

CSED342 Spring 2021 Homework 8

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Problem 2

(a) Show that C could be derived within given knowledge base KB.

(i) Firstly, convert KB into CNF.

$$\begin{aligned} & \frac{(A \vee B) \rightarrow C}{\neg(A \vee B) \vee C} \quad (\because P \rightarrow Q \text{ is equivalent to } \neg P \vee Q) \\ & \frac{\neg(A \vee B) \vee C}{(\neg A \wedge \neg B) \vee C} \quad (\because \neg(P \vee Q) \text{ is equivalent to } (\neg P \wedge \neg Q)) \\ & \frac{(\neg A \wedge \neg B) \vee C}{(\neg A \vee C) \wedge (\neg B \vee C)} \quad (\because (P \wedge Q) \vee R \text{ is equivalent to } (P \vee R) \wedge (Q \vee R)) \end{aligned}$$

Therefore, given knowledge base KB can be expressed in the following CNF.

$$\text{KB}' = \{(\neg A \vee C) \wedge (\neg B \vee C), A\}$$

(ii) Lastly, inference from the derived formula.

$$\begin{aligned} \{(\neg A \vee C) \wedge (\neg B \vee C), A\} & \iff \{(A \rightarrow C) \wedge (B \rightarrow C), A\} \\ & \iff \{A \rightarrow C, B \rightarrow C, A\} \end{aligned}$$

From (ii), KB' is equivalent to $\{A \rightarrow C, B \rightarrow C, A\}$, and it satisfies $\frac{A \rightarrow C, A}{C}$ (Modus ponens). It means C can be derived from KB' by modus ponens. Also, using (i), KB' is equivalent to KB, thus C can be derived within KB. \square