```
PROBLEM-I
              PL Sentences into CNF form.
                               Conjunction(MOF Disjunction(V)
       a) (PAQ) => (RAS)
          T(PAO) V (RAS)
          (7PV70)V (RAS)
        (TPV-QVR) 1 (PV-QVS)
      b> (PAQ) => (RVS)
         T (PAQ) Y (RVS)
         TPV TQ V RVS
      c> (PvQ) => (RAS)
        7(PVQ) V (RAS)
       (TPATQ) Y (RAS)
       [TPV (RAS)] A [TQV (RAS)]
       (TPVR) 1 (TPVS) 1 (TRYR) 1 (18 VS)
    d) (PvQ) => (RVS)
      7(PVQ)V (RVS)
     (TPA -Q) V(RVS)
    (TPVRVS) 1 (TQVRVS)
 e> (¬PAQ) (RV¬S) -> [(¬PAQ) -> (RV¬S)] A [(RV¬S) -> (¬PAQ)]
[7 (7PAQ) V (RV7S)] A [7 (RV7S) V (7PAQ)]
 [(PV70)V(RV7S)] 1 [(1R15)V(7P1Q)]
```

[(PV70)V(RV7S)] 1 [TRV(TP10) 1 SV(TP10)]

([PV70)V(RV75)] A (TRV7P) A(TRV6) A(SV7P) A(SV0)

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PROBLEM- II
             a> KB Entail (TANTB)?
        Given KB.
           R: TAVBVE
           R2: TBVA
           R3: TEVA
           Ru: TEVD
           Rs: 7CV7FV7B
           RC: TEVB
           Ra: 7BVF
            Rx: TBVC.
            Rq: ¬(¬AN¬B) ≈ (AVB) (Proof By Controdiction)
            R10: A (R22 R9)
            R11: (B VE) (R, 2 R10)
            R12: B (R62R11)
             R13: F (R72 R12)
             R14: C [R82R12)
             RIS: 7C VTF (R52 R12)
             R17: 7F (R142R15)
             R18: Ø (R142R17)
```

Hence KB Entails (TANTB) !!

KB = (TANTB)

Given KR: b> KB Entails E??	0
Given kB.  RI: TAV BVE	
Re: JBVA	
R3: TEVA	
R4: TEVD	
R5: 7CV7FV7B	
Re: JEV B	
Ra: TBVF	
R8: 7BVC	
	Contradiction.
Rio: TAVB	
R11: ¬BVB ≈ True	R2&R10
Rig! T CVT AVT F	R52 R10
Ris! TAVF	R72R10
RI4: TAVC	R82 R10
RIS: 7BV7CV7F	R22 R12
RIG: TEVTONTE	R3 & R12
R17: 7AV 7B=V 7C	R72 R12
RIB: TAVTEVTB	R82 R12
Rig: -18EVF	(R32R13)
R20: JAVJCVJB	R52 R13
Rai: TEVC	R32 R14
Ru: TAVEVTCYTE	R12 R15
Raz: TBVTC	R72R15
Re4: 7BV7F	R82R15
RES: TAVBYCVTF	R12 R16
R26: 7BVTEVTF	R\$ & R16

(3)

ROT: JAVJEVJE

R28: JAVJEVJC

Rog: TEVTC

R30: TEVTF

R31: 7A V TC

RIY & RIB

Ri3 & Rib

RIL & Rig

R168 R21

RigeRze

PROBLEM III

English Sendences Using FOL

Given Predicates

Occupation (P.O)

Customer (P1, P2)

Boss (P, P2)

Given Constants.

Doctor, Surgeon, Lowyer, Actor.

Emily, Joe.

as Emily is either a surgeon or a lawyer.

Occupation (Emily, Surgeon) V Occupation (Emily, Lawyer).

by Joe is and actor but he holds another Job.

Occupation (Joe, Actor) 1 Occupation (Joe, Actor).

In Occupation (Joe, x).

c> All Surgeons are Doctors.

tx [Occupation (x, Surgeon) ⇒ Occupation (x, doctor)]

D) Joe doesn't have a Lawyer.

3x Occupation (x, Lawyer) 1 T Customer (Joe, x)

E) Every Surgeon has a Lawyer.

∀x [Occupation (x, Surgeon) ⇒ Constantes

∃y Occupation (y, Lawyer) Λ

Customer (x,y)

a)  $\forall x P(x) \Rightarrow \theta(x)$ YX TP(X) Y Q(X)

TP(x) VQ(x)

by txty P(x,y) => ((x)

Yx 7 [ Yy P(X,Y)] V Q(X)

(x) B V (Y, X) 9 P VE XX

Yx P(x), F(x)) Y Q(x)

P(x, F(x)) V Q(x)/

(x) D x (x) A Q(x)

(X) A (X) A XE

(x,y) D N (Y,x) YEXE (D

FX BY P(x,x) A Q(y,x)

P(A, B) A Q(B, A)

EX Jx Xy P(X,Y)

3x xy P(X, Y)

Ty PlA, Y)

P(A, Y)

F> Xx Jy P(x, y)

(Y, X) q yExt

Yx P(x, F(x))

P(x, F(x)

XX PECKET & A CONTROL X FOX

(XIA A ((XII)) A ((X) 7-X)

G>  $\forall x \forall y \exists z P(x, y, z)$   $\forall x \forall y \exists z P(x, y, z)$   $\forall x \forall x \Rightarrow P(x, y, F(x, y))$ P(x, y, F(x, y))

H.  $\exists_{X} \forall_{Y} \forall_{Z} P(X,Y,Z)$   $\exists_{X} \forall_{Y} \forall_{Z} P(X,Y,Z)$   $\forall_{X} \forall_{Z} P(A,Y,Z)$  P(A,Y,Z)

I.  $\forall_x (\exists_y P(x,y) \land Q(y)) \Rightarrow R(x)$   $\forall_x \neg [\exists_y P(x,y) \land Q(y)] \lor R(x)$   $\forall_x \forall_y \neg P(x,y) \lor \neg Q(y) \lor R(x)$   $\neg P(x,y) \lor \neg Q(y) \lor R(x)$ I.  $\forall_x (\forall_y P(x,y) \Rightarrow Q(y)) \Rightarrow R(x)$   $\forall_x \neg (\forall_y \neg P(x,y) \lor Q(y)) \lor R(x)$   $\forall_x \exists_y (P(x,y) \land Q(y)) \lor R(x)$   $\forall_x [P(x,F(x)) \land Q(F(x))] \lor R(x)$   $[P(x,F(x)) \land Q(F(x))] \lor R(x)$ 

P(x,F(x) Y R(x)) 1 Q(F(x)) Y R(x)

PROBLEM V

Substantation to Unity Sentinces,

a. P(x) b. PLA)

SXIAZ

a. P(A) b. P(A)

C. P(x) V Q(x,A) d. PLB) Y Q(X,A)

{X/B} C: P(B) V Q(B, A)

J: P(B) VQ(B, A)

e. P(x) v &(A,x)

{X/B} e: P(B) V Q (A, B) f: P(B) V Q (A, B)

f. Plx) V Q(A,B)

9. P(x,A) VQ(A,X)

h. P(B, Y) YQ (Y,B)

{X/B, Y/A} 9: P(B,A) Y Q(A,B) h: P(B,A) Y Q(A,B)

: PLX) V Q(FLX))

SX/A3

: P(A) V Q(F(A))

J: P(A) Y Q(F(A))

j: PLA) VQ(F(A))

k: P(x,A) V Q(F(x), X) [x/B, Y/A]
L: P(B,Y) V Q(F(B), B)

k: P(B,A) VQ(F(B),B) l: P(B,A) V Q ( F(B), B).

m: P(x,A) V Q(F(x), X) No Substantation to n: P(B, V) V Q(F(A), A) Unify these sentences.

0: P(X,Y) V Q(F(A),B) {x/F(A),Y/B} 0: P(F(A),B) VQ(F(A),B)
P: P(X,Y) V Q(X,Y)

Q: P(x, y) Y Q(F(A), A) {x/F(A), Y/A} Y: P(F(A), A) Y Q(F(A), A)
Y: D(x, y) X Q(x, y)

r: P(x, y) V Q(x, y)

s: P(x,y) VQ (f(x), Y)

No Substantation to

t: P(Z,Y) Y Q(Z, Y)

Unify these sentences.