

AI Assignment 1

- (i) Convert the following FOL into CNF.
- $$\forall x [\exists z \text{Animal}(z) \wedge \text{kills}(x, z)] \Rightarrow [\forall y \neg \text{Loves}(y, x)]$$
- (ii) Eliminate implication. $\because (A \Rightarrow B) \equiv \neg A \vee B$
- $$\forall x [\neg \exists z \text{Animal}(z) \wedge \text{kills}(x, z)] \vee \forall y \neg \text{Loves}(y, x)$$
- (iii) Move \neg Inwards $\because \neg \exists x p \equiv \forall x \neg p$
- $$\forall x [\forall z \neg (\text{Animal}(z) \wedge \text{kills}(x, z))] \vee \forall y \neg \text{Loves}(y, x)$$
- $$\forall x [\forall z \neg (\text{Animal}(z)) \vee \neg \text{kills}(x, z)] \vee \forall y \neg \text{Loves}(y, x)$$
- (iii') Drop universal quantifiers \because
- $$\neg \text{Animal}(z) \vee \neg \text{kills}(x, z) \vee \neg \text{Loves}(y, x)$$
- (iv) CNF \because
- $$\neg \text{Animal}(z) \vee \neg \text{kills}(x, z) \vee \neg \text{Loves}(y, x)$$

(2) Convert the sentences into FOL & prove using resolution.

Rules & facts:-

(i) Cold and precipitation \rightarrow snow.

$$\text{Cold}(x) \wedge \text{precipitation}(x) \Rightarrow \text{Snow}(x)$$

$$\neg (\text{Cold}(x) \wedge \text{precipitation}(x)) \vee \text{Snow}(x)$$

$$\neg \text{Cold}(x) \vee \neg \text{precipitation}(x) \vee \text{Snow}(x)$$

(ii) January \rightarrow cold

$$\text{January}(x) \Rightarrow \text{Cold}(x)$$

$$\neg \text{January}(x) \vee \text{Cold}(x)$$

(iii) clouds \rightarrow Precipitation

$$\text{clouds}(x) \Rightarrow \text{precipitation}(x)$$

$$\neg \text{clouds}(x) \vee \text{precipitation}(x)$$

(iv) January (x)

(v) clouds (x)

To prove:- Snow(x)

\rightarrow Resolution of (i) & (ii)

$$(vi) \neg \text{precipitation}(x) \vee \text{Snow}(x) \vee \neg \text{January}(x)$$

\rightarrow Resolution of (vi) & (iv)

$$(vii) \neg \text{precipitation}(x) \vee \text{Snow}(x)$$

\rightarrow Resolution of (vii) and (iii)

$$(viii) \text{Snow}(x) \vee \neg \text{clouds}(x)$$

\rightarrow Resolution of (viii) and (v)

$$\text{Snow}(x) \Rightarrow \text{Hence proved}$$