```
(a) (A = 7B) = 7(BAA) + (A = 7B) => 7(BAA)
                                      (A=) 7B) => 7 (B/A)
           A => 7B 7 (B/A)
 AB
    T
                F
 TF
                             T
                                             T
                 T
  FT
                T
  FF
                 T
                                             T
                             T
      (A \gg 7B) = 7(B \land A)
(6) (A => 7B) F 7 (B/A)
   i) (A⇒7B) ⇒ 7(BAA) = 7(A⇒7B) V 7(BAA)
                         =7(7AV7B)V7(BAA)
    ii) 7 (7A V7B) = AAB
    iii) (A/B) V7(B/A) = True, (Valid)
       : (A ⇒ 7B) } 7 (B/A)
(c) (A \Rightarrow 7B) \models 7(BAA)
 KB: A=>7B = 7A V7B ---- 0
  € 7 (7 (BAA)) = BAA ---- 2
         $\phi$ generated by $\phi + \emptyset$
```

= (A ⇒ 7B) = 7 (B ∧A)

```
2. (a) ((5 1R) ⇒ P) A (5 ⇒ 7R) A (R ⇒ 75) A S
   = (7(5\Lambda R)VP) \Lambda (75V7R) \Lambda (7R\Lambda75) \Lambda5
  = (75 V7R VP) 1 (75 V7R)15
  = (75 V 7R VP) A { (75 / 5) V (7R / 5)}
  = (75 V7R VP) 1 7R 15 = 51 (75 V7R VP) 17R
  = {(5/175) V (5/17R) V (5/1P)}/17R
  = { (5/1R) V (5/1P) } / 7R = 5/ (7R VP) / 7R
(Truth Table)
                    S N (TR VP) NTR
    5 7R P
                        TATAT =T
    TTT
                        T \wedge (TVF) \wedge T = T
    T F
    TFT
```

TA (FVT) AF =F

TA (FVF) AF =F

F / (TVT) AT = F

F A (TVF)AT =F

F 1 (FVT) 1F=F

F / (F VF) /F=F

.. The sentence is satisfiable. (neither valid nor unsatisfiable)

FTT

TFF

FTF

FFF

FFT

```
(b) ((p 1 75) ⇒R) ⇒ (7PV5 VR)
 \equiv \left( \neg (P \land 15) \lor R \right) \Rightarrow \left( \neg P \lor 5 \lor R \right) \equiv \neg \left( \neg (P \land 75) \lor R \right) \lor \left( \neg P \lor 5 \lor R \right)
 = (P/15/17R) V (1P V5 VR)
= (PV(7PV5VR)) / (75 V (7P V5VR)) / (7R V (7PV5 R))
= (Truev S vR) 1 (Truev 7P VR) 1 (Truev 7P VS)
 (: PV7P = 75 VS = 7R VR = True (Valid))
= True / True True = True (Valid)
    : The sentence is valid.
 51: P=> 7(QVR) = 7P V7(QVR) = 7P V/7QA
                                                                 JR)
                       = (7P V 7Q) 1 (7P V7R)
  .. 51 = (7P V7Q) A (7P V7R)
 52: (P \land Q) \Leftrightarrow S = ((P \land Q) \Rightarrow S) \land (S \Rightarrow (P \land Q))
                      \equiv (\gamma(P \wedge Q) \vee S) \wedge (\gamma S \vee (P \wedge Q))
                      = (7PV7QV5) \wedge (75V(PAQ))
                      = (7P V 7Q V S) A (75VP) A (75VQ)
```

 $1.52 \equiv (7PV7QV5) \wedge (75VP) \wedge (75VQ)$

```
4.
(KB)
 /. A VB
 2. 7B V7C
 3.7C VD
 4. B V 1E
 5. 1D V E
(a) KB = 70?
                   11. BV > ( 4+10)
 6. D (7(701)
 7 E (5+6)
                    12. 7C V7E (2+4)
 8. B (4+9)
                     13, 70 (8+12)
 9.70 (2+8)
                      14. A V7C (1+2)
 10. 1( VE (3+5) 15. BV7D (4+5)
   : $\phi$ not generated.
      : KB # 7D. (KB does not entail 1D.)
(b) KB = (BV7D)
 6. 7B1D (7 (BV70))
 7. B V 7D (4+5)
 \phi. \phi = \{3, (6+7)\}
```

Since ϕ is generated, $KB \models (BV7D)$. $\therefore KB \models (BV7D) \cdot (KB \text{ en tails } (BV7D))$