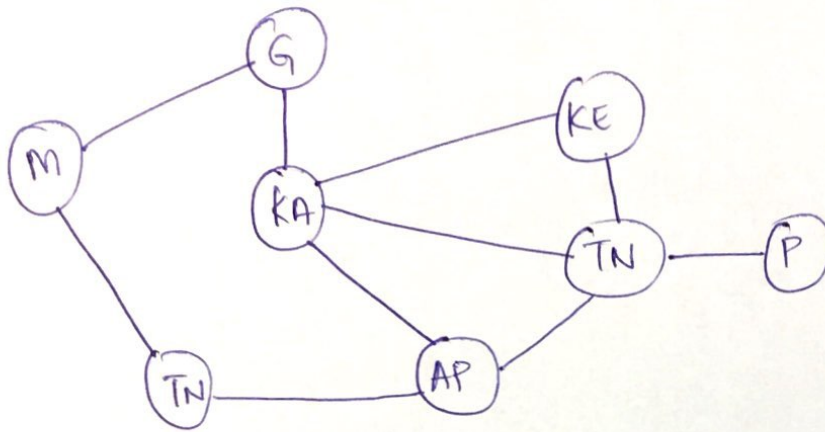


Solution 1 :

(a)



Subproblem-1

SL

Subproblem-2

Yes, we can simplify this problem since SL is not connected to other nodes and it is an independent subproblem.

Both these subproblems can be solved independently and their subproblems are combined together in order to get the final solution.

(b)

Subproblem 1

Level 0	(KA)	TN	M	TL	AP	KE	G	P
MRU	4	4	4	4	4	4	4	4
Degree Heuristic	6	4	3	3	3	2	2	1

KA is chosen

Level 1	(TN)	M	TL	AP	KE	G	P
MRU	3	3	3	3	3	3	4
Degree Heuristic	4	3	3	3	2	2	1

TN is chosen

Level 2	M	TL	(AP)	KE	G	P
MRU	3	3	2	2	3	3
Degree Heuristic	3	3	3	2	2	1

AP is chosen

Level 3	M	(TL)	KE	G	P
MRV	3	2	2	3	3
Degree Heuristic	3	3	2	2	1

TL is chosen

Level 4	(M)	KE	G	P
MRV	2	2	3	3
Degree Heuristic	3	2	2	1

M is chosen.

Level 5	(KE)	G	P
MRV	2	2	3
Degree Heuristic	2	2	1

KE is chosen

Level 6	G	P
MRV	2	3
Degree Heuristic	2	1

G is chosen

Level 7	(P)
MRV	3
Degree Heuristic	1

P is chosen.

For SL, it can be assigned any value and can be combined with solⁿ of 1st subproblem for final solution.

(C) Degree Harizbe - First Sub Problem

- Level 0 KA-G, TN-4, M-3, TL-3, AP-3, KE-2, G-2, P-1, SL-0
- Level 1 KA-R, TN-4, M-3, TL-3, AP-3, KE-2, G-2, P-1
- Level 2 KA-R, TN-B, M-3, TL-3, AP-3, KE-2, G-2, P-1
- Level 3 KA-R, TN-B, M-3, TL-3, AP-G, KE-2, G-2, P-1
- Level 4 KA-R, TN-B, M-G, TL-B, AP-3, KE-2, G-2, P-1
- Level 5 KA-R, TN-B, M-G, TL-B, AP-G, KE-2, G-2, P-1
- Level 6 KA-R, TN-B, M-G, TL-B, AP-G, KE-G, G-2, P-1
- Level 7 KA-R, TN-B, M-G, TL-B, AP-G, KE-G, G-B, P-1
- Level 8 KA-R, TN-B, M-G, TL-B, AP-G, KE-G, G-B, P-R

↓
Solution

SL-R ← Second Sub Problem

⇒ M-R, G-G, KA-B, TL-Y, AP-R
TN-G, KE-Y, P-R, SL-R.

Solution 2 :

```
Check_Equivalence (KB1, KB2) {  
    return Check_Implies (KB1, KB2) and Check_Implies (KB2, KB1);  
}
```

```
Check_Implies (KB1, KB2) {  
    return OR (NOT (KB1), KB2);  
}
```

```
NOT (KB) {  
    return !KB;  
}
```

```
OR (KB1, KB2) {  
    return KB1 || KB2;  
}
```


Solution 3 :

PART A :

Yes, because if KB is true at any state, S_1 is true too if KB is false at any state S_1 is either true or false which satisfies the conditions for entailment.

Hence, $KB \models S_1$

PART B :

No, if KB is true at any state and S_1 is false, this doesn't satisfy the conditions for entailment.

Hence, by truth table for ~~entailment~~ inference,

$KB \not\models S_1$

Solution 4

$$\text{CNF form} = (\neg A \vee B \vee \neg C \vee D) \wedge (\neg A \neg B \vee \neg C \vee \neg D)$$

A	B	C	D	KB
F	F	F	F	T
F	F	F	T	T
F	F	T	F	T
F	F	T	T	T
F	T	F	F	T
F	T	F	T	T
F	T	T	F	T
F	T	T	T	T
T	F	F	F	T
T	F	F	T	T
T	F	T	F	F
T	F	T	T	T
T	T	F	F	T
T	T	F	T	T
T	T	T	F	T
T	T	T	T	F

As per Rules, CNF is calculated.

$$(NF(KB)) = \neg (Row 10) \wedge \neg (Row 15)$$

$$= \neg (A \wedge \neg B \wedge (C \wedge \neg D)) \vee \neg (A \wedge B \wedge (C \wedge D)) \quad \therefore \text{De Morgan Law}$$

$$= (\neg A \vee B \vee \neg(C \vee D)) \wedge (\neg A \vee \neg B \vee \neg C \vee \neg D)$$

\therefore CNF

Solutions:

A : It rains on May 1, 2017

B : John gives a check for \$10,000 on May 2, 2017

C : Mary mows the lawn on May 3, 2017

Part A : $(A \rightarrow B) \wedge (B \rightarrow C)$

Part B : What truly happened:

$\neg A$: Did not Rain

B : John gave Mary a \$10,000

C : Mary mowed the lawn

Part C : Contract was not violated as you see below

$\neg A \wedge B \wedge C$: F, T, T;

Contract : T

\therefore Contract is not violated.

Truth Table

A	B	C	$(A \rightarrow B)$	$(B \rightarrow C)$	Contract $(A \rightarrow B) \wedge (B \rightarrow C)$
F	F	F	T	T	T
F	F	T	T	T	T
F	T	F	T	F	F
F	T	T	T	T	T
T	F	F	F	T	F
T	F	T	F	T	F
T	T	F	T	F	F
T	T	T	T	T	T

Solution 6:

① $\exists x \text{ Dog}(x)$

② $\exists x \text{ Dog}(x) \wedge \text{Name}(x, \text{Shadow})$

③ $\text{Gives}(\text{John}, \text{Mary}, \text{Shadow})$

④ $\text{Male}(\text{Shadow}) \rightarrow \text{Gives}(\text{Mary}, \text{John}, x) \wedge \text{Smartphone}(x)$

⑤ $\text{Female}(\text{Shadow}) \rightarrow \text{Gives}(\text{Mary}, \text{John}, x) \wedge \text{Laptop}(x)$

⑥ $\forall x \forall y \text{ Gives}(\text{John}, x, y) \wedge \text{Person}(x) \rightarrow \text{Male}(y) \wedge \text{Dog}(y)$

⑦ $\text{Gives}(\text{Mary}, \text{John}, x) \wedge \text{Laptop}(x)$

* x, y, z are

→ x and y are variables. Shadow, John & Mary are constants
→ Male, Dog, Name, Gives, Female, Laptop, Smartphone and person are all boolean predicates

→ $\text{Gives}(x, y, z)$ means gives y to z .

→ $\text{Male}(x)$ means x is a male.

Solution 7:

(1) Symbols :

$B(x)$: x is taller than Bill

$C(x)$: x is tall

$B(\text{John})$: John is taller than Bill

FOL : $(\text{taller}(x, \text{Bill}))$

FOL : $(\text{tall}(x))$

FOL : $(\text{taller}(\text{John}, \text{Bill}))$

(2) Propositional Logic KB :

$B(\text{John})$

~~$\forall x B$~~

$\forall x B(x) \rightarrow C(x)$