4CCS1ELA: Tutorial list 5

1. Determine whether this argument is valid, using natural deduction:

> *"Lynn works part time or full time. If Lynn does not play on the team, then she does not work part time. If Lynn plays on the team, she is busy. Lynn does not work full time.* ***Therefore,*** *Lynn is busy."*

2. Suppose we have the two propositions (with symbols to represent them):

> *It is raining (R) or I work in the yard (W).*
> *It is not raining ($\neg R$) or I go to the library (L).*

Show that $R \vee W, \neg R \vee L \vdash W \vee L$ using natural deduction.

3. Formalise the following argument in propositional logic and demonstrate its validity using natural deduction.

> *"If I graduate this semester, then I will have passed physics. If I do not study physics for 10 hours a week, then I will not pass physics. If I study physics for 10 hours a week, then I cannot play volleyball.* ***Therefore,*** *I will not graduate this semester if I play volleyball.*

4. Show that the following hold using natural deduction:

1. $P \to Q, \neg Q \vdash \neg P$
2. $(P \to Q) \to Q, Q \to P \vdash P$
3. $\neg(P \wedge \neg Q) \vdash P \to Q$

5. Prove (using natural deduction) that the *variant* rules can be obtained from the basic ones. (That is, for each variant rule, provide a natural deduction proof of its conclusion from its premises using only the basic rules)