Exercise sheet 1

CS242 Formal Specification and Verification

Autumn term 2006

1.1.1 Use $\neg$, $\rightarrow$, $\wedge$ and $\vee$ to express the following declarative sentences in propositional logic; in each case state what your respective propositional atoms p, q, etc. mean:

   (h) Today it will rain or shine, but not both.

   (i) If Dick met Jane yesterday, they had a cup of coffee together, or they took a walk in the park.

   (j) No shoes, no shirt, no service.

1.1.2 Reinsert as many brackets as possible:

   (c) $(p \rightarrow q) \rightarrow (r \rightarrow s \vee t)$

1.2.1 Prove the validity of the following sequents:

   (o) $p \rightarrow q, r \rightarrow s \vdash p \wedge r \rightarrow q \wedge s$

   (r) $p \rightarrow q \wedge r \vdash (p \rightarrow q) \wedge (p \rightarrow r)$

   (x) $p \rightarrow (q \vee r), q \rightarrow s, r \rightarrow s \vdash p \rightarrow s$

1.2.3 Prove the validity of the sequents below:

   (n) $p \wedge q \vdash \neg(\neg p \vee \neg q)$

   (q) $\vdash (p \rightarrow q) \vee (q \rightarrow r)$ using LEM

1.2.5 Prove the following theorem of propositional logic:

   (d) $(p \rightarrow q) \rightarrow ((\neg p \rightarrow q) \rightarrow q)$