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HOMEWORK
7.1, 7.2, 7.4 e f, 7.10 g h
8.6 a, b, c, 8.10 a, c, e, f, 8.23 a, c, 8.24 a, b, d

7.1 Suppose the agent has progressed to the point shown in Figure 7.4(a), page 239, having perceived nothing in [1,1], a breeze in [2,1], and a stench in [1,2], and is now concerned with the contents of [1,3], [2,2], and [3,1]. Each of these can contain a pit, and at most one can contain a wumpus. Follow the example of Figure 7.5, construct the set of possible worlds. (You should find 32 of them.) Mark the worlds in which the KB is true and those in which each of the following sentences is true:

alpha2 = "There is no pit in [2,2]."

alpha3 = "There is a rumpus in [1,3]."

Hence show that KB |= alpha2 and KB |= alpha3

[1,3]	**[2,2]**	**[3,1]**	**follows KB**	**alpha2 = "There is not pit in [2,2]"**	alpha3 = "There is a rumpus in [1,3]."	Hence show that KB |= alpha2 and KB |= alpha3
W, P	P	P	0	0	1	0
W, P		P	0	1	1	0
W, P	P		0	0	1	0
W	P	P	0	0	1	0
W, P			0	1	1	0
W	P		0	0	1	0
W		P	1	1	1	1
P	W,P	P	0	0	0	0
P	W,P		0	0	0	0
P	W	P	0	1	0	0
	W,P	P	0	0	0	0
P	W		0	1	0	0
	W,P		0	0	0	0
	W	P	0	1	0	0
W			0	1	1	0
	W		0	1	0	0

[1,3]	**[2,2]**	**[3,1]**	**follows KB**	**alpha2 = "There is not pit in [2,2]"**	alpha3 = "There is a rumpus in [1,3]."	Hence show that KB |= alpha2 and KB |= alpha3
		W	0	1	0	0
P	P	W, P	0	0	0	0
P	P	W	0	0	0	0
P		W, P	0	1	0	0
	P	W, P	0	0	0	0
P		W	0	1	0	0
	P	W	0	0	0	0
		W, P	0	1	0	0
P	P	P	0	0	0	0
P	P		0	0	0	0
	P	P	0	0	0	0
P		P	0	1	0	0
P			0	1	0	0
	P		0	0	0	0
		P	0	0	0	0
(nothing)	(nothing)	(nothing)	0	1	0	0

As we can see if the table, the one place where the KB is true, alpha2 is true and alpha3 is true. Thus we can say that KB |= alpha2 and KB |= alpha3

7.2 (adapted from bar wise and Etchemendy (1993).) Given the following, can you prove that the unicorn is mythical? How about magical? Horned?

If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned.

KB:
mythical(unicorn) -> immortal(unicorn)
not mythical(unicorn) -> mortal(unicorn) and mammal(unicorn)
immortal(unicorn) or mammal(unicorn) -> horned(unicorn)
horned(unicorn) -> magical(unicorn)

Mythical: We cannot determine if the unicorn is mythical. The only thing we know about mythical is that if it is it is immortal. Thus, we cannot prove it is mythical unless we were give more knowledge about the unicorn.

Magical: Working backwards through the KB, to be magical it must be horned. To be horned it must be either immortal or a mammal. Since we do not know if the unicorn is mythical we must look at the fact that the unicorn could be immortal or mortal and a mammal. Since both of mammal and immortal produce a horned unicorn we can prove that the unicorn is magical.

Horned: Since we had to prove the unicorn was horned to be magical and we decided that it was magical then yes we can prove that it is horned.

7.4 Which of the following are correct?

e. $A \Leftrightarrow B \models \neg A \vee B$

A	B	LHS	RHS
0	0	1	1
1	0	0	0
0	1	0	1
1	1	1	1

Since for all cases where the LHS is true the RHS is also true, this statement is correct.

f. $(A \wedge B) \Rightarrow C \models (A \Rightarrow C) \vee (B \Rightarrow C)$

A	B	C	LHS	RHS
0	0	0	1	1
0	0	1	1	1
0	1	0	1	1
0	1	1	1	1
1	0	0	1	1
1	0	1	1	1
1	1	0	0	1
1	1	1	1	1

Since for all cases where the LHS is true the RHS is also true, this statement is correct.

7.10 Decide whether each of the following sentences is valid, unsatisfiable, or neither. Verify your decision using truth tables or the equivalence rules of Figure 7.11 (page 249).

g. $Big \vee Dumb \vee (Big \Rightarrow Dumb)$

Big	Dumb	Big => dumb	big or dumb or (big=>dumb)
0	0	1	1
0	1	1	1
1	0	0	1
1	1	1	1

Valid, it is true in all models.

h. There is no part h in my book…

8.6 Which of the following are valid (necessarily true) sentences?

a. $(\exists x)(x = x) \Rightarrow (\forall y)(\exists z)(y = z)$

Valid.

b. $(\forall x)P(x) \vee \neg P(x)$

Valid

c. $(\forall x)Smart(x) \vee (x = x)$

Valid

8.10 Consider a vocabulary with the following symbols:
Occupation(p,o): Predicate. Person p has occupation o.
Customer(p1,p2): Predicate. Person p1 is a customer of person p2.
Boss(p1, p2): Predicate. Person p1 is a boss of person p2.
Doctor, Surgeon, Lawyer, Actor: Constants denoting occupations.
Emily, Joe: Constants denoting people.
Use these symbols to write the following assertions in first-order logic:
a. Emily is either a surgeon or a lawyer.

$Occupation(Emily, Surgeon) \vee Occupation(Emily, Lawyer)$

c. All surgeons are doctors

$(\forall p)Occupation(p, Surgeon) \Rightarrow Occupation(p, Doctor)$

e. Emily has a boss who is a lawyer

$(\exists p)Occupation(p, Lawyer) \wedge Boss(p, Emily)$

f. Every surgeon has a lawyer.

$(\forall p1)(\exists p2)Occupation(p1, surgeon) \wedge Occupation(p2, Lawyer)Customer(p1, p2)$

8.23 For each of the following sentences in English, decide if the accompanying first-order logic sentence is a good translation. If not explain why not and correct it. (Some sentenced may have more than one error!).

a. No two people have the same social security number:

$(\neg \exists x, y, n)Person(x) \wedge Person(y) \Rightarrow [HasSS\#(x, n) \wedge HasSS\#(y, n)]$

They need to take into account that person x and y need to be different people.

$(\neg \exists x, y, n)Person(x) \wedge Person(y) \wedge \neg(x = y) \Rightarrow [HasSS\#(x, n) \wedge HasSS\#(y, n)]$

c. Everyone's social security number has nine digits.

$(\forall x, n)Person(x) \Rightarrow [HasSS\#(x, n) \wedge Digits(n, 9)]$

This one looks ok

8.24 Represent the following sentences in first-order logic, using a consistent vocabulary (which you must define):
classtaken(s, c, y): A student s has taken class c in semester y
classPassed(s, c): A student s has passed class c
bestScore(c): best score received in class c
French, Greek: constants denoting classes
Spring2001: constants denoting semester

a. Some student took French in Spring 2001.

$$(\exists s) classtaken(s, French, Spring2001)$$

b. Every student who takes French passes it.

$$(\forall s y) classtaken(s, French, y) \Rightarrow classPassed(s, French)$$

d. The best score in Greek is always higher than the best score in French.

Got stuck determining how to denote a higher than clause.