Tik-79.144 **Syksy 1998**
Logic in Computer Science: Foundations
Exercise 7

1. We define predicates $L(x,y)$ (there is a flight from city x to city y) and $Y(x,y)$ (there is a connection from city x to city y) in following way:

$$\forall x \forall y (L(x,y) \rightarrow L(y,x))$$
$$\forall x \forall y (L(x,y) \rightarrow Y(x,y))$$
$$\forall x \forall y \forall z (Y(x,y) \land L(y,z) \rightarrow Y(x,z))$$

Write a database (using predicate logic) which states that there is a flights from Helsinki to London, Rovaniemi and New York, that there is a flight from New York to Paris and that there is a flight from Petersburg to Berlin. Use semantic tableaux to prove that there is a connection between Rovaniemi and New York.

2. Let P and Q be 3-ary predicate symbols. Use sematic tableaux to prove:

$$\forall x \exists y \neg \forall z P(x,y,z) \leftrightarrow \forall x \exists y \exists z \neg P(x,y,z)$$

3. We know that

(i) All guilty persons are liars.

(ii) At least one of the accused is also a witness.

(iii) No witness lies.

Prove that all accused are not guilty. Use semantic tableaux.