Quiz Submissions - MidTerm 2- Requires Respondus LockDown Browser

Attempt 1

Written: Oct 26, 2022 17:01 - Oct 26, 2022 18:51

Submission View

Your quiz has been submitted successfully.

[10%] True/False

For each of the statements below, fill in the bubble **True** if the statement is always and unconditionally true, or fill in the bubble **False** if it is always false, sometimes false, or just does not make sense:

Question 1 **1 / 1 point**

[1%] In FOL, constant symbols refer to relations, while predicate symbols refer to objects.

- ( ) True
- ✓ (•) False

Question 2 **1 / 1 point**

[1%] (A ⇔ B)∧(¬A∨B) is valid.

- ( ) True
- ✓ (•) False

Question 3 **1 / 1 point**

[1%] The completeness theorem says that a sentence can be proved if it is entailed by another set of sentences.

- ✓ (•) True
- ( ) False

Question 4 **1 / 1 point**

[1%] Skolemization is the process of removing universal quantifiers by elimination.

- ( ) True
- ✓ (•) False

Question 5 **1 / 1 point**

[1%] First Order Logic is monotonic.

- [x] True
- [ ] False

Question 6 **1 / 1 point**

[1%] Sound inference algorithms are always complete.

- [ ] True
- [x] False

Question 7 **1 / 1 point**

[1%] First Order Logic has quantifiers ∀ and ∃.

- [x] True
- [ ] False

Question 8 **1 / 1 point**

[1%] Linearization is the process of deriving a totally ordered plan from a partially ordered plan.

- [x] True
- [ ] False

Question 9 **1 / 1 point**

[1%] All sentences can be expressed in Horn form.

- [ ] True
- [x] False

Question 10 **1 / 1 point**

"Everything attracts something", where "something" means "something or other", is equivalent to "∀x ∀y A(x, y) " [Given that Attract is a relation from x to y, i.e., A(x,y) says that "x attracts y" or equivalently that "y is attracted by x".]

- [ ] True
- [x] False

[15%] Propositional Logic

[8%] (This section will be graded automatically)

Consider the following KB and :

$$KB = (p \rightarrow \neg q) \wedge (r \rightarrow q) \wedge (\neg r \rightarrow p)$$

$$\alpha = ((\neg p \wedge q) V (p \wedge \neg q)) \wedge ((q \wedge r) V (\neg q \wedge \neg r)) \wedge (p V \neg q)$$

Please fill in the truth table with "T" or "F" and answer the following questions.

Question 11 **1 / 1 point**

[P, Q, R] = [F, F, F]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✔(50 %)

Answer for blank # 2: F ✔(50 %)

Question 12 **1 / 1 point**

[P, Q, R] = [F, F, T]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✔(50 %)

Answer for blank # 2: F ✔(50 %)

Question 13 **0.5 / 1 point**

[P, Q, R] = [F, T, F]

value of KB = ?

value of alpha= ?

Answer for blank # 1: T ✖ **(F, False)**

Answer for blank # 2: F ✔(50 %)

Question 14 **1 / 1 point**

[P, Q, R] = [F, T, T]

value of KB = ?

value of alpha= ?

Answer for blank # 1: T ✔(50 %)

Answer for blank # 2: F ✔(50 %)

Question 15 **0.5 / 1 point**

[P, Q, R] = [T, F, F]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✗ **(T, True)**

Answer for blank # 2: T ✓(50 %)

Question 16 **1 / 1 point**

[P, Q, R] = [T, F, T]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✓(50 %)

Answer for blank # 2: F ✓(50 %)

Question 17 **1 / 1 point**

[P, Q, R] = [T, T, F]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✓(50 %)

Answer for blank # 2: F ✓(50 %)

Question 18 **1 / 1 point**

[P, Q, R] = [T, T, T]

value of KB = ?

value of alpha= ?

Answer for blank # 1: F ✓(50 %)

Answer for blank # 2: F ✓(50 %)

[7%] (This section will be graded manually)

Question 19 **3 / 3 points**

[3%] Does

$$KB \models \alpha$$

, why or why not?

no, because there is case when KB = T and alpha = F

The correct answer is not displayed for Written Response type questions.

Question 20 **1 / 1 point**

[1%] Is KB satisfiable?

yes

The correct answer is not displayed for Written Response type questions.

Question 21 **1 / 1 point**

[1%] Is

$$\alpha$$

satisfiable?

yes

The correct answer is not displayed for Written Response type questions.

Question 22 **1 / 1 point**

[1%] Is KB valid?

no

The correct answer is not displayed for Written Response type questions.

Question 23 **1 / 1 point**

[1%] Is

$$\alpha$$

Valid?

no

The correct answer is not displayed for Written Response type questions.

[15%] First Order Logic

Consider a domain with the following relations and objects.

Eats(x,y) -> Person x eats Food y
Tastes(x,y) -> Person x tastes Food y
Cooks(x,y) -> Person x cooks Food y
Person(x) -> x is a Person
Customer(x,y) -> Person x is a customer of Person y
Chef(x) -> Person x is a chef

Food(y) -> y is Food.
LivesAlone(x) -> Person x lives alone
Meat, Vegetables, Fruit -> Constants denoting Food

Formalize the following sentences for this domain. (this section will be graded manually)
OR: V
AND: ^
NOT: ~
EXISTS: (ex)
FOR ALL: (all)
IMPLIES: =>

Question 24 **3 / 3 points**

[3%] There is no Chef who doesn't taste all of the food they cook.

~(ex)x, (ex)y Chef(x) ^ Food(y) ^ Cooks(x,y) ^ ~Tastes(x,y)

The correct answer is not displayed for Written Response type questions.

Question 25 **0 / 5 points**

[5%] There is a chef who cooks meat, but is not a customer of any chef that cooks meat

(ex)x, (ex)y Chef(x) ^ Cooks(x,Meat) => ~Customer(x,y) ^ Chef(y) ^ Cooks(y,Meat) ^ ~(x = y)

The correct answer is not displayed for Written Response type questions.

Question 26 **0 / 4 points**

[4%] Any person who does not cook any food either does not live alone or is a customer of at least one chef.

(ex)x, (ex)y, (ex)z Person(x) ^ Food(y) => ~LivesAlone(x) V (Customer(x,z) ^ Chef(z))

The correct answer is not displayed for Written Response type questions.

Question 27 **3 / 3 points**

[3%] Every chef who eats food is a customer of a chef.

(all)x, (ex)y, (ex)z Chef(x) ^ Food(y) ^ Eats(x,y) => Customer(x,z) ^ Chef(z)

The correct answer is not displayed for Written Response type questions.

[20%] Inference

OR: V
AND: ^
NOT: ~
EXISTS: (ex)

FOR ALL: (all)
IMPLIES: =>

Question 28 **3 / 12 points**

Prove KB |= α using contradiction. KB and α are defined as follows:

KB: (p ⟶ q), (¬r v s), (p v r)
α: (¬q ⟶ s)

Fill the rest of the table to complete the proof:

Resolvent	**Sentence1, Sentence2, …., Rule used**
1. (p ⟶ q)	Premise
2. ¬(¬q ⟶ s)	Adding ¬α to the KB
3. ¬q /\ ¬s	S2, Simplifying the implication and distributing ¬

Please use the above format for your answer (left side resolvent, right side justification).
Allowed symbol representations:
negation: ~, (not)
implication: ->, (implies)
conjunction: ^, (and)
disjunction: v, (or)

4. ~p V q	simplify from S1
5. p V r	premise
6. q V r	resolution from S4 and S5
7. ~r V s	premise
8. q V s	resolution from S6 and S7
9. (~q -> s)	target
10. q V s	simplify from S9
11. S8 = S11	when KB is true, alpha is true

The correct answer is not displayed for Written Response type questions.

Question 29 **3 / 3 points**

[3%] If "x = 10", then "there is no solution". "There is no solution", therefore "x =10". Is the above inference correct or not?

- ○ Yes
- ✔ ● No

Question 30 **2 / 2 points**

[2%] If there is no solution, x = 10. There is no solution, therefore x = 10.

Is the above argument a valid one?

- [x] Yes
- [ ] No

Question 31 **3 / 3 points**

[3%] If p→q and p→r, can we conclude that p→(q∧r)

- [x] Yes
- [ ] No

[10%] CNF Transformation (Skolemization)

Convert the following sentence into Conjunctive Normal Form (CNF):

∀x[∀y A(y) → L(x,y)] →[∃y L(y, x)]

Fill in the blanks:

1. The two Skolem Functions being used are F(.) and G(.)
2. No whitespaces
3. No unnecessary brackets
4. Use the character "~" for "NOT"
5. Uppercase letters for functions, lowercase letters for variables

For your reference:

OR: V
AND: ^
NOT: ~
EXISTS: (ex)
FOR ALL: (all)
IMPLIES: =>

Question 32 **8 / 8 points**

[8%]

The following is the sentence obtained after performing **all except the last step of the CNF transformation** (right before the final step of converting to conjunctions of disjunctions):

(A(F(x)) ^ ~ ___1___) v (___2___)

___1___: _____

___2___: _____

1: L(x, F(x))
2: L(x, G(x))

The correct answer is not displayed for Written Response type questions.

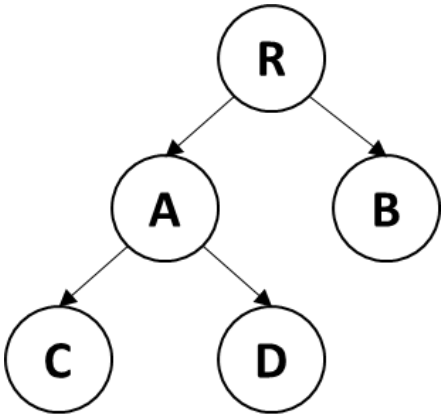
Question 33 **2 / 2 points**

[2%] Denoting A(F(x)) as "3", and denoting your answers above by the blank number they fill (i.e. your answer for ___1___ will be denoted as "1"), which of the following is the final CNF form of the given sentence?:

- ( ) (3 v 2) ^ (1 v 2)
- ( ) (3 v ~2) ^ (1 v ~2)
- (✓) (3 v 2) ^ (~1 v 2)
- ( ) (~3 v 2) ^ (1 v 2)

[20%] Planning

Tree, one of the basic data structures in computer science, describes hierarchical relations between entities. The figure below depicts a tree:



In the given sample tree, R is the root, A and B being R's children and C, D being A's children.

We now define two valid actions for a tree:

- **addChild(X, Y)**: Let Y be a child of X. We will have X->Y in the tree.
- **removeNode(X)**: Remove node X from the tree. When it has children, its children will become children of its parent node. If X is the root, simply delete the entire tree.

And the following conditions:

- **isRoot(X)**: Some node X is the root of the given tree. For example, in the sample tree, we have isRoot(R).
- **isEmpty()**: The given tree is empty, which means there is no node in the tree.
- **pointTo(Y, X)**: Some node X points to some node Y, which means X is the parent node of Y. For example, in the given stack, we have pointTo(R, A), etc.

Note:

- The names of all entities, conditions and actions in this question are **case-sensitive**.
- For pre and post conditions, you should **only** include conditions that are impacted by the action in your answers. For example, if some X is the root of the given sample tree, you shouldn't always have isRoot(X) in your answers unless it is no longer the root after the action, and you **don't need** to have a negated one once the condition is no longer satisfied.
- Pay attention to the **order of the parameters** when there are multiple.
- In this question, a node can have only one parent but can have multiple children.

Question 34 **5 / 5 points**

[5%] What are the current conditions for the given sample tree? Check all valid conditions below.

- ✔ ☑ isRoot(R)
- ✔ ☐ isRoot(B)
- ✔ ☐ isRoot(C)
- ✔ ☐ isRoot(D)
- ✔ ☐ isEmpty()
- ✔ ☐ pointTo(R, A)
- ✔ ☐ pointTo(R, B)
- ✔ ☐ pointTo(R, C)
- ✔ ☐ pointTo(R, D)
- ✔ ☐ pointTo(A, C)
- ✔ ☐ pointTo(A, D)
- ✔ ☑ pointTo(A, R)
- ✔ ☑ pointTo(B, R)
- ✔ ☑ pointTo(C, A)
- ✔ ☐ pointTo(C, R)
- ✔ ☑ pointTo(D, A)
- ✔ ☐ pointTo(D, R)

Question 35 **2 / 2 points**

[2%] Please judge whether the following statements are true or false.

The pre and post conditions for action addChild(X, Y) are always the same under all situations (Assuming the tree is not empty before this action).

- ✔ ◉ True

False

Question 36 **2 / 2 points**

[2%] Please judge whether the following statements are true or false.

The pre and post conditions for action removeNode(X) are always the same under all situations.

True

✓ False

Question 37 **2 / 2 points**

[2%] In the given situation, what are the postconditions for action addChild(A, E). Check all valid options below (follow the requirements above).

✓ isRoot(R)

✓ isRoot(B)

✓ isRoot(C)

✓ isRoot(D)

✓ isEmpty()

✓ pointTo(R, A)

✓ pointTo(R, B)

✓ pointTo(R, C)

✓ pointTo(R, D)

✓ pointTo(A, C)

✓ pointTo(A, D)

✗ pointTo(A, E)

✓ pointTo(A, R)

✓ pointTo(B, R)

✓ pointTo(C, A)

✓ pointTo(C, R)

✓ pointTo(C, E)

✓ pointTo(D, A)

✓ pointTo(D, E)

✓ pointTo(D, R)

View question 37 feedback

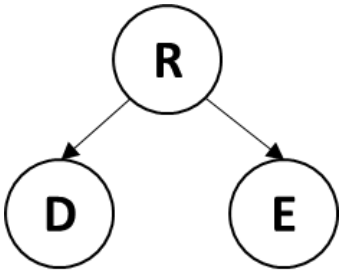
Question 38 **5 / 5 points**

[5%] In the given situation (before the action in question C), what are the preconditions for action removeNode(R). Check all valid options below (follow the requirements above).

- [x] isRoot(R)
- [ ] isRoot(B)
- [ ] isRoot(C)
- [ ] isRoot(D)
- [ ] isEmpty()
- [ ] pointTo(R, A)
- [ ] pointTo(R, B)
- [ ] pointTo(R, C)
- [ ] pointTo(R, D)
- [ ] pointTo(A, C)
- [ ] pointTo(A, D)
- [x] pointTo(A, R)
- [x] pointTo(B, R)
- [x] pointTo(C, A)
- [ ] pointTo(C, R)
- [x] pointTo(D, A)
- [ ] pointTo(D, R)

Question 39 **2 / 2 points**

[2%] To reach the following state, how many steps, in minimum, should be taken from the initial state?



Answer: 4 ✓

Question 40 **0 / 2 points**

[2%] Please judge whether the following statements are true or false.

In question E, linearization is not needed to get a valid plan.

- ✗ (●) True
- ➡ ( ) False

{10%] Multiple Choice

Question 41 **0 / 2.5 points**

[2.5%] Given

- A set of operators O is said to be adequate for propositional logic, if for every formula in propositional logic, there is a logically equivalent formula using only the operators in O.
- Let $\Gamma = \{ \phi_i \mid 1 <= i <= n \}$ be a finite set of propositions, and let Ψ be any proposition.

Which of the following are true

- ➡ ✗ [ ] { => , ¬} is an adequate set of operators for Propositional Logic
- ➡ ✓ [✓] Γ |= Ψ if and only if, ((...((ϕ2 ^ ϕ2)^ ϕ3)^ ... ^ ϕn)) => Ψ is a tautology.
- ➡ ✗ [ ] Γ |= Ψ if and only if, ((...((ϕ2 ^ ϕ2)^ ϕ3)^ ... ^ ϕn)) ^ ¬Ψ is a contradiction.
- ✓ [ ] Γ |= Ψ if and only if, ((...((ϕ2 ^ ϕ2)^ ϕ3)^ ... ^ ϕn)) v ¬Ψ is a contradiction.
- ➡ ✗ [ ] ((X => Y) => X) => X is a Tautology.

Question 42 **0 / 2.5 points**

[2.5%] Given:

- => and <=> are both right associative meaning, X=>Y=>Z should be considered as (X => (Y => Z))
- A set of operators O is said to be adequate for propositional logic, if for every formula in propositional logic, there is a logically equivalent formula using only the operators in O.

Which of the following are true :

- ➡ ✓ [✓] False |= True
- ➡ ✗ [ ] X => X => X => X => X ... (inf) is a Tautology
- ➡ ✗ [ ] X => Y => X is a Tautology
- ✗ [✓] We can unify P(x, y, F(z)) and Q(a, b, F(Madonna)).
- ➡ ✗ [ ] {∨, ¬} is an adequate set of operators for Propositional Logic

Question 43 **0 / 2.5 points**

[2.5%] If "Everyone in the world loves a lover"(interpreted as anyone who is a lover is loved by everyone in the world) and "Romeo loves Juliet" are true, then:

- ☐ I love you
- ☐ You love yourself
- ☐ Everyone loves everyone
- ☑ If I love you, then you love me
- ☑ Dude, No one loves anyone.

Question 44 **0 / 2.5 points**

[2.5%] Consider the universe of discourse to be the set of all nodes of directed graphs and let the atomic binary predicate symbol e stand for the edge relation on nodes, i.e. e(x, y) stands for there is an edge from node x to node y in a directed graph. Further, let "=" stand for the usual identity relation on nodes.

Which of the following **can be true** for a directed graph:

- ☐ ∀x [∃y [~(x = y) ^ e(x, y)]]
- ☐ ∀x [∀y [e(x, y) => ~(x = y)]]
- ☐ ∀x [∀y [~(x = y) => (e(x, y) => e(y, x))]]
- ☐ ∀x [∀y [∀z [e(x, y) ^ e(y, z) => e(x, z)]]]
- ☑ ∀x ∀y ~(x = y) => [e(x, y) v e(y, x)]

Attempt Score: 69 / 100 - 69 %

Overall Grade (highest attempt): 69 / 100 - 69 %

Done