

Question1

1- Transform axioms into clause form: [2mark]

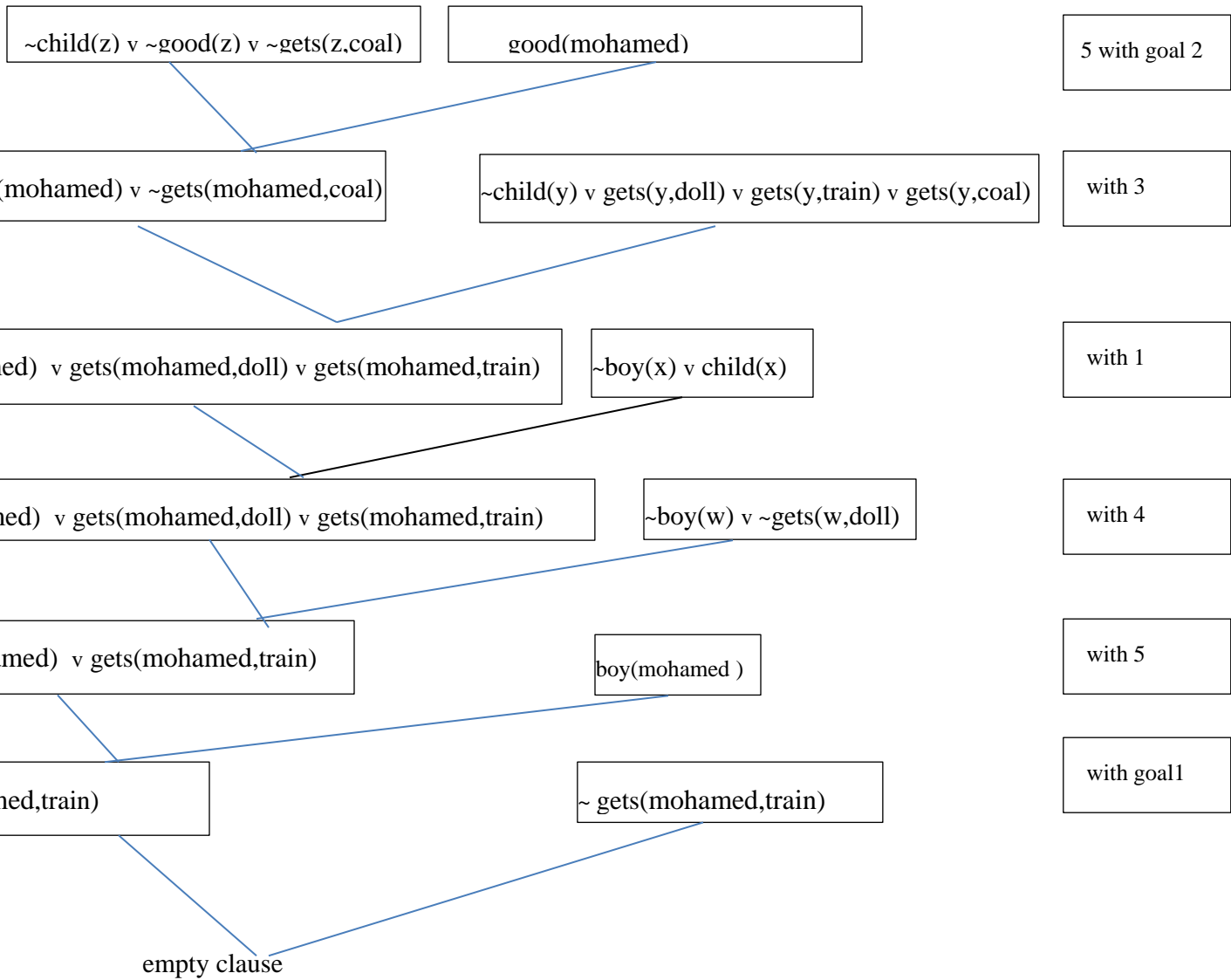
- 1 $X \text{ (boy}(X) \vee \text{girl}(X) \rightarrow \text{child}(X))$
 $\sim (\text{boy}(x) \vee \text{girl}(x)) \vee \text{child}(x)$
 $(\neg \text{boy}(x) \wedge \neg \text{girl}(x)) \vee \text{child}(x)$
 $(\sim \text{boy}(x) \vee \text{child}(x)) \wedge (\sim \text{girl}(x) \vee \text{child}(x))$
1.1 $\sim \text{boy}(x) \vee \text{child}(x)$
1.2 $\sim \text{girl}(x) \vee \text{child}(x)$
- 2 $Y \text{ (child}(Y) \rightarrow (\text{gets}(Y, \text{doll}) \vee \text{gets}(Y, \text{train}) \vee \text{gets}(Y, \text{coal})))$
 $\sim \text{child}(y) \vee \text{gets}(y, \text{doll}) \vee \text{gets}(y, \text{train}) \vee \text{gets}(y, \text{coal})$
- 3 $W \text{ (boy}(W) \rightarrow \sim \text{gets}(W, \text{doll}))$
 $\sim \text{boy}(w) \vee \sim \text{gets}(w, \text{doll})$
- 4 $Z \text{ (child}(Z) \wedge \text{good}(Z) \rightarrow \sim \text{gets}(Z, \text{coal}))$
 $\sim (\text{child}(z) \wedge \text{good}(z)) \vee \neg \text{gets}(z, \text{coal})$
 $\sim \text{child}(z) \vee \sim \text{good}(z) \vee \sim \text{gets}(z, \text{coal})$
- 5 $\text{boy}(\text{mohamed})$

Negate the goal

- 1- $\sim \text{gets}(\text{mohamed}, \text{train}) \rightarrow \sim \text{good}(\text{mohamed})$
 $\sim (\sim \text{gets}(\text{mohamed}, \text{train})) \vee \sim \text{good}(\text{mohamed})$
 $\sim \text{gets}(\text{mohamed}, \text{train}) \wedge \text{good}(\text{mohamed})$
6. (a) $\sim \text{gets}(\text{mohamed}, \text{train})$ (b) $\text{good}(\text{mohamed})$

- 1 $\sim \text{boy}(x) \vee \text{child}(x)$
- 2 $\sim \text{girl}(x) \vee \text{child}(x)$
- 3 $\sim \text{child}(y) \vee \text{gets}(y, \text{doll}) \vee \text{gets}(y, \text{train}) \vee \text{gets}(y, \text{coal})$
- 4 $\sim \text{boy}(w) \vee \sim \text{gets}(w, \text{doll})$
- 5 $\sim \text{child}(z) \vee \sim \text{good}(z) \vee \sim \text{gets}(z, \text{coal})$
- 6 $\text{boy}(\text{mohamed})$

$\sim \text{gets}(\text{mohamed}, \text{train})$
 $\text{good}(\text{mohamed})$



- | | |
|---|--|
| 1. $\forall X$ (boy(X) \vee girl(X) \rightarrow child(X)) | // every boy or girl is a child |
| 2. $\forall Y$ (child(Y) \rightarrow (gets(Y,doll) \vee gets(Y,train) \vee gets(Y,coal))) | //every child gets a doll or a train or a lump of coal |
| 3. $\forall W$ (boy(W) \rightarrow \sim gets(W,doll)) | // no boy gets any doll |
| 4. $\forall Z$ (child(Z) \wedge good(Z) \rightarrow \sim gets(Z,coal)) | //no good child gets any lump of coal |
| 5. boy(mohamed) | //Mohamed is a boy |

Construct a proof by refutation for the following goal:

- \sim gets(mohamed,train) \rightarrow \sim good(mohamed) //if Mohamed doesn't get a train, then Mohamed is not a good boy.

child(X):- boy (X); girl(X).

get(X,train):- child(X).

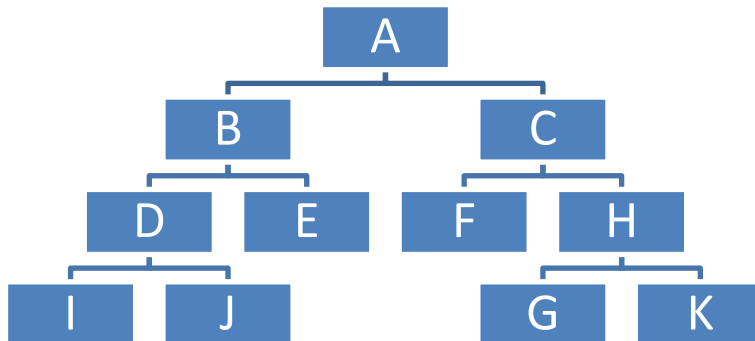
get(X,doll):- child(X),+\ boy(X).

get(X,coal):- child(X), +\good(X).

boy (mohamed).

Question2

[3 marks]



Limit 0

Ex-node Open list

A {}

CLOSED list

{}

Limit 1

Ex-node Open list

A {B,C}

CLOSED list

{A}

B {C}

{A,B}

C {}

{A,B,C}

Limit 2

Ex-node Open list

A {B,C}

CLOSED list

{A}

B {D,E, C}

{A,B}

D {E,C}

{A,B,D}

E {C}

{A,B,D,E}

C {F,H}

{A,B,D,E,C}

F {H}

{A,B,D,E,C,F}

H {}

{A,B,D,E,C,F,H}

Limit 3

Ex-node	Open list	CLOSED list
A	{B,C}	{A}
B	{D,E, C}	{A,B}
D	{I,j E,C}	{A,B,D}
i	{j,E, C}	{A,B,D,I}
j	{E,C}	{A,B,D,I,J}
E	{C}	{A,B,D,I,J,E}
C	{F,H}	{A,B,D,I,J, E,C}
F	{H}	{A,B,D,I,J, E,C,F}
H	{G,K}	{A,B,D,I,J, E,C ,F, H}
G	{K}	{A,B,D,I,J, E,C ,F, H,G}

B) Consider the following frame system which presents the following: **(2 marks)**

- 1 Give the class precedence list for Mohamed [WPI department-AAA-- Washington –AE- UFFF – company member]
- 2 Discount = 40%