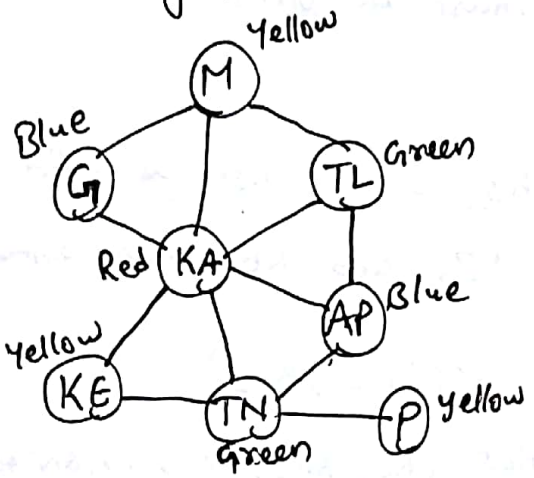
Name: Harsha Keerthipati
ID: 1001874263

Assignment-5

1) (a) Constraint graph:



variables: M, G, TL, KA, AP, TN, SL, KE, P

Constraint: Color the graph such that no 2 adjacent states have same color.

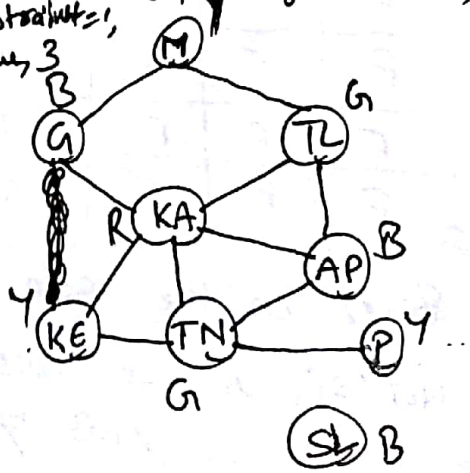
SL
Green/Red/Yellow/Blue

(b) Backtracking search with MRV and Degree heuristic

Color: {Red, Green, Blue, Yellow}

Level 1: Max constraint, legal values,
KA assigned Red (has max constraint (=6)
Level 2: TN assigned Green (Max constraint = 4)
Level 3: AP assigned Blue (Max constraint = 3, legal val = 2)
Level 4: TL assigned Green (Max constraint = 3, Legal val = 2)
Level 5: M assigned Yellow (Max constraint = 3, legal val = 2)
Level 6: G assigned Blue (Max constraint = 2, legal val = 2)
Level 7: KE assigned Yellow (Max constraint = 2, legal val = 2)
Level 8: SL assigned Red (Max constrain = 0, legal value = 4)
Level 9: P assigned yellow (Max constraint = 1, legal value, 3

(c) Constraint graph solution:



2) $A \Leftrightarrow B$

means

$A \Rightarrow B$ AND $B \Rightarrow A$ (Biconditional Elimination)

i.e $A \Rightarrow B$ AND $B \Rightarrow A$ must be valid.

For $KB_1 \Leftrightarrow KB_2$,

$KB_1 \Rightarrow KB_2$ AND $KB_2 \Rightarrow KB_1$ must be valid.

i.e KB_1 must entail KB_2 and KB_2 must entail KB_1

fun CHECK_EQUIVALENCE(KB_1, KB_2)

return (TT_ENTAILS? (KB_1, KB_2) AND TT_ENTAILS?(KB_2, KB_1))

3) (a) Yes KB entail S_1 ($KB \models S_1$)

i.e whenever KB is true, S_1 is always true.

A	B	C	KB	S_1
T	T	T	T	T
T	F	T	T	T

(b) Checking NOT(KB) entail NOT(S_1) ($\neg KB \models \neg S_1$)

A	B	C	NOT(KB)	NOT(S_1)
T	T	F	T	F
T	F	F	T	F
F	T	T	T	T
F	T	F	T	T
F	F	T	T	T
F	F	F	T	T

Based on the table values,

NOT(S_1) is not TRUE whenever NOT(KB) is True

$\neg KB \not\models \neg S_1$

7) Constants: John, Bill

Predicates:- tall, taller

Proposition:

tall(John): tall_John

tall(Bill): tall_Bill

taller(John, Bill): taller_John_Bill

taller(John, John): taller_John_John

taller(Bill, John): taller_Bill_John

taller(Bill, Bill): taller_Bill_Bill

KB taller(John, Bill): taller_John_Bill

$\forall_x$ taller(X, Bill) $\Rightarrow$ tall(X):

taller_Bill_Bill $\Rightarrow$ tall_Bill

taller_John_Bill $\Rightarrow$ tall_John

5) Let A be true, if it rains on May 1, 2017

Let B be true, if John must give mary a check of 10,000$ on May 2, 2017

Let C be true if Mary must mow the lawn on May 3, 2017

(a) Propositional logical statement:

$A \Rightarrow B$

$B \Rightarrow C$

(b) Logical statement

$\neg A \wedge B \wedge C$

(c) The contract was violated.

According to the contract John must give a check of $10,000 to mary if it rains on May 1, 2017. But even though it didn't rain on May 1, 2017, John gave a check of 10,000$ to Mary.

Name: Harsha Keerthipati ID: 1001374263 (4)

4) Symbols: A, B, C, D

The two cases of false in KB are

	A	B	C	D	KB
First case	T	T	T	T	F
Second case	T	F	T	T	F

CNF is the product of sums.

$$\Rightarrow \overline{(A \cdot B \cdot C \cdot D)} \cdot \overline{(A \cdot \bar{B} \cdot C \cdot \bar{D})}$$

$$\Rightarrow (\bar{A} + \bar{B} + \bar{C} + \bar{D}) \cdot (\bar{A} + B + \bar{C} + D)$$

$$\Rightarrow ((\neg A) \cup (\neg B) \cup (\neg C) \cup (\neg D)) \cap ((\neg A) \cup B \cup (\neg C) \cup D)$$

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6) Constants: John, Mary, Smartphone, Laptop and Shadow.

predicates:

Dog(X): x is a dog

Gave(X,Y,Z): x gave y to z

Male(X): x is a male

Female(X): x is a female

KB:- Dog(Shadow)

Gave(John, Shadow, Mary)

Male(Shadow) $\Rightarrow$ Gave(Mary, Smartphone, John)

$\neg$Male(Shadow) $\Rightarrow$ Gave(Mary, Laptop, John)

$\exists_x, \exists_y$ Gave(John, X, Y) $\cap$ Male(X) $\cap$ Dog(X)

Gave(Mary, Laptop, John) //