Amy Ses 505 328 863 CS 161 HW 5

1. $P \Rightarrow 1Q$, $Q \Rightarrow 7P$ 1PV7Q 7QV7P

_Р	ပြ	76	ો વ	P=>7Q	Q ⇒ 7P
τ	٦	F	F	F	F
τ	F	F	T	Т	Ť
F	T	T	F	T	Т
۴	F	T	Ť	T	T

P⇒ 7Q and Q⇒7P are equivalent

P⇔ 7Q: P⇒1Q,7Q⇒P, ((PN7Q) V (1P \Q)) (7P V 7Q)N(Q V P)

	() (
<u> </u>	Q	1P	7Q	P# 70	((PA7Q) U (7PAQ))
τ	τ	F	£	F	F
τ	F	F	Τ	т	Т
F	T	T	F	ΙT	l T
P	١٢	T	Τ̈́	ľĖ	Ė
				,	

 $P \Leftrightarrow 7Q$ and (CPN 7Q) V ($1P \land Q$)) are equivalent

d. (smoke ⇒ fire) ⇒ (7 smoke ⇒ 7 fire) (7 smoke v fire) ⇒ (smoke v 7 fire) 7(7 smoke v fire) V (smoke v 7 fire) (smoke ∧ 7 fire) V (smoke v 7 fire)

smoke	fire	smoke 17 fire	smoke V 7 fire	(smoke 17 7Are) V	(smoke V 7 fire)
7	Т	F	Т	T	
T	F	Т	ī	7	
F	T	F	F	F	
F	F	F	Τ	, T	

since (smoke => fire) => (7 smoke => 7 fire) is satisfied in 3 of the 4 wonds, it is neither valid nor unratified.

(Smoke ⇒ fire) ⇒ ((Smoke V heat) ⇒ fire) (7 smoke V fire) ⇒ (7 (Smoke V heat) V fire) 7(7 smoke V fire) V ((7 smoke 1/2 Theat) V fire) (smoke 1/2 Theat) V ((7 smoke 1/2 Theat) V fire)

smoke	fire	lneat	smoke 17 The	(7 smoke 1 7 heat) V fire	(smoke 17 fire) V ((7 smoke 1 7 heat) V fire)
7	7	т	F	T	Т
τ	7	F	F		7

T	F	T F T F T F	Τ	Þ	Т
T	F	F	7	F	T T
P	T	lτ	F	T	T
F	T	F	F	T	T
F	F	Τ	F	F T	F
F	F	F	F	7	1

since (smoke ⇒ fire) ⇒ ((smoke V heat) ⇒ fire) is satisfied in 7 of the 8 wonds, it is neither valid nor unsatisfied.

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((smoke N neat) ⇒ fire) ↔ ((smoke ⇒ fire) V (neat ⇒ fire))

(7(smoke N reat) V fire) ↔ ((7 smoke V fire) V (7 heat V fire))

((7 smoke V 7 heat) V fire) ↔ ((7 smoke V fire) V (7 heat V fire))

S((7 smoke V 7 heat) V fire) → ((7 smoke V fire) V (7 heat V fire))

((7 smoke V fire) V (7 neat V fire)) ⇒ ((7 smoke V 7 heat) V fire)

F ((7 smoke V 7 heat) V fire) V ((7 smoke V fire)V(7 heat V fire))

7((7 smoke V fire) U (7 heat V fire)) V ((7 smoke V 7 Vreat) V fire))

S(7(7 smoke V 7 heat) N 7 fire) V (7 smoke V 7 heat)

((7 smoke V 7 heat) N 7 (7 heat V fire)) V (7 smoke V 7 heat)

S(smoke N heat N 7 fire) V (7 smoke V 7 heat)

((smoke N 7 fire) N ( heat N 7 fire)) V (7 smoke V 7 heat V fire)
```

<u>smoke</u>	heat	fire	(smoke 1 heat 17 fire) U (Ismoke v fire v 7 heat)	((smoke 17 firt) 1 (heat 1 7 fire)) V (7 smoke v 7 hear V fire)
Т	T	T	Т	Τ
τ	T	F	T	Т
T	F	τ	Т	T
T	F	F	τ	Τ
F	τ	T	7	T
F	Т	F	T	τ
F	F	۲	Т	l T
F	F	F	T	٦
				•

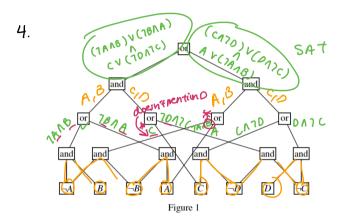
((smoke Λ heat) \Rightarrow fire) \iff ((smoke \Rightarrow fire) V (heat \Rightarrow fire)) is T in all would so it is valid.

3. a) mythical
$$\Rightarrow$$
 immortal $N \Rightarrow I$ abbreviated $M \Rightarrow I$ $M \Rightarrow$

b) 7MVI MV(7I A A) distribute to (MV7I) A (MVA) 7(IVA) VH = (7I A 7A) V H distribute to (7I V 7A) A (7A V H) 7HVG \(\Delta : \{ 7MVI \, (MV7I) \, A (MVA) \, (7I V 7A) \, A (7A V H) \, 7H V G\}\) CNF: (7MVI) \(A (MV7I) \, A (MVA) \, A (7I V 7A) \, A (7A V H) \, A (7H V G)\)

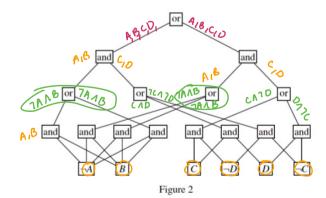
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c) m= mythical
   I = inmonal
    A = mammal
    H = horned
    G = magical
   Δ: {7MVI, (MV7I) Λ (MVA), (7IV7A) Λ (7AVH), 7HVG}
  * Is unicorn mythical?
    0 = M
    KB: D17X
      O. IMVI
      1. MV7I
     2. MVA
        7 # V7A
     4. 7AVH
      5. 7HVG
     6. 7m VA
                30
        7 M
                 2,7
         Α
                 2,8
      9. 7I
     10.
        H
                 4,8
                 5,10
     11.
     no contradiction is found, so ∆ ≠ & and unicorn cannot be proven mythical.
  * Is unicorn magical?
    Q= G
    KB: A170
      O. IMVI
      1. MV7I
     2. MVA
         7 # V7A
                     Δ
     4. 7AVH
      5. 7HVG
      6. 7m V A
                   7 X
      7. 79
                    5,7
     С.
        7H
     9.
         7 A
                    4,8
                   2,9
     10.
                    0,10
     11.
    12. TM)
                    619
    contradiction, so A = X
    unicorn is proven magical
 * 15 unicorn horned?
    Q=H
    KB: ANTA
      O. IMVI
      1. MV7I
      2. MVA
        7 ‡ v 7 A
                     Δ
```

4.	7A V F	1 (
5.	7H V	ia \	
G.	7m v	a J	
7.	74	}	X
8.	7A		4,7
9.	(m)		8, ۾
10.	I		0,9
11.	(m)		8, ع
cont	radict	ion , so	Δþα
unic	corn is	proven	horned



- · decomposable v
- · deterministic X
- · not smooth *

Figure 1 is decomposable, but not deterministic nor smooth because the top OR gate has children that are SAT and some of the OR gates have children w/a different set of variables.



- · decomposable V
- · deterministic X
- · smooth V

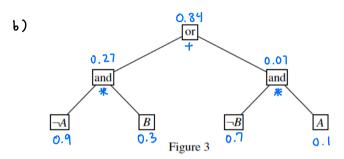
Figure 2 is decomposable and smooth because all the AND gates do not share variables and all Ok gates have children that mention the same variables. It is NUT deterministic because there are Ok gates w/ children that are SAT.

5. $\omega(A,7B,C) = \omega(A) \omega(7B) \omega(C)$

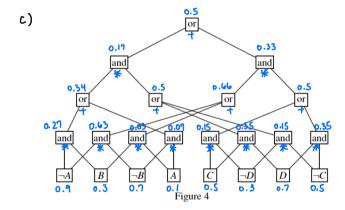
WMC: added weight of its satisfying assignments W(A)= 0.1 W(B)=0.3 W(C)=0.5 W(D)=0.7 W(7A)=0.9 W(7B)=0.7 W(TC)=0.5 W(7D)=0.3

a) (7A 1 B) V (7B 1 A)

•					
_A	В	71 1 B	7B / A	(7A N B) V C 7B N A)	weight
T	T	F	F	F	×
T	F	F	τ	T	(0.1)(0.7)= 0.07
È	`	Т	l F	T	(0.1)(0.7) = 0.07 (0.9)(0.3) = 0.27
F	F	F	F	F	t x
•	•		•	' \wMረ:	0.34



The count on the noot is equal to the wmc.



wmc = 0.5