

CSC 411 Study Guide for Midterm 02

You are allowed one (1) sheet of paper (8"x11") with handwritten notes (front and back) and a calculator. You may be required to wipe the memory of your calculator before the exam. No other review materials are permitted.

Remember, this is a study guide, meant to help you get ready for the exam. The questions here are meant to represent what to expect, but not limited to the only questions that will be on the exam.

You should be ready to answer any of the questions seen here, as well as questions similar to those seen in Lectures, Lecture Exercises, and Problem Sets.

Section	Possible Points
Evaluating Formulas	
CNF	
Knowledge Representation	
FOL Inference	
Planning	
Conditional Probability	
TOTAL	100

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Evaluating Formulas

1. Given $(a \vee b) \rightarrow (b \rightarrow (a \wedge c))$, answer the questions below:

a. True or False: This formula satisfiable.

b. Build a truth table to show your justification. Draw arrows on the left of the rows to show this justification.

a	b	c	
T	T	T	
T	T	F	
T	F	T	
T	F	F	
F	T	T	
F	T	F	
F	F	T	
F	F	F	

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CNF

2. Convert the following formula into CNF.

$$\neg(p \wedge q) \rightarrow \neg(r \wedge s)$$

3. Convert the following formula into CNF.

$$\forall x ((P(x) \vee Q(x)) \rightarrow \forall y (S(y) \wedge T(y)))$$

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Knowledge Representation

4. Circle the formula appropriately converts the sentence into FOL: "The night is dark and full of terror."
- $\forall x \text{Night}(x) \rightarrow \text{Dark}(x) \wedge \text{FullOf}(x, \text{Terror})$
 - $\forall x (\text{Dark}(x) \vee \text{Terrible}(x)) \rightarrow \text{Night}(x)$
 - $\forall x \text{Night}(x) \rightarrow \text{Dark}(x) \vee \text{Terrible}(x)$
 - $\exists x \text{Night}(x) \rightarrow \text{Dark}(x) \wedge \text{FullOf}(\text{Terror})$
5. Circle the formula appropriately converts the sentence into FOL: "If you don't succeed, try again."
- $\forall x \neg \text{Success}(x) \rightarrow \text{Repeat}(x)$
 - $\forall x \text{Success} \rightarrow \neg \text{Repeat}(x)$
 - $\forall x \text{Failed}(x) \rightarrow \text{Repeat}(x)$
 - $\forall x \neg \text{Failed}(x) \rightarrow \neg \text{Repeat}(x)$
6. Circle the formula appropriately converts the sentence into FOL: "Some students study for all exams"
- $\forall xy \text{Student}(x) \rightarrow \text{Exam}(y) \wedge \text{Studied}(x, y)$
 - $\exists x \forall y \text{Student}(x) \rightarrow \text{Exam}(y) \wedge \text{Studied}(x, y)$
 - $\forall x \exists y \text{Student}(x) \rightarrow \text{Exam}(y) \wedge \text{Studied}(x, y)$
 - $\exists xy \text{Student}(x) \rightarrow \text{Exam}(y) \wedge \text{Studied}(x, y)$

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FOL Inference

7. Given the *KB* below, use backwards chaining to determine whether the query is true.

$$\alpha = \text{Took}(\text{Bill}, \text{Cookie}, \text{Jar})$$

Draw out the clauses that need to be resolved in order to resolve α . Place a ✓ by clauses that can be inferred through the KB and an ✗ by clauses that cannot.

1	$\text{Holds}(\text{Jar}, \text{Cookie})$	The Jar contains Cookies
2	$\text{Thief}(\text{Tom})$	Tom is a Thief
3	$(\text{Thief}(x) \wedge \text{Holds}(y, z)) \rightarrow \text{Took}(x, z, y)$	If X is a Thief and Y contains Z, then X took Z from Y (converted to CNF)
?	$\text{Took}(\text{Bill}, \text{Cookie}, \text{Jar})$	

$$\text{Took}(\text{Bill}, \text{Cookie}, \text{Jar})$$

8. Based on the chaining above, α is:

- a. True
- b. False

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9. Given the *KB* below, use resolution through contradiction to determine whether the query is true.

$$\alpha = \text{Flies}(\text{Tweety})$$

Make sure to indicate the premise's line number you are referencing and substitutions necessary at each step in the right column. More rows than necessary were included.

1	$\neg\text{Bird}(x) \vee \text{Flies}(x)$	All Birds Fly
2	$\text{Bird}(\text{Tweety})$	Tweety is a Bird
3	$\neg\text{Flies}(\text{Tweety})$	Negation of α (Goal)
4		
5		
6		
7		
8		
9		
10		

10. Based on the resolution above, α is:

- a. True
- b. False

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Planning

Given the following initial and goal states,

Initial State: $AtTile(T1) \wedge Clean(T1) \wedge Dirty(T2)$

Goal State: $Clean(T1) \wedge Clean(T2)$

11. Design an **Action(Move(from, to))**, such that you can only move if you are at a location and it is clean.
The result is that you are no longer at the **from** location, and are now at the **to** location.

Action(Move(from, to))

Preconditions:

Effect:

12. Design an **Action(Sweep(location))**, such that you can only sweep if you are at location and it is dirty.
The result is that location is no longer **dirty** and is **clean**.

Action(Sweep(location))

Preconditions:

Effect:

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13. What is the plan for reaching the goal state from the initial state? Note more rows were provided than need to be filled.

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Conditional Probability

Consider the following truth table:

A	B	C	$P(A, B, C)$
T	T	T	0.20
T	T	F	0.10
T	F	T	0.15
T	F	F	0.05
F	T	T	0.15
F	T	F	0.15
F	F	T	0.10
F	F	F	0.10

14. Answer the following conditional probability formulas. Please round your answers to the nearest thousandths.

$P(A = \text{false} B = \text{true}, C = \text{true})$	
$P(A = \text{false}, B = \text{false} C = \text{true})$	
$P(A = \text{true}, B = \text{true} C = \text{false})$	
$P(A = \text{false} B = \text{false}, C = \text{true})$	
$P(A = \text{true}, B = \text{false} C = \text{true})$	

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This page has been left blank for notes.

THIS SHEET WILL NOT BE CONSIDERED FOR GRADING