Key Definition (2)

- **Interpretation**: An interpretation is an assignment of values to all variables

- **Model**: A model is an interpretation that satisfies the constraints
  - A model also refers to a possible world in which a sentence (or set of sentences) is true

Examples:

- On the right, {(P=0, Q=0), (P=0, Q=1), (P=1, Q=0), (P=1, Q=1)} are 4 different interpretations

- Among all interpretations, model = {(P=0, Q=0), (P=0, Q=1), (P=1, Q=0)}, since only these interpretations satisfy the constraints (make the statement true)

P	Q	$(P \land Q)$	**$\neg(P \land Q)$**
0	0	0	**1**
0	1	0	**1**
1	0	0	**1**
1	1	1	**0**

Key Definition (2)

- **Entailment**: Entailment means that one sentence follows logically from another sentence, or set of sentences (i.e. a knowledge base):

$$KB \models \alpha$$

- The above expressions stands for "KB(knowledge base) entails α"

- Knowledge base KB entails sentence α means **when KB is true then α is true**

- Compute whether $S \models P$ by calculating a truth table for S and P, check if whenever all formulae in S are True, P is True

- A tautology is a special case of entailment where S is the empty set

Entailment

Example 1:

- Recall that $S \models P$ means when S is true then P is true

- In the right table, we find $\{P, P \rightarrow Q\} \models Q$ since when both P and P → Q are True (row 1), Q is also True

- Also, we find $P \rightarrow Q \models Q$, since when $P \rightarrow Q$ is True, Q is True

P	Q	(P → Q)
0	0	1
0	1	0
1	0	1
1	1	1

Entailment

Example 2:

- Recall that $S \vDash P$ means when S is true then P is true
- Let S = {p → q, q → p, p ∨ q}, P = p ∧ q
- We find $S \vDash P$, since when S is True, P is True (Row 1)
- Each row is an interpretation of S, but only the first row is a model of S

p	q	p→q	q→p	p ∨ q	S	P
1	1	1	1	1	**1**	**1**
1	0	0	1	1	0	0
0	1	1	0	1	0	0
0	0	1	1	0	0	0

Entailment

Example 3:

- Recall that $S \vDash P$ means when S is true then P is true
- Let S = S = {q ∨ r, q → ¬p, ¬(r ∧ p)}, P = ¬p
- Also, we find $S \vDash P$, since when S is True, P is True (Row 6-8)

p	q	r	q ∨ r	q→¬p	¬(r∧p)	S	P
1	1	1	1	0	0	0	0
1	1	0	1	0	1	0	0
1	0	1	1	1	0	0	0
1	0	0	0	1	1	0	0
0	1	1	1	1	1	1	1
0	1	0	1	1	1	1	1
0	0	1	1	1	1	1	1
0	0	0	0	1	1	0	1

Quiz Time!