrow happy'(x)) \vee (\forall x.student'(x) \rightarrow tired'(x))$

Q 2.

- (a) Do (1d) and (1e) mean the same thing? Why or why not?
(b) Do (1f) and (1g) mean the same thing? Why or why not?

Solution: The *and* versions are equivalent, but *or* versions are not. Any kind of proof, semantic or syntactic is fine.