

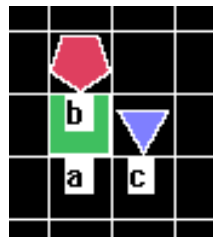
Instructor: Richard Johns

Answers to Problem Set 2

[Total: 45 marks]

1. It's invalid, as shown by this world where the premises are true and the conclusion is false. (Note that we could have $b=c$ in our world.)

- | | |
|---|------------------|
| T | 1. Adjoins(a, b) |
| T | 2. Adjoins(a, c) |
| T | 3. BackOf(b, a) |
| | |
| F | 4. FrontOf(c, a) |



[3 marks for world]

2. Here's a formal proof. You could of course go via $a = c$ instead of Tet(b).

[4 marks for the proof]

- | | |
|------------|-----------------|
| 1. Tet(a) | |
| 2. $a = b$ | |
| 3. $c = b$ | |
| 4. $c = c$ | ✓ ▽ = Intro: |
| 5. $b = c$ | ✓ ▽ = Elim: 4,3 |
| 6. Tet(b) | ✓ ▽ = Elim: 1,2 |
| 7. Tet(c) | ✓ ▽ = Elim: 6,5 |

2.24 [4 marks for proof] (You may give more detail, but this is a minimum.)

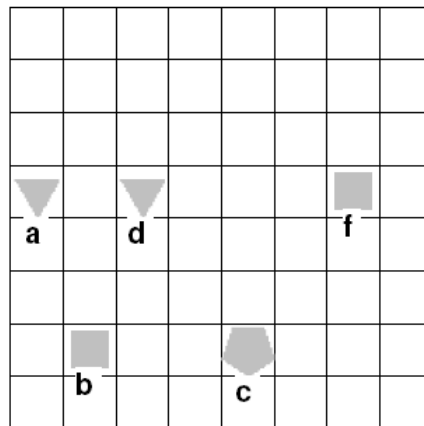
Larger(b, c)
 Smaller(b, d)
 SameSize(d, e)

 Larger(e, c)

Proof: P2 tells us that b is smaller than d. Hence d is larger than b. But b, in turn, is larger than c (from P1). Hence d is larger than c. Further, P3 says that d and e are the same size, so clearly e is larger than c. This is the required conclusion. ■

2.26 [3 marks for world]

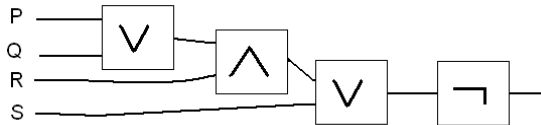
- T | 1. SameRow(b, c)
- T | 2. SameRow(a, d)
- T | 3. SameRow(d, f)
- T | 4. LeftOf(a, b)
- |
- F | 5. LeftOf(f, c)



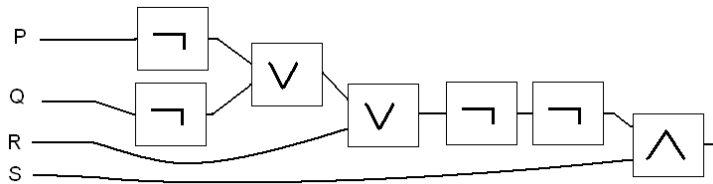
3. [2 marks each]

- | | |
|---|----------------------|
| (i) $\neg(P \wedge Q)$ | Negation sentence |
| (ii) $\neg P \wedge Q$ | Conjunction sentence |
| (iii) $\neg(\neg P \vee Q) \wedge (R \wedge S)$ | Conjunction sentence |
| (iv) $\neg((P \wedge (Q \vee R)) \vee S)$ | Negation sentence |

(v) Negation sentence



(vi) Conjunction sentence



4. [1 mark for each truth value -- total 10 marks]

F 1. $d \neq e$

T 2. $\text{Dodec}(c) \vee \text{Dodec}(a)$

T 3. $\text{Cube}(d) \wedge \text{Cube}(e)$

F 4. $\neg(\text{Cube}(d) \wedge \text{Cube}(f))$

F 5. $\neg(\text{Cube}(a) \vee \text{Cube}(f))$

T 6. $\neg(\text{Small}(a) \wedge \neg \text{Small}(f))$

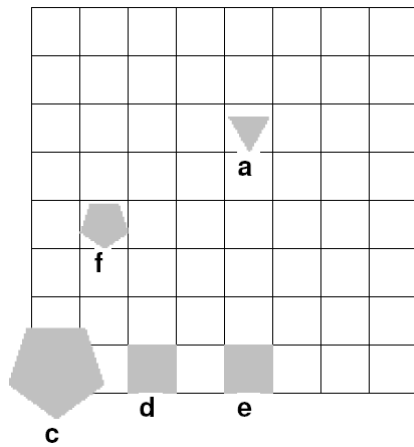
T 7. $\text{Dodec}(f) \vee \neg \text{Medium}(a) \vee \text{Tet}(e)$

T 8. $\neg(\text{Large}(c) \wedge \neg \text{Medium}(a)) \vee \neg \neg \text{Small}(f)$

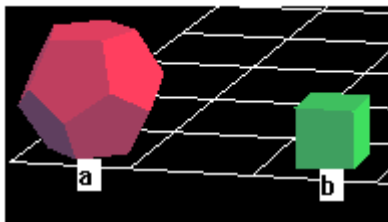
T 9. $(\text{SameSize}(a, f) \vee \text{SameSize}(d, e) \vee \text{Larger}(c, f)) \wedge \neg \text{Larger}(f, a)$

T 10. $\neg \neg \neg \neg \text{Medium}(d)$

5. Here's one such world. [5 marks for world]

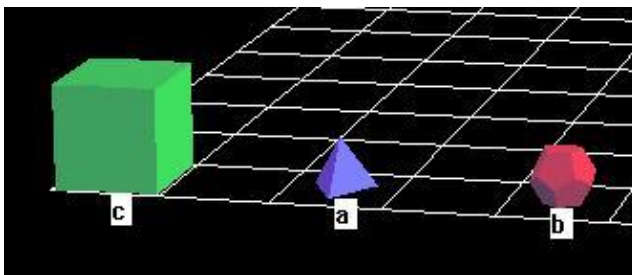


3.14 [2 marks for world]



T	1. $\neg \text{Small}(a) \vee \text{Small}(b)$
F	2. $\neg(\text{Small}(a) \vee \text{Small}(b))$

3.15 [2 marks for world] (You could make b a cube if you want.)



T	1. $(\text{Cube}(a) \wedge \text{Cube}(b)) \vee \text{Cube}(c)$
F	2. $\text{Cube}(a) \wedge (\text{Cube}(b) \vee \text{Cube}(c))$