Philosophy 1102

Instructor: Richard Johns

Problem Set 9

Hand in answers to the following questions during class on Thursday, March 21.

1. Translate the six sentences below into FOL *by completing the partial translations provided.* All the sentences are true in Peirce's world below. [1 mark each]

(E.g.) *Every cube is to the left of every tetrahedron.*

(i) Every small cube is in back of a large cube.

(ii) Some cube is in front of every tetrahedron.

(iii) A large cube is in front of a small cube.

(iv) Everything to the right of a large cube is small.

(v) Anything with nothing in back of it is a cube.

(vi) Every dodecahedron is smaller than some tetrahedron.
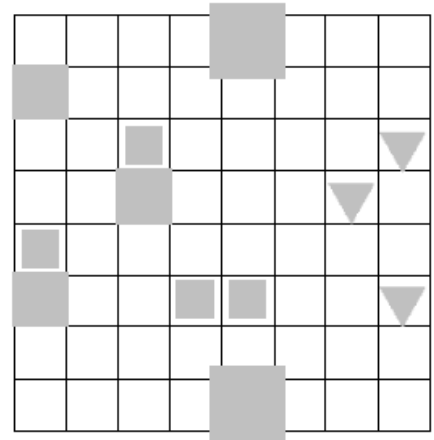
	Partial translations	missing part to add in FOL
E.g.	∀x (Cube(x) → ∀y (Tet(y) → LeftOf(x, y)))	x-is-to-the-left-of-every-tet
(i)	∀x ((Cube(x) ∧ Small(x)) →)	x-is-in-back-of-a-large-cube
(ii)	∃x (Cube(x) ∧)	x-is-in-front-of-every-tet
(iii)	∃x ((Cube(x) ∧ Large(x)) ∧)	x-is-in-front-of-a-small-cube
(iv)	∀x (→ Small(x))	x-is-to-the-right-of-a-large-cube
(v)	∀x(→ Cube(x))	there-is-nothing-in-back-of-x
(vi)	∀x (Dodec(x) →)	x-is-smaller-than-some-tet

2. Translate the following sentences into FOL. If correct, your answers will all be true in the world given below. [2 marks each, total 10]

   (i)   Some dodecahedron is such that all the tetrahedra in its row are medium.
   (ii)   If two tetrahedra are in the same row, then they're the same size.
   (iii) Every tetrahedron that adjoins a cube is the same size as it.
   (iv)   Only large objects have nothing in front of them.
   (v)   If e is between two objects, then they (the two objects) are both small.

(i)

(ii)

(iii)

(iv)

(v)
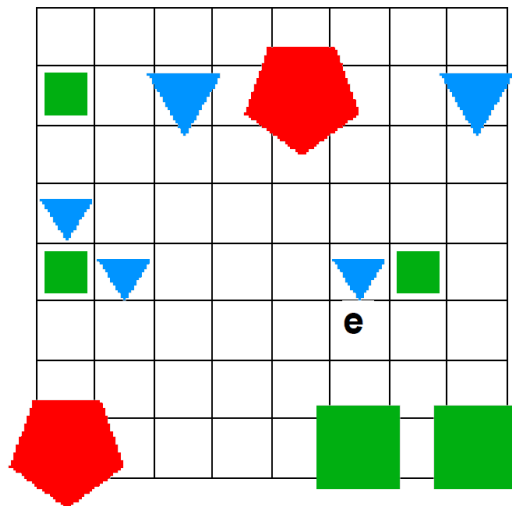
3. Translate each of the four ambiguous sentences below into **two** different sentences of FOL, each one expressing a possible meaning of the English. Please number your translations '(i)a' and '(i)b', '(ii)a' and '(ii)b', etc. as shown below.

In Carroll's world, given below, one of each pair of translations should be true and the other false. **The true sentence should be written as answer (a), and the false one as answer (b).** [2 marks for each FOL sentence, total 16]
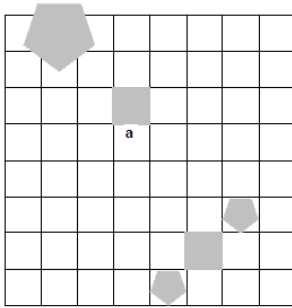
(i) Every cube is between a pair of dodecahedra.

(ii) Every cube to the right of a dodecahedron is smaller than it is.

(iii) <u>a</u> is not larger than every dodecahedron.

(iv) No cube is to the left of some dodecahedron.

(i)   a.

       b.

(ii)   a.

       b.

(iii)   a.

       b.

(iv)   a.

       b.

4. Show that the following arguments are FO con by providing *formal* proofs.

(i) [6 marks]

$\forall x\ (Tet(x) \rightarrow Large(x))$
$\neg Large(c)$
$\overline{\neg Tet(c)}$

(ii) [6 marks]

$\forall x(Tet(x) \rightarrow LeftOf(x, b))$
$\forall y(LeftOf(y, b) \rightarrow Small(y))$
$\overline{\forall y(Tet(y) \rightarrow Small(y))}$

(iii) [6 marks]

$\exists x(Tet(x) \lor Cube(x))$
$\forall y\ \neg Cube(y)$
$\overline{\exists x\ Tet(x)}$