Philosophy 1102

Answers to Problem Set 7

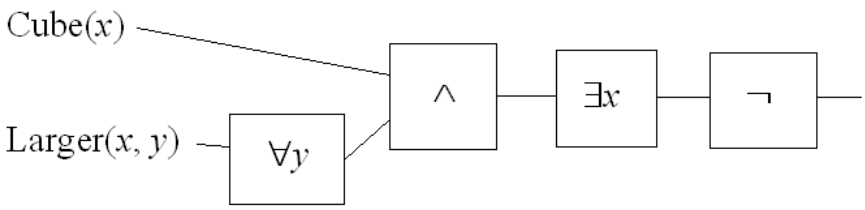
Total: 50 marks

1. [1 mark each, 8 total]

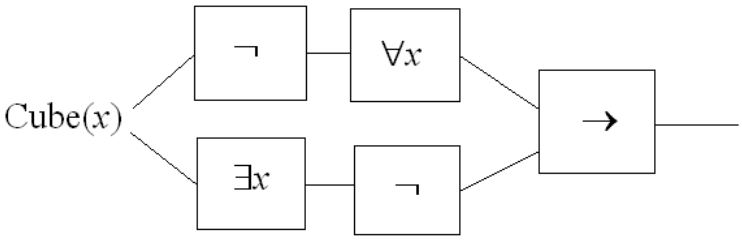
		Wff?	**Sentence?**
(i)	$\forall a$ (Medium(a) $\rightarrow$ Cube(a))	No	(No)
(ii)	Larger($\exists$, b) $\rightarrow$ Tet(b)	No	(No)
(iii)	$\exists t$ (Dodec(t) $\rightarrow$ Tet(t))	Yes	Yes.
(iv)	Cube(a) $\rightarrow$ Tet(x) $\rightarrow$ Tet(y)	No	(No)
(v)	$\exists x(\text{Dodec}(x) \wedge \text{Large}(y))$	Yes	No
(vi)	$\forall z(\exists w\ \text{Large}(w) \rightarrow \text{Cube}(z))$	Yes	Yes
(vii)	$\forall$v Cube(v) $\rightarrow$ Large(v)	Yes	No
(viii)	$\forall x$(Large(Cube(x)) $\rightarrow$ Small(y))	No	(No)

2. [2 marks each, 8 total]

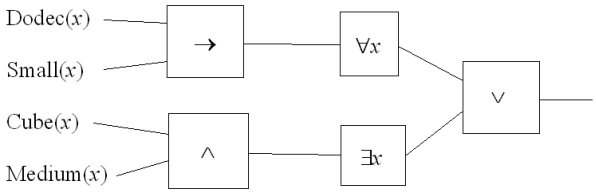
(i) Negation Sentence [Question was: $\neg\exists x(\text{Cube}(x) \wedge \forall y\ \text{Larger}(x, y))$]



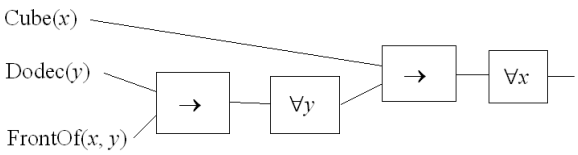
(ii) Conditional Sentence [Question was: $\forall x \neg \text{Cube}(x) \rightarrow \neg\exists x\ \text{Cube}(x)$]



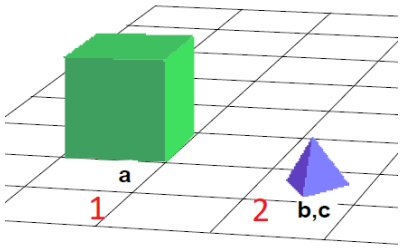
(iii) Disjunction Sentence $\forall x\ (\text{Dodec}(x) \rightarrow \text{Small}(x)) \vee \exists x\ (\text{Cube}(x) \wedge \text{Medium}(x))$
[question below]



(iv) Universal Sentence $\forall x(\text{Cube}(x) \rightarrow \forall y(\text{Dodec}(y) \rightarrow \text{FrontOf}(x, y)))$
[question below]



3. For each sentence below, fill in the satisfaction table to determine whether the sentence is true or false in the world provided. [1 mark for each table + 1 for each truth value = 6 total]



(i) $\forall x$ (Cube(x) $\rightarrow$ x = a) Truth value T [1 mark]

x =	$\forall x$	(Cube(x)	$\rightarrow$	(x = a	$\vee$	x = c))
1	T	T	T	T	T	F
2		F	T	F	T	T

(ii) $\forall x$ (x = a $\vee$ x = b) Truth value T [1 mark]

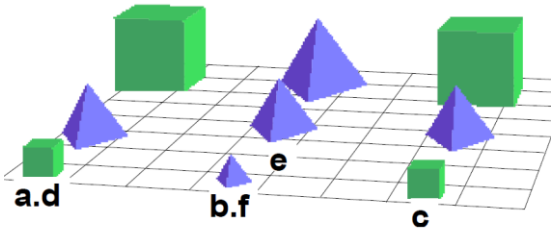
x =	$\forall x$	(x = a	$\vee$	x = b)
1	T	T	T	F
2		F	T	T

(iii) $\exists x$ (Smaller(x, a) $\wedge$ x $\neq$ b) Truth value F [1 mark]

x =	$\exists x$	(Smaller(x, a)	$\wedge$	x $\neq$ b)
1	F	F	F	T
2		T	F	F

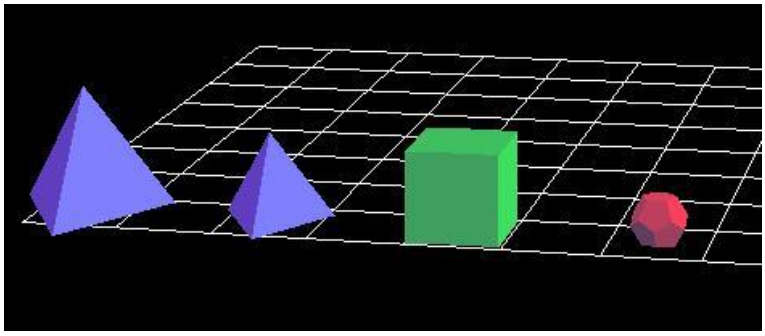
4. [1 mark for each truth value, 8 total]

T	1. ∃x (x ≠ a ∧ x ≠ b ∧ x ≠ c ∧ x ≠ d ∧ x ≠ e)
T	2. ∀x (x = a → x = d)
F	3. ∃x (Between(x, c, a) ∧ x ≠ b)
T	4. ∀x (Between(x, c, a) → x = b)
F	5. ∀x ((Tet(x) ∧ Medium(x)) → x = e)
T	6. ∀x (x = e → (Tet(x) ∧ Medium(x)))
T	7. ∀x ((Tet(x) ∧ Small(x)) ↔ x = b)
T	8. ∃y (y ≠ e ∧ SameRow(y, e))



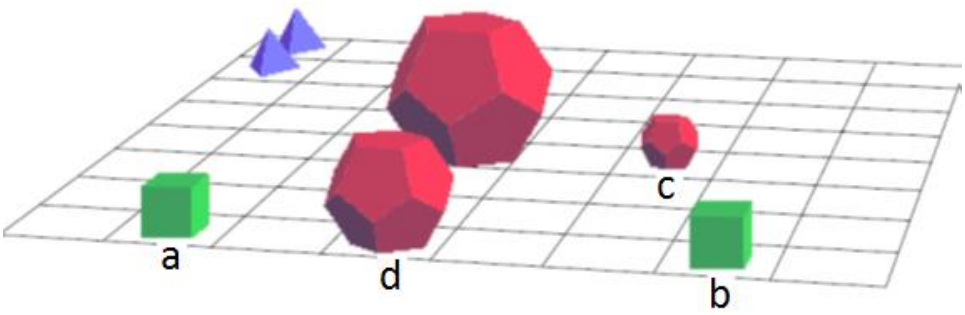
5. [5 marks for world]

T	1. ∃x (Tet(x) ∧ Large(x))
T	2. ∃x (Tet(x) ∧ Medium(x))
T	3. ∃x (Cube(x) ∧ ¬Small(x))
T	4. ∃y (Dodec(y) ∧ ¬Large(y))
T	5. ∀x (Cube(x) → Medium(x))
T	6. ∀x (Dodec(x) → Small(x))
T	7. ∀x (Tet(x) → ¬Small(x))
T	8. ∀y (Cube(y) → ¬Tet(y))



6. [1 mark each, 5 total]

1. All the tetrahedra are small. $\forall x\ (Tet(x) \rightarrow Small(x))$
2. Every large thing is a dodecahedron. $\forall y\ (Large\ (y) \rightarrow Dodec(y))$
3. Some dodecahedron is small. $\exists x\ (Dodec(x) \wedge Small(x))$
4. Some dodecahedron is neither large nor small. $\exists x\ (Dodec(x) \wedge \neg\ Large(x) \wedge \neg\ Small(x))$
5. No tetrahedron is medium. $\neg\exists x\ (Tet(x) \wedge Medium(x))$



7. Translate the five sentences below into FOL. If correct, all five sentences will be true in the world from Question 6. [2 marks each]

1. Some small dodecs are in back of d.

   $\exists x\ (Small(x) \wedge Dodec(x) \wedge BackOf(x, d))$

2. Only dodecs are medium.

   $\forall x\ (Medium(x) \rightarrow Dodec(x))$

3. Every tetrahedron is both left of and the same size as c.

   $\forall x\ (Tet(x) \rightarrow (LeftOf(x, c) \wedge SameSize(x, c)))$

4. No large dodec is in the same row as b.

   $\neg\exists x(Large(x) \wedge Dodec(x) \wedge SameRow(x, b))$

5. Every dodec that's in the same row as a is medium.

   $\forall x\ ((Dodec(x) \wedge SameRow(x, a)) \rightarrow Medium(x))$