## 5.3.1. Semantic Problems: Names, Predicates, and Models

**A**. For each of the formal sentences below, decide if that sentence is **true** or **false** in the following model.

$\mathbb{D}$: {**2**, **3**}

**a**: **2**
**b**: **3**

**G**: {**2**}
**H**: {**3**}
**I**: {**2**, **3**}
**J**: { }

1. (Ga $\wedge$ Ha)
2. ((Ga $\wedge$ Ha) $\vee$ (Gb $\wedge$ Hb))
3. ((Ga $\vee$ Ha) $\rightarrow$ Ja)
4. (Ja $\rightarrow$ (Ga $\vee$ Ha))
5. (Ga $\rightarrow$ Ia)
6. (Ga $\leftrightarrow$ Ia)
7. (Ha $\leftrightarrow$ Ja)

**B**. **Translate** the following English argument into the formal language; then decide, for each of the models below, whether that model is a **validity counterexample** for the argument.

**Argument**:

1. Rex isn't a fat cat, but Neko is.

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∴ Rex isn't fat, but Neko is.

**Translation Key**:

**a**: Rex
**b**: Neko
**G**: __is fat
**H**: __is a cat

**Model A**

𝔻: {**Rex**, **Neko**}

**a**: **Rex** **b**: **Neko**
**G**: {**Rex**} **H**: {**Neko**}

**Model B**

𝔻: {**Rex**, **Neko**}

**a**: **Rex** **b**: **Neko**
**G**: {**Rex**, **Neko**} **H**: {**Neko**}

**Model C**

𝔻: {**Rex**, **Neko**}

**a**: **Rex** **b**: **Neko**
**G**: { } **H**: {**Neko**}

**Model D**

𝔻: {**Rex**, **Neko**}

**a**: **Rex** **b**: **Neko**
**G**: {**Rex**, **Neko**} **H**: {**Rex**, **Neko**}

**C**. **Translate** the following English argument into the formal language; then decide, for each of the models below, whether that model is a **validity counterexample** for the argument.

**Argument**:

1. Kitty isn't a cigar-smoking gambler.

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∴ Kitty isn't a gambler.

**Translation Key**:

**a**: Kitty
**G**: __smokes cigars / (is) cigar-smoking
**H**: __is a gambler

**Model A**

𝔻: {**KITTY**, **ELVIS**}

**a**: **KITTY** **b**: **ELVIS**
**G**: {**KITTY**, **ELVIS**}
**H**: {**KITTY**, **ELVIS**}

**Model B**

𝔻: {**KITTY**, **ELVIS**}

**a**: **KITTY** **b**: **ELVIS**
**G**: {**KITTY**} **H**: { }

**Model C**

𝔻: {**KITTY**, **ELVIS**}

**a**: **KITTY** **b**: **ELVIS**
**G**: {**ELVIS**} **H**: {**ELVIS**}

**Model D**

𝔻: {**KITTY**, **ELVIS**}

**a**: **KITTY** **b**: **ELVIS**
**G**: {**KITTY**, **ELVIS**} **H**: {**ELVIS**}

**D**. **Translate** the following English argument into the formal language; then decide, for each of the models below, whether that model is a **validity counterexample** for the argument.

**Argument**:

1. Either Neko is a cat who both eats fish and picks locks, or either Barbie or Jack left the refrigerator unlocked.
2. Jack didn't leave the refrigerator unlocked.

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∴ Neko is a lock-picking fish-eater.

**Translation Key**:

**a**: Neko **c**: Jack
**b**: Barbie
**G**: __is a cat
**H**: __eats fish
**I**: __picks locks
**J**: __left the refrigerator unlocked

**Model A**

𝔻: {**Neko**, **Barbie**, **Jack**}

**a**: **Neko** **b**: **Barbie** **c**: **Jack**
**G**: {**Neko**, **Jack**} **I**: {**Barbie**}
**H**: {**Barbie**} **J**: {**Neko**, **Barbie**}

**Model B**

𝔻: {**Neko**, **Barbie**, **Jack**}

**a**: **Neko** **b**: **Barbie** **c**: **Jack**
**G**: {**Neko**, **Jack**} **I**: {**Neko**, **Jack**}
**H**: {**Neko**, **Barbie**, **Jack**} **J**: { }

**Model C**

𝔻: {**Neko**, **Barbie**, **Jack**}

**a**: **Neko** **b**: **Barbie** **c**: **Jack**
**G**: {**Neko**, **Jack**} **I**: {**Jack**}
**H**: {**Neko**, **Jack**} **J**: {**Neko**, **Barbie**}

**Model D**

𝔻: {**Neko**, **Barbie**, **Jack**}

**a**: **Neko** **b**: **Barbie** **c**: **Jack**
**G**: {**Neko**, **Jack**} **I**: {**Neko**, **Barbie**, **Jack**}
**H**: {**Neko**, **Jack**} **J**: {**Barbie**}