The language of predicate logic

1. Rx means that x is a rodent. Fx means that x is a feline. Exy means that x eats y. Cx means that x is cute. Let j be a constant referring to Jerry, t be a constant referring to Tom, m be a constant referring to Minnie, and k be a constant referring to Kitty. Translate the following English sentences into sentences of predicate logic.

   (a) Jerry is a rodent.

   ....

   (b) Kitty is a feline.

   ....

   (c) Felines are cute.

   ....

   (d) Tom is not cute.

   ....

   (e) If Tom is feline, then some felines are not cute.

   ....

   (f) Tom does not eat Jerry.

   ....

   (g) Minnie is not a feline.

   ....

   (h) If something is not a feline, it is a rodent.

   ....

   (i) Some things are rodents.

   ....

(j) There are rodents.

(k) Rodents are not cute.

(l) No rodent is cute.

(m) If Minnie is a rodent, Kitty eats Minnie.

(n) Some rodents eat felines.

(o) There are rodents that eat felines.

(p) No rodents eat felines.

(q) Kitty does not eat rodents.

(r) If something is a rodent, Kitty does not eat it.

(s) Some rodents are cute.

(t) Some cute things eat cute things.

2. Let the domain of discourse be all 5C (Pomona, Pitzer, Scripps, Harvey Mudd, CMC) students. Let Fx mean that x is a Pomona student, Gx mean that x is a Scripps student, Hx mean that x is a Harvey Mudd student, Jx mean that x is a Pitzer student. Let's also say no one attends two 5C colleges at once (I think that's true), every 5C college has some students. Let Px mean that x is currently taking PHIL60, and let's say that PHIL60 has a mix of 5C students except CMC students. Finally, let Sxy mean that x and y are taking the same class.

   Given this interpretation, indicate for each of the following sentences whether or not it is true.

   (a) $\exists x Gx \wedge \exists x Zx$

   .... True/False

   (b) $\exists x(Fx \wedge Hx)$

   .... True/False

   (c) $\forall x(Fx \supset Zx)$

   .... True/False

   (d) $\forall x(Gx \supset \neg Hx)$

   .... True/False

   (e) $\exists x(Zx \wedge Hx)$

   .... True/False

   (f) $\exists x(Px \wedge Fx)$

   .... True/False

   (g) $\exists y(Py \wedge Fy)$

   .... True/False

   (h) $\neg\forall x(Px \supset Hx)$

   .... True/False

   (i) $\forall x\forall y[(Px \wedge Py) \supset Sxy]$

   .... True/False

(j) $\forall x \forall y[Sxy \supset (Px \wedge Py)]$

. . . . True/False

(k) $\forall x\{Fx \vee [Gx \vee (Hx \vee Zx)]\}$

. . . . True/False

(l) $\exists x \neg\{Fx \vee [Gx \vee (Hx \vee Zx)]\}$

. . . . True/False

(m) $\exists x(\neg Fx \wedge \neg Gx)$

. . . . True/False

(n) $\exists x[(\neg Fx \wedge \neg Gx) \wedge Px]$

. . . . True/False

(o) $\forall x \forall y[(Gx \wedge Hy) \supset \neg Sxy]$

. . . . True/False

(p) $\exists x \exists y[(Fx \wedge Zy) \wedge Sxy]$

. . . . True/False

(q) $\forall z\Big(Pz \supset \{Fz \vee [Gz \vee (Hz \vee Zz)]\}\Big)$

. . . . True/False

(r) $\forall x[Px \supset \exists y(Zy \wedge Sxy)]$

. . . . True/False

(s) $\forall x \exists y[Px \supset (Zy \wedge Sxy)]$

. . . . True/False

(t) $\neg\exists x\Big(Px \wedge \neg\{Fx \vee [Gx \vee (Hx \vee Zx)]\}\Big)$

. . . . True/False

(u) $\neg\exists x\Big(Px \wedge \{\neg Fx \wedge [\neg Gx \wedge (\neg Hx \wedge \neg Zx)]\}\Big)$

. . . . True/False

3. For each of the following sentences, create an interpretation that makes the sentence true.

   (a) Gb

   (b) $Gc \supset Fc$

   (c) $(Gc \supset Fc) \wedge \neg Fd$

   (d) $\exists x Fx$

   (e) $\exists x Gx$

(f) $\exists x Fx \wedge \exists x Gx$

. . . .

. . . .

. . . .

. . . .

. . . .

(g) $\exists x Fx \wedge \neg \exists x Gx$

. . . .

. . . .

. . . .

. . . .

. . . .

(h) $\forall x (Gx \supset Fx)$

. . . .

. . . .

. . . .

. . . .

. . . .

(i) $\neg \forall x (Gx \supset Fx)$

. . . .

. . . .

. . . .

. . . .

. . . .

(j) $\neg \exists x (Fx \vee Gx)$

. . . .

. . . .

. . . .

. . . .

. . . .