COG356: Generative Processes and Logical Forms +
Ace DeSiena - Apr 2015

1. **Write a paragraph which says something significant about Jacques Herbrand and his contributions to symbolic logic.**

   Jacques Herbrand was a French logician who died at a very young age after making great contributions to the field of logic. One of his legacies is Herbrand's theorem, a proof that any first-order logical expression is provable if and only if it can be derived propositionally. He also determined the consistency of a weaker form of mathematics than the form used by Godel in his first incompleteness theorem.

2. **Write a paragraph which says something significant about Alfred Horn and his contributions to symbolic logic.**

   Alfred Horn was an American mathematician who described the horn clauses which are used in logic programming.

3. **Write a paragraph which says something significant about John Alan Robinson and his contributions to symbolic logic.**

   John Alan Robinson is a mathematician and Professor Emeritus at SU. He developed the resolution principle and unification algorithm which are used in logic programming.

4. **define disjunctive normal form.**

   Disjunctive normal form is a series of disjoined expressions which are all either literals or conjunctions of literals.

5. **Transform the following into disjunctive normal form:**

   (a) $(\sim P \wedge Q) \rightarrow R$

   $\Rightarrow \sim (\sim P \wedge Q) \vee R$

   (b) $\sim (P \vee \sim Q) \wedge (S \rightarrow T)$

   $\Rightarrow \sim (P \vee \sim Q) \wedge (\sim S \vee T)$

   $\Rightarrow \sim\sim (\sim P \wedge \sim\sim Q) \wedge \sim (\sim\sim S \wedge \sim T)$

   $\Rightarrow \sim P \wedge Q \wedge \sim S \wedge \sim T$

   (c) $(P \rightarrow Q) \rightarrow R$

   $\Rightarrow (\sim P \vee Q) \rightarrow R$

   $\Rightarrow \sim (\sim P \vee Q) \vee R$

   $\Rightarrow \sim\sim (\sim\sim P \wedge \sim Q) \vee R$

   $\Rightarrow (P \wedge \sim Q) \vee R$

6. **Define conjunctive normal form.**

   Conjunctive normal form is a series of conjoined expressions which are all either literals or disjunctions of literals.

7. **Transofrm the following into conjunctive normal form:**

   (a) $P \vee (\sim P \wedge Q \wedge R)$

   $\Rightarrow (P \vee \sim P) \wedge (P \vee Q) \wedge (P \vee R)$

   $\Rightarrow (P \vee Q) \wedge (P \vee R)$

   (b) $\sim (P \rightarrow Q)$

   $\Rightarrow \sim (\sim P \vee Q)$

   $\Rightarrow P \wedge \sim Q$

   (c) $(P \rightarrow Q) \rightarrow R$

   $\Rightarrow \sim (P \rightarrow Q) \vee R$

   $\Rightarrow \sim (\sim P \vee Q) \vee R$

   $\Rightarrow \sim\sim (\sim\sim P \wedge \sim Q) \vee R$

   $\Rightarrow (P \wedge \sim Q) \vee R$

   $\Rightarrow (P \vee R) \wedge (\sim Q \vee R)$

8. **State the resolution principle.**

9. **Define what is meant by the resolution principle.**

10. **Show by means of resolution that the formula U is a logical consequence of these three formulae: $(P \to S), (S \to U)$, and P.**

11. **Show thy means of the inconsistency truth table approach that the formula U is a logical consequent of the three formulae $(P \to S), (S \to U)$, and P.**

12. **Define the horn clause.**

13. **Can the formula $(P \wedge Q \wedge R) \to S$ be converted to a horn clause?**