

CSC 384 Test 5 on KR

Wednesday, December 7, 2022

Last Name: _____

First Name: _____

Email: _____

1. Conceptual Questions (12 marks total)

1.1 Circle all of the following statements that are true: **(5 marks)**

- a) A proof procedure that is sound is also complete
- b) A proof procedure that is complete is also sound
- c) A sound proof procedure will always generate true conclusions
- d) A complete proof procedure can generate all true statements
- e) Unsound proof procedures could generate true statements.

1.2 Circle the words that are syntactic symbols in KR: **(5 marks)**

conjunctions	methods	relations
descriptors	functions	predicates
variables	interpretations	constants

1.3 True or False? Refutation proofs are sound but not complete.

(1 mark)

True False

1.4 What does the abbreviation MGU stand for? **(1 mark)**

2. KB Conversion (18 marks total)

Convert the formulae
below into Clausal
Normal Form, using the
steps on the right.
Label the steps that

1. Eliminate Implications.
2. Move Negations inwards.
3. Standardize Variables.
4. Skolemize.
5. Convert to Prenix Form.
6. Distribute conjunctions over disjunctions.
7. Flatten nested conjunctions and disjunctions.
8. Convert to Clauses.

you use with the step number, and only use the steps that you need.

2.1 (4 marks)

$$\exists X (\text{rich}(X) \rightarrow \text{smart}(X))$$

2.2 (6 marks)

$$\neg \exists X (\text{rich}(X) \rightarrow \exists Y \text{happy}(Y))$$

2.2 (8 marks)

$$\forall X \forall Y \exists Z ((\text{friends}(X,Z) \wedge \text{friends}(Z,Y)) \rightarrow \text{friends}(X,Y))$$

3. Resolution (10 marks total)

3.1 Use the following statements (listed here in English and Clausal Normal Form) to prove that **babies can manage crocodiles**.

Use the **Forward Chaining** technique, present your proof as a sequence of statements in the table provided. **(4 marks)**

Statement	Clausal Form
Babies are illogical	[1] $(\neg \text{baby}(X), \text{illogical}(X))$
Nobody is despised who can manage a crocodile	[2] $(\text{manage}(X, \text{crocodile}), \neg \text{despised}(X))$
Illogical persons are despised.	[3] $(\neg \text{illogical}(X), \text{despised}(X))$

Clause #	Clauses to Combine	Resulting Clause
[4]		
[5]		
[6]		
[7]		

3.2 Use the following statements (listed here in English and Clausal Normal Form) to prove that **you missed class** (in clausal form: **missClass(you)**).

Using the **Refutation** technique, present your proof as a sequence of statements in the table provided. **(6 marks)**

Statement	Clausal Form
People who oversleep miss their bus.	[1] (\neg oversleep(X), missBus(X))
If you miss your bus and can't get a ride, you will miss your class	[2] (\neg missBus(X), hasRide(X), missClass(X))
You overslept and nobody can give you a ride.	[3] (oversleep(you)) [4] (\neg hasRide(you))

Clause #	Clauses to Combine	Resulting Clause
[5]	<i>Refutation Clause</i>	
[6]		
[7]		
[8]		
[9]		
[10]		

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