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CS 6364.002 – Artificial Intelligence

FINAL EXAM

Fall 2020
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Instructions: Do not communicate with anyone in any shape or form. This is an independent exam. Do not delete any problem formulation, just attach your answer in the space provided. If the problem is deleted and you send only the answer, you shall receive ZERO points.

Copy and paste the Final Exam into a Word document, enter your answers (either by typing in Word, or by inserting a VERY CLEAR picture of your hand-written solution) and transform the file of the exam into a PDF format. If we cannot clearly read the picture, you will get ZERO for that answer! If you create an enormous file for your final exam (i.e. larger than 5 Mbytes) you will receive ZERO for your entire exam. Please follow the instructions from the attached **instructions_submission_EXAM.pdf** file to make sure your final pdf file is of reasonable size.

If you will use a pencil instead of a black pen, you will receive a ZERO for the entire final exam.

Make sure that you insert EACH answer immediately after EACH question. Failure to do so will result in ZERO points for the entire exam! Submit the PDF file with the name **Final_Exam_netID.pdf**, where netID is your unique netid provided by UTD. If you submit your exam in any other format your will receive ZERO points.

The Final exam shall be submitted in eLearning <u>before the deadline</u>. No late submissions shall be graded! Any cheating attempt will determine the ENTIRE grade of the final exam to become ZERO.
Write your answers immediately after the problem statements.

Problem 1 Uncertainty (10 points)
Given the joint probability table:

	rain		*¬rain*	
	sprinkle	*¬sprinkle*	*sprinkle*	*¬sprinkle*
Grasswet	0.1	0.02	0.023	0.007
¬Grasswet	0.09	0.06	0.14	0.56

Compute:
1. $P(\neg Grasswet)$ (**2points**)
2. $P(rain|Grasswet)$ (**3points**)
3. $P(Grasswet|rain \vee sprinkle)$ (**5points**)

Answers:

1. $P(\neg Grasswet)$ = 0.09 + 0.06 + 0.14 + 0.56
= 0.85

2. $P(rain|Grasswet) = \frac{P(Grasswet,rain)}{P(Grasswet)}$
$= \frac{0.1\ +\ 0.02}{0.1+0.02+0.023+0.007} = \frac{0.12}{0.15} = 0.8$

3. $P(Grasswet|rain \vee sprinkle) = \frac{P(Grasswet,rain \vee sprinkle)}{P(rain \vee sprinkle)}$

From the table given, P(Grasswet , rain ∨ sprinkle)
= P(Grasswet , rain) + P(Grasswet , sprinkle)
= (0.1+0.02) + (0.1+0.023)
= 0.243

P($rain \vee sprinkle$) = P(rain) + P(sprinkle)
= (0.1+0.02+0.09+0.06) + (0.1+0.09+0.023+0.14)
= 0.27 + 0.353
= 0.623

$P(Grasswet|rain \vee sprinkle) = \frac{P(Grasswet,rain \vee sprinkle)}{P(rain \vee sprinkle)} = \frac{0.243}{0.623} = 0.39$

Problem 2 First Order Logic Representations (30 points)

(a) (**15 points**) Represent in First-Order Logic (FOL) the following sentences, using the semantics of the predicates provided for each sentence:

1. *Every artist is inspired by a painting.*
   Predicates: *artist(x)*- x is artist;
   inspire(x,y): x is inspired by y;
   painting(z): z is a painting.

2. *All musicians in an orchestra follow the instructions of their conductor.* Predicates: *musician(x)*- x is musician;
   inOchestra(x,y): x is in orchestra y;
   conductor(z,y): z is conductor of orchestra y;
   follows(x,y): x follows the instructions of y;
3. *In each concert, every musician plays some instrument and sings some song and no one gets bored.*
   Predicates: *concert(c)* – c is a concert;
   musician(m) – m is a musician;
   musicianInConcert(m,c) – m is a musician participating in concert c;
   playsInstrument(m,i) – m plays instrument i;
   singsSong(m,s) – m sings song s;
   getBored(m) – m is getting bored;

Answers:

(a) 1. (**5 points**)
Every artist is inspired by a painting.
Predicates: *artist(x)*- x is artist;
inspire(x,y): x is inspired by y;
painting(z): z is a painting.

First Order Logic:
∀x [artist(x) => ∃z [painting(z) ^ inspired(x,z)]]

(a) 2. (**5 points**)
All musicians in an orchestra follow the instructions of their conductor.
Predicates: *musician(x)*- x is musician;
inOchestra(x,y): x is in orchestra y;
conductor(z,y): z is conductor of orchestra y;
follows(x,y): x follows the instructions of y;

First Order Logic:
∀x [musician(x) => ∃y ∃z [inOchestra(x,y) ^ conductor(z,y) ^ follows(x,z)]]

(a) 3. (**5 points**)

In each concert, every musician plays some instrument and sings some song and no one gets bored.

Predicates: *concert(c)* – c is a concert;
musician(m) – m is a musician;
musicianInConcert(m,c) – m is a musician participating in concert c;
playsInstrument(m,i) – m plays instrument i;
singsSong(m,s) – m sings song s;
getBored(m) – m is getting bored;

First Order Logic:
∀c ∀m [concert(c) ^ musician(m) ^ musicianInConcert(m,c) => ∃i ∃s [playsInstrument(m,i) ^ singsSong(m,s) ^ ¬getBored(m)]]

(b) Generate the Conjunctive Normal Form (CNF) for the FOL expressions obtained in (a). Specify at each step of the conversion in CNF what you are doing!

Answers:

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1. (**5 points**)

First Order Logic:
∀x [artist(x) => ∃z [painting(z) ^ inspired(x,z)]]

STEP 1: Eliminate Implications
∀x [¬artist(x) ᵛ ∃z [painting(z) ^ inspired(x,z)]]

STEP 2: Eliminate ∃ quantifiers. z is in scope of quantized variable x
Skolem function z = f(x)

STEP 3: Skolemize
∀x [¬artist(x) ᵛ [painting(f(x)) ^ inspired(x,f(x))]]

STEP 4: Eliminate ∀ quantifiers
¬artist(x) ᵛ [painting(f(x)) ^ inspired(x, f(x))]

STEP 5: Distribute ^ over ᵛ
(¬artist(x) ᵛ painting(f(x))) ^ (¬artist(x) ᵛ inspired(x, f(x)))

CNF obtained: (¬artist(x) ᵛ painting(f(x))) ^ (¬artist(x) ᵛ inspired(x, f(x)))

2. (**5 points**)

First Order Logic:

∀x [musician(x) => ∃y ∃z [inOchestra(x,y) ^ conductor(z,y) ^ follows(x,z)]]

STEP 1: Eliminate Implications

∀x [¬musician(x) ˅ ∃y ∃z [inOchestra(x,y) ^ conductor(z,y) ^ follows(x,z)]]

STEP 2: Eliminate ∃ quantifiers. y and z are in scope of quantized variable x

Skolem function y = f(x), z = g(x)

STEP 3: Skolemize

∀x [¬musician(x) ˅ [inOchestra(x,f(x)) ^ conductor(g(x),f(x)) ^ follows(x,g(x))]]

STEP 4: Eliminate ∀ quantifiers

¬musician(x) ˅ [inOchestra(x,f(x)) ^ conductor(g(x),f(x)) ^ follows(x,g(x))]

STEP 5: Distribute ^ over ˅

(¬musician(x) ˅ inOchestra(x,f(x))) ^ (¬musician(x) ˅ conductor(g(x),f(x))) ^
(¬musician(x) ˅ follows(x,g(x)))

CNF obtained: (¬musician(x) ˅ inOchestra(x,f(x))) ^ (¬musician(x) ˅ conductor(g(x),f(x))) ^ (¬musician(x) ˅ follows(x,g(x)))

3. (**5 points**)

First Order Logic:

∀c ∀m [concert(c) ^ musician(m) ^ musicianInConcert(m,c) => ∃i ∃s
[playsInstrument(m,i) ^ singsSong(m,s) ^ ¬getBored(m)]]

STEP 1: Eliminate Implications

∀c ∀m [¬(concert(c) ^ musician(m) ^ musicianInConcert(m,c)) ˅ ∃i ∃s
[playsInstrument(m,i) ^ singsSong(m,s) ^ ¬getBored(m)]]

STEP 2: Move ¬ inwards

∀c ∀m [¬concert(c) ˅ ¬musician(m) ˅ ¬musicianInConcert(m,c)) ˅ ∃i ∃s
[playsInstrument(m,i) ^ singsSong(m,s) ^ ¬getBored(m)]]

STEP 3: Eliminate ∃ quantifiers. i and s are in scope of quantized variable c and m

Skolem function i = f(c,m), s = g(c,m)

STEP 4: Skolemize

∀c ∀m [¬concert(c) ˅ ¬musician(m) ˅ ¬musicianInConcert(m,c)) ˅
[playsInstrument(m, f(c,m)) ^ singsSong(m, g(c,m)) ^ ¬getBored(m)]]

STEP 5: Eliminate ∀ quantifiers

(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ [playsInstrument(m, f(c,m)) ^ singsSong(m, g(c,m)) ^ ¬getBored(m)]

STEP 6: Distribute ^ over ᵛ

(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ playsInstrument(m, f(c,m))) ^
(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ singsSong(m, g(c,m))) ^
(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ ¬getBored(m))

CNF obtained:

(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ playsInstrument(m, f(c,m))) ^
(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ singsSong(m, g(c,m))) ^
(¬concert(c) ᵛ ¬musician(m) ᵛ ¬musicianInConcert(m,c)) ᵛ ¬getBored(m))

<u>Problem 3 (20 points) Inference in First Order Logic</u>

You are given the following description:

"*If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned*"

1. Transform the text in First-Order Logic (FOL) **(4 points).**
2. Convert each axiom in Conjunctive Normal Form (CNF) and produce a knowledge base (KB) containing all the clauses derived from the CNF. **(6 points).**
3. Given the KB, can you prove that a unicorn is mythical? How about magical? Or horned? Use refutation to prove each of your answers and show the entire proof. **(10 points)**

<u>Answer:</u>

1. *"If the unicorn is mythical, then it is immortal, but if it is not mythical, then it is a mortal mammal. If the unicorn is either immortal or a mammal, then it is horned. The unicorn is magical if it is horned."*

   Transforming the propositions into FOL:
   S1: Mythical => ¬Mortal
   S2: ¬Mythical => Mortal ^ Mammal
   S3: ¬Mortal ᵛ Mammal => Horned
   S4: Horned => Magical

2. Converting the axioms to CNF:

S1: Mythical => ¬Mortal
Step1: Remove the implication
C1: ¬Mythical ᵛ ¬Mortal

S2: ¬Mythical => Mortal ^ Mammal
Step1: Remove the implication
S2: ¬¬Mythical ᵛ (Mortal ^ Mammal)
Step2: Distribute ^ over ᵛ
S2: (Mythical ᵛ Mortal) ^ (Mythical ᵛ Mammal)

C2: Mythical ᵛ Mortal
C3: Mythical ᵛ Mammal

S3: ¬Mortal ᵛ Mammal => Horned
Step1: Remove the implication
S3: ¬(¬Mortal ᵛ Mammal) ᵛ Horned
Step2: Move ¬ inward
S3: (¬¬Mortal ^ ¬Mammal) ᵛ Horned
S3: (Mortal ^ ¬Mammal) ᵛ Horned
Step3: Distribute ^ over ᵛ
S3: (Mortal ^ ¬Mammal) ᵛ Horned
S3: (Mortal ᵛ Horned) ^ (¬Mammal ᵛ Horned)

C4: Mortal ᵛ Horned
C5: ¬Mammal ᵛ Horned

S4: Horned => Magical
Step1: Remove the implication
C6: ¬Horned ᵛ Magical

We get the following knowledge base(KB) after conversion :
C1: ¬Mythical ᵛ ¬Mortal
C2: Mythical ᵛ Mortal
C3: Mythical ᵛ Mammal
C4: Mortal ᵛ Horned
C5: ¬Mammal ᵛ Horned
C6: ¬Horned ᵛ Magical

3. Derived the above KB, we need to prove 3 queries by refutation:
    a. Q1: Mythical
    b. Q2: Magical
    c. Q3: Horned

    a.) Q1: Mythical

    ¬Q1: ¬Mythical

    Knowledge Base:

    C1: ¬Mythical ᵛ ¬Mortal
    C2: Mythical ᵛ Mortal
    C3: Mythical ᵛ Mammal
    C4: Mortal ᵛ Horned
    C5: ¬Mammal ᵛ Horned
    C6: ¬Horned ᵛ Magical

    With any combination, the query cannot be proved.

    Thus, the unicorn is not mythical.

    (If additional information is given like, a unicorn is not a mammal, then this query can be proven)

    b.) Q2: Magical

    ¬Q2: ¬Magical

    Knowledge Base:

    C1: ¬Mythical ᵛ ¬Mortal
    C2: Mythical ᵛ Mortal
    C3: Mythical ᵛ Mammal
    C4: Mortal ᵛ Horned
    C5: ¬Mammal ᵛ Horned
    C6: ¬Horned ᵛ Magical

    Step1: Resolve C6 and ¬Q2

    C6: ¬Horned ᵛ Magical
    ¬Q2: ¬Magical

    Y1: ¬Horned

    Step2: Resolve Y1 and C5

    Y1: ¬Horned
    C5: ¬Mammal ᵛ Horned

    Y2: ¬Mammal

    Step3: Resolve C4 and Y1

    Y1: ¬Horned
    C4: Mortal ᵛ Horned

    Y3: Mortal

    Step4: Resolve C3 and Y2

    Y2: ¬Mammal
    C3: Mythical ᵛ Mammal

    Y4: Mythical

Step5: Resolve C1 and Y4

Y4: Mythical

C1: ¬Mythical $^{\vee}$ ¬Mortal

Y5: ¬Mortal

Step6: Resolve Y3 and Y5

Y3: Mortal

Y5: ¬Mortal

Y6: NIL

Thus, the unicorn is indeed magical.

c.) Q3: Horned

¬Q3: ¬Horned

Knowledge Base:

C1: ¬Mythical $^{\vee}$ ¬Mortal

C2: Mythical $^{\vee}$ Mortal

C3: Mythical $^{\vee}$ Mammal

C4: Mortal $^{\vee}$ Horned

C5: ¬Mammal $^{\vee}$ Horned

C6: ¬Horned $^{\vee}$ Magical

Step1: Resolve C5 and ¬Q3

C5: ¬Mammal $^{\vee}$ Horned

¬Q3: ¬Horned

Z1: ¬Mammal

Step2: Resolve ¬Q3 and C4

¬Q3: ¬Horned

C4: Mortal $^{\vee}$ Horned

Z2: Mortal

Step3: Resolve Z1 and C3

Z1: ¬Mammal

C3: Mythical $^{\vee}$ Mammal

Z3: Mythical

Step4: Resolve C1 and Z2 and Z3

C1: ¬Mythical $^{\vee}$ ¬Mortal

Z3: Mythical

Z2: Mortal

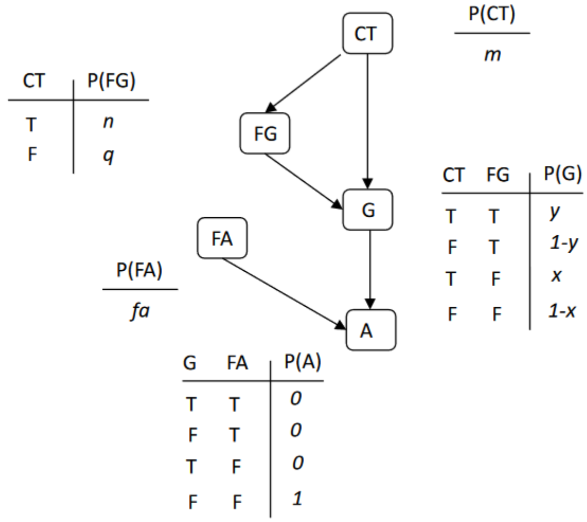
X4: NIL

Thus, the unicorn is indeed horned.

Problem 3 (20 points) Probabilistic Reasoning

In a nuclear power plant, there is an alarm that senses when a temperature gauge exceeds a given threshold. The gauge measures the temperature of the core. Consider the Boolean random variables A (alarm sounds), FA (alarm is faulty), FG (gauge is faulty), G (gauge is reading) and CT (the core temperature is too high).

The following Bayesian network represents this domain:



1. **(5 points)** Compute the probability that A=1, FA=0, FG=0 and CT=1.
2. **(10 points)** Compute the probability that the core temperature is too high when the alarm sounds, and the alarm and the gauge work well, i.e. P(CT|A, ¬FA, ¬FG).
3. **(5 points)** Decide whether A and FA have any effect on CT given G and explain why you reached that decision.

Answer:

1. Compute the probability that A=1, FA=0, FG=0 and CT=1
   P (A=1, FA=0, FG=0, CT=1) = P (A=1) * P(FA=0) * P(FG=0) * P(CT=1)
   => P (A=1 | FA=0, FG=0, CT=1) * P(FA=0) * P(FG=0 | CT=1) * P(CT=1)
   => P(CT=1) = m ---- 1

   Since FG is dependent on CT, P(FG=0 | CT=1)
   => P(FG=0 | CT=1) = 1-n ---- 2

   Since G is dependent on CT and FG
   => P(G|FG=0, CT=1) = x
   => P(FA=0) = 1- fa ---- 3

   Since A is dependent on FA and G
   => P (A=1 | FA=0, FG=0, CT=1) = (1-x) * (1-fa) ---- 4

   Comibing 1,2,3 and 4 we get:

=> P (A=1 | FA=0, FG=0, CT=1) * P(FA=0) * P(FG=0 | CT=1) * P(CT=1)
=> (1-x) *(1-fa) * (1-n) * m

2. Compute the probability that the core temperature is too high when the alarm sounds, and the alarm and the gauge work well, i.e. P(CT|A, ¬FA, ¬FG).

By Bayes Rule

=> P(CT|A, ¬FA, ¬FG) = $\frac{P(A,\neg \mathrm{FA},\neg \mathrm{FG}\ |CT)\ P(CT)}{P(A,\neg FA,\neg FG)}$

=> $P(A, \neg\mathrm{FA}, \neg\mathrm{FG}\ |CT) = P(A \mid CT) * P(\neg\mathrm{FA} \mid \mathrm{CT}) * \mathrm{P}(\neg\mathrm{FG} \mid \mathrm{CT})$

=> Let's compute $P(A \mid CT)$ first

P(CT=1) = m,

Since CT is known and FG depends on it

P(FG|CT=1) = n

Now G depends on CT and FG, and CT is given

Using Variable Elimination:

FG	G	g(D)	h1
1	1	y	n*y
1	0	1-y	n*(1-y)
0	1	x	(1-n)*x
0	0	1-x	(1-n)*(1-x)

Eliminating FG from the above table:

G	h1=>h2
1	ny + (1-n)x
0	n(1-y) + (1-n)(1-x)

We get P(G) = ny + (1-n)x,

P(¬G) = n(1-y) + (1-n)(1-x)

P(FA=1) = fa,

P(FA=0) = 1-fa

Now A depends on FA and G

Also, Looking forward we see that the P(A) = 1 only when FA=0 and G=0, so we will only calculate that parts.

Using Variable Elimination:

FA	G	A	g(A)	h1
0	0	1	1	(1-fa) * (n(1-y) + (1-n)(1-x))
0	0	0	0	0

Eliminating and combining terms for A, we get

P(A|CT) = (1-fa) * (n*(1-y) + (1-n)*(1-x))

=> Now P(¬FA|CT)

Since FA is not depended on CT, so P(¬FA) = 1-fa

=> Finally P(¬FG|CT) = 1-n

Overall, $P(A, \neg\text{FA}, \neg\text{FG} \mid CT) = P(A \mid CT) * P(\neg\text{FA} \mid \text{CT}) * \text{P}(\neg\text{FG} \mid \text{CT})$

=> (1-fa) * ((n)*(1-y) + (1-n)*(1-x)) * (1-fa) * (1-n)

Since $P(m|s) = \alpha < P(s|m)P(m), (P(s|\neg m)P(\neg m)>$

To calculate α, we also need to find $P(A, \neg\text{FA}, \neg\text{FG} \mid \neg CT)\ P(\neg CT)$

=>P(¬CT) = 1-m

=> $P(A, \neg\text{FA}, \neg\text{FG} \mid \neg CT) = P(A \mid \neg CT) * P(\neg\text{FA} \mid \neg\text{CT}) * \text{P}(\neg\text{FG} \mid \neg\text{CT})$

=> Let's compute $P(A \mid \neg CT)$ first

P(¬CT) = 1-m,

FG depends on CT, and ¬CT is given, so P(FG|¬CT)=q

Now G depends on CT and FG, and ¬CT is given

Using Variable Elimination:

FG	G	g(D)	h1
1	1	1-y	q*(1-y)
1	0	y	q*y
0	1	1-x	(1-q)*(1-x)
0	0	x	(1-q)*(x)

Eliminating FG from the above table:

G	h1=>h2
1	q(1-y) + (1-q)(1-x)
0	qy + (1-q)x

We get P(G) = q(1-y) + (1-q)(1-x),

P(¬G) = qy + (1-q)x

P(FA=1) = fa,

P(FA=0) = 1-fa

Now A depends on FA and G

Also, Looking forward we see that the P(A) = 1 only when FA=0 and G=0, so we will only calculate that parts.

Using Variable Elimination:

FA	G	A	g(A)	h1
0	0	1	1	(1-fa) * (qy + (1-q)x)
0	0	0	0	0

Eliminating and combining terms for A, we get

P(A|¬CT) = (1-fa) * (q*y + (1-q)*x)

=> Now P(¬FA|¬CT) = P(¬FA) = 1-fa

=> Finally P(¬FG|¬CT) = 1-q

Overall, $P(A, \neg\text{FA}, \neg\text{FG} \mid \neg CT) = P(A \mid \neg CT) * P(\neg\text{FA} \mid \neg\text{CT}) * \text{P}(\neg\text{FG} \mid \neg\text{CT})$

=> (1-fa) * (q*y + (1-q)*x) * (1-fa) * (1-q)

Finally, putting in values we get

=> P(CT|A, ¬FA, ¬FG) = $\frac{P(A,\neg \text{FA},\neg \text{FG} \mid CT)\ P(CT)}{P(A,\neg \text{FA},\neg \text{FG})}$

=> $\frac{P(A,\neg \text{FA},\neg \text{FG} \mid CT)\ P(CT)}{P(A,\neg \text{FA},\neg \text{FG} \mid CT)\ P(CT) + P(A,\neg \text{FA},\neg \text{FG} \mid \neg CT)\ P(\neg CT)}$

=> $\frac{(1-\text{fa}) * (\text{n}*(1-\text{y}) + (1-\text{n})*(1-\text{x})) * (1-\text{fa}) * (1-\text{n})*\text{m}}{(1-\text{fa}) * (\text{n}*(1-\text{y}) + (1-\text{n})*(1-\text{x})) * (1-\text{fa}) * (1-\text{n})*\text{m} + (1-\text{fa}) * (\text{q}*\text{y} + (1-\text{q})*\text{x}) * (1-\text{fa}) * (1-\text{q})*(1-\text{m})}$

Taking (1-fa) common and removing from both sides

=> $\frac{\left(\text{n}*(1-\text{y}) + (1-\text{n})*(1-\text{x})\right)*(1-\text{n})*\text{m}}{\left(n*(1-\text{y}) + (1-\text{n})*(1-\text{x})\right)*(1-\text{n})*\text{m} + (\text{q}*\text{y} + (1-\text{q})*\text{x}) *(1-\text{q})*(1-\text{m})}$

3. Decide whether A and FA have any effect on CT given G and explain why you reached that decision.

FA is not dependent on anyone. However, A is dependent on G which in turn is dependent on CT.

P(CT|G) = $\frac{\text{P(G|CT)}*\text{P(CT)}}{P(G)}$

It only depends on P(G|CT)

Now P(G|CT) does not have A or FA dependency.

So, neither A, nor FA will affect CT given G.

<u>Problem 4 (20 points) Inference in Propositional Logic</u>

If your knowledge base (KB) contains the following Horn clauses:

1. B => A
2. C ^ D ^ E => B
3. B ^ F => C
4. F ^ G => D
5. G ^ H => E
6. F
7. G
8. H

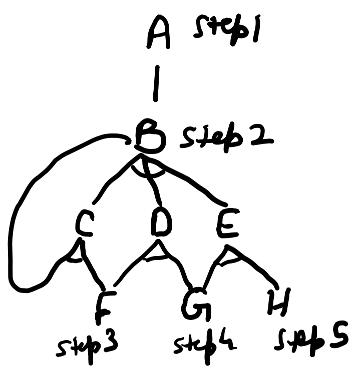
Use backward chaining to prove A.

i. Draw the AND=OR graph for this KB (**5 points**).

ii. Show each step of your proof using backward chaining (**15 points**).

Answer:

i.



AND-OR graph for this Knowledge base.

ii.

S1: B => A
S2: C ^ D ^ E => B
S3: B ^ F => C
S4: F ^ G => D
S5: G ^ H => E
S6: F
S7: G
S8: H

Count	Step1	Step2
S1: 1	0	0
S2: 3	0	0
S3: 2	2	0
S4: 2	2	0
S5: 2	2	0
S6: 0	0	0
S7: 0	0	0
S8: 0	0	0

Agenda: A, B, C, D, E, F, G, H

Step1: We assume A = T, infer B =T
count(S2) = 0
Step2: We know B=T, infer C=T, D=T, E=T
count(S3) = 0, count(S4) = 0, count(S5) = 0
Step3: Because count(S3) = 0, infer B=T and F=T.
F=T is a fact from the KB.
Step 4: Because count(S4) = 0, infer F = T, G = T.
F=T and G=T are both facts from the KB.
Step 5: Because count(S5) = 0, infer G=T, H=T.
G=T and H=T are both facts from the KB.
No more literals in Agenda
All literals have been inferred.
Query A is true.