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.

∴ 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: {**Neko**} **H**: {**Rex**}

Model B

𝔻: {**Rex**, **Neko**}

A: **Rex** **B**: **Neko**
G: {**Neko**} **H**: {**Rex**, **Neko**}

Model C

𝔻: {**Rex**, **Neko**}

A: **Rex** **B**: **Neko**
G: { **Rex**, **Neko**} **H**: {**Rex**}

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. Jack isn't a coffee-drinking gambler.

∴ Jack doesn't drink coffee.

Translation Key:

A: Jack
G: __drinks coffee / coffee-drinking
H: __is a gambler

Model A

𝔻: {**Jack, Elvis**}

A: **Jack** **B**: **Elvis**
G: {**Jack, Elvis**}
H: {**Jack, Elvis**}

Model B

𝔻: {**Jack, Elvis**}

A: **Jack** **b**: **Elvis**
G: { } **H**: { **Elvis**}

Model C

𝔻: {**Jack, Elvis**}

A: **Jack** **B**: **Elvis**
G: {**Elvis**} **H**: {**Elvis**}

Model D

𝔻: {**Jack, Elvis**}

A: **Jack** **B**: **Elvis**
G: {**Jack, 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 Rex or Jack left the refrigerator unlocked.
2. Jack didn't leave the refrigerator unlocked.

∴ Neko is a lock-picking fish-eater.

Translation Key:

A: Neko
B: Rex
C: Jack
G: __is a cat
H: __eats fish
I: __picks locks
J: __left the refrigerator unlocked

Model A

𝔻: {**Neko**, **Rex**, **Jack**}

A: **Neko** **B**: **Rex** **C**: **Jack**
G: {**Neko**, **Jack**} **I**: {**Rex**}
H: {**Rex**} **J**: {**Neko**, **Rex**}

Model B

𝔻: {**Neko**, **Rex**, **Jack**}

A: **Neko** **B**: **Rex** **C**: **Jack**
G: {**Neko**, **Jack**} **I**: {**Neko**, **Jack**}
H: {**Neko**, **Rex**, **Jack**} **J**: { }

Model C

𝔻: {**Neko**, **Rex**, **Jack**}

A: **Neko** **B**: **Rex** **C**: **Jack**
G: {**Neko**, **Jack**} **I**: {**Jack**}
H: {**Neko**, **Jack**} **J**: {**Neko**, **Rex**}

Model D

𝔻: {**Neko**, **Rex**, **Jack**}

A: **Neko** **B**: **Rex** **C**: **Jack**
G: {**Neko**, **Jack**} **I**: {**Neko**, **Rex**, **Jack**}
H: {**Neko**, **Jack**} **J**: {**Rex**}