Models.

1. Definitions.

1) Model: an interpretation designed to show a particular semantic property.

2). Countermodel (example): an interpretation designed to show the absence of a particular semantic property.

2. Categories.

1). Intensional.	2). Extensional.
Infinite	Finite.
Concrete.	Abstract.

3. Abstract Translation (Key Skill). (don't consider UD, Pr first).

1) $\forall x(Fx \to Gx)$: Everything if in F then in G.

= All Fs are Gs

2) $\forall x(Fx \to \sim Gx)$: Everything if in F then not in G.

= All Fs are not Gs

3). $\forall x(\sim Fx \to Gx)$: Everything if not in F then in G.

4) $\forall x(Bx \leftrightarrow Gx)$: If in B then in G and if in G then in B

= B and D are identical

5) $\sim\forall x(Bx \leftrightarrow Dx)$: Not everything If in B then in G and if in G then in B

= B and D are different

informal equivalence. ←

6) $\forall x \sim (Fx \leftrightarrow Gx)$: Everything is if in F then not in G or if not in G then in F.
$= \forall x (Fx \leftrightarrow \sim Gx)$.

= Everything is F exclusive or G.

7) $\forall x (Fx \vee Gx)$: Everything is F or G.

8) $\exists x Fx \wedge \exists x Gx$: There exist sth. in F and there exist sth. in G.

= F and G are not empty.

9) $\exists x (Fx \wedge Gx)$: There exist sth. is in both F and G.

10) $\exists x (Fx \wedge \sim Gx)$: sth. is in F and not in G

11) $\exists x (Fx \wedge Gx) \rightarrow \sim \exists y Dy$: If sth is in both F and G, then nothing is in D.

4. Informal Equivalence: helping abstract translation

e.g. $\sim \exists x (Fx \rightarrow \sim Gx)$.

$= \forall x \sim (Fx \rightarrow \sim Gx)$.

$= \forall x (Fx \wedge Gx)$. Everything is in F and G.

5. Finite Abstract Model Tips.

1) Focus on Abstract Translation.

→ use informal equivalence appropriately.

2). Begin with a UD of 2 elements. (don't close right bracket).

3) Start with constants → extentials.

→ Because universal Q always has a conditional

4) rechecking.

e.g. $\{\forall x(Bx \leftrightarrow Dx).\ \exists x(Ax \wedge \sim Dx).\ \exists x\, Dx\}$. consistent

↓

all true.

S1: B and D are identical

S2: There exists sth. in A and not in D.

S3: D is not empty.

UD: $\{0, 1\}$.

B: $\{0\}$

D: $\{0\}$

A: $\{1\}$

e.g. $Fa \wedge Ma.\ \forall x(Mx \vee Hx).\ \sim\forall x(Fx \leftrightarrow Hx)\ \therefore \forall x(Fx \rightarrow Mx)$ Invalid.

Pr1. a is in F and M.

$\sim\forall x(Fx \rightarrow Mx)$
$= \exists x(Fx \wedge \sim Mx)$

Pr2. Everything is in M inclusive or H.

Pr3. F and H are different

~C: There exists sth. in F and not in M.

UD: $\{0, 1\}$

a: 0

F: $\{0, 1\}$

M: $\{0\}$

H: $\{1\}$

e.g. $\sim\forall x(Fx \rightarrow Gx).\ \therefore \sim\exists x\forall y(Fy \rightarrow Gx)$. Invalidity.

Pr1: $\exists x(Fx \wedge \sim Gx)$: sth in F and not in G.

~C: $\exists x\forall y(Fy \wedge \sim Gx)$. UD $= \{0, 1\}$.

$= \forall y(Fy \wedge \sim G0) \vee \forall y(Fy \wedge \sim G1)$.

$= [(F0 \wedge \sim G0) \wedge (F1 \wedge \sim G0)] \vee [(F0 \wedge \sim G1) \wedge (F1 \wedge \sim G1)]$.

T T T T T

$F0$: T

$F1$: T

$G0$: F

$G1$: 不重要.

总结：一个 variable，直接翻译.
两个 variable 用 expand.（∃：用 ∨；∀：用 ∧）先列出 (D) 下的所有情况.

e.g. $\forall x \exists y (Fx \leftrightarrow Gy)$. $\therefore \exists y \forall x (Fx \leftrightarrow Gy)$. Invalidity.

Pr1: $\exists y (F0 \leftrightarrow Gy) \wedge \exists y (F1 \leftrightarrow Gy)$.

$= [(F0 \leftrightarrow G0) \vee (F0 \leftrightarrow G1)] \wedge [(F1 \leftrightarrow G0) \vee (F1 \leftrightarrow G1)]$

~C: $\forall y \exists x (Fx \leftrightarrow \sim Gy)$.

$= \exists x (Fx \leftrightarrow \sim G0) \wedge \exists x (Fx \leftrightarrow \sim G1)$.

$= [(F0 \leftrightarrow \sim G0) \vee (F1 \leftrightarrow \sim G0)] \wedge [(F0 \leftrightarrow \sim G1) \vee (F1 \leftrightarrow \sim G1)]$.

F0 或 F1 有一个与 ~G0 相同即可.

$F0$: F

$F1$: T

$G0$: T

$G1$: F