Q1. Propositional Logic

(a) Provide justification for whether each of the following are correct or incorrect.

    (i) $(X \vee Y) \models Y$

    (ii) $\neg X \vee (Y \wedge Z) \models (X \implies Y)$

    (iii) $(X \vee Y) \wedge (Z \vee \neg Y) \models (X \vee Z)$

(b) Consider the following sentence:

$$[(Food \implies Party) \vee (Drinks \implies Party)] \implies [(Food \wedge Drinks) \implies Party] .$$

    (i) Determine, using enumeration, whether this sentence is valid, satisfiable (but not valid), or unsatisfiable.

    (ii) Convert the left-hand and right-hand sides of the main implication into CNF.

    (iii) What do you observe about the LHS and RHS after converting to CNF? Explain how your results prove the answer to part b.i.

Q2. [Optional] Propositional Logic

(a) Pacman has lost the meanings for the symbols in his knowledge base! Luckily he still has the list of sentences in the KB and the English description he used to create his KB.

For each English sentence on the left, there is a corresponding logical sentence in the knowledge base on the right (**not necessarily the one across from it**). Your task is to recover this matching. Once you have, please fill in the blanks with the English sentence that matches each symbol.

English	**Knowledge Base**
There is a ghost at $(0, 1)$.	$(C \vee B) \wedge (\neg C \vee \neg B)$
If Pacman is at $(0, 1)$ and there is a ghost at $(0, 1)$, then Pacman is not alive.	$C \wedge \neg D$
	$\neg A \vee \neg(B \wedge D)$
Pacman is at $(0, 0)$ and there is no ghost at $(0, 1)$.	D
Pacman is at $(0, 0)$ or $(0, 1)$, but not both.	

$A = $ _____ $\qquad\qquad$ $B = $ _____

$C = $ _____ $\qquad\qquad$ $D = $ _____

(b) Consider a propositional model with four symbols A, B, C, D. For each of the following sentences α_i, how many possible worlds make it true?

(i) $\alpha_1 = A$: _____

(ii) $\alpha_2 = (C \wedge D) \vee (A \wedge B)$: _____

(iii) $\alpha_3 = (A \vee B) \Rightarrow C$: _____