Unit 13 - Week 10

Assignment 10

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-04-08, 23:59 IST.

A note on models:

Recall that a knowledge base (KB) is a set of sentences in a given language L(R, F, C). The KB is also referred to as a **first order theory**. Some authors refer to the theory as the KB and all the consequences of the KB. We will adopt this definition, which is the closure of the KB under implication. For example, if the KB is { Man(socrates), ∀x [Man(x) ⊃ Mortal(x)] }, then the theory will include Mortal(socrates).

An interpretation <D,I> of a theory is a domain D and a mapping I from the relations, functions and constants of the language to the domain. An interpretation is a model of the KB (model of the theory) if all the sentences in the theory are true in the interpretation. For example, an interpretation in which I(Man) = set of humans, and I(Mortal) = set of tall things (after all a predicate can mean whatever we intend it to mean!) then domain in which Socrates is human, Socrates is tall, and the set of humans is a subset of tall things is a model. But also a domain in which Plato is a human in addition to Socrates, even though Plato does not find mention in the KB.

Thus, models can have more "facts" than are implied by the KB, as long as the sentences in the theory associated with the KB are true in the interpretation.

A minimal model is the smallest interpretation, in terms of the number of "facts", that is a model.

1) Which of the following is/are true about default reasoning? *1 point*

- It is monotonic: If some statement is entailed by a KB, it is also entailed by any superset of the KB
- It is non monotonic: It allows us to draw conclusions from limited data, which may be withdrawn later if we get more information
- It allows us to make reasonable inferences in the absence of complete information
- Once a conclusion has been drawn, it remains valid thereafter

No, the answer is incorrect.
Score: 0
Accepted Answers:
It is non monotonic: It allows us to draw conclusions from limited data, which may be withdrawn later if we get more information
It allows us to make reasonable inferences in the absence of complete information

2) What is closed-world assumption? *1 point*

- Unless an atomic sentence is known to be false, it is assumed to be true
- Unless an atomic sentence is known to be true, it is assumed to be false
- The KB is fixed and cannot be expanded by entailments
- None of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
Unless an atomic sentence is known to be true, it is assumed to be false

3) Given a consistent knowledge base (KB) composed of a single sentence { p ∨ q } and the augmented knowledge base (KB+), mark all the correct options. *1 point*

- Under CWA, KB+ is always consistent
- Under GCWA, KB+ is always consistent
- Under CWA, KB+ is { p ∨ q, ¬p, ¬q }
- GCWA agrees with CWA in the absence of disjunctions
- GCWA is a stronger version of the CWA

No, the answer is incorrect.
Score: 0
Accepted Answers:
Under GCWA, KB+ is always consistent
Under CWA, KB+ is { p ∨ q, ¬p, ¬q }
GCWA agrees with CWA in the absence of disjunctions

4) Given the knowledge base KB = { p ∨ q ∨ r, q, ¬q ∨ r }, mark all the entailments of the KB when we use Generalized Closed World Assumption. *1 point*

- Neither q nor ¬q
- Both q and ¬q
- Neither p nor ¬p
- Both p and ¬p
- p
- ¬p
- q
- r
- ¬q
- ¬r

No, the answer is incorrect.
Score: 0
Accepted Answers:
¬p
q
r

5) Consider a KB containing atomic sentences of the form Edge(x, y) where x and y are nodes and Edge(x,y) means that node x is connected to node y. Suppose there is a node called 'p' which is not connected to any other node. Which properties of KB would necessarily entail ¬∃x Edge(x, p)? *1 point*

- Circumscription only
- Closed World Assumption only
- Domain closure and Closed World Assumption
- Circumscription and Closed World Assumption

No, the answer is incorrect.
Score: 0
Accepted Answers:
Domain closure and Closed World Assumption

6) Identify the set of statements below that define the minimal model for circumscription on the given KB. *1 point*

KB = { ∀x [(NoCough(x) ∧ ¬Ab(x)) ⊃ CovidFree(x)],
∀y [TestsPositive(y) ⊃ ¬CovidFree(y)],
NoCough(sneha), NoCough(sangeeta), NoCough(avinash),
sneha ≠ sangeeta, sneha ≠ avinash, sangeeta ≠ avinash,
TestsPositive(avinash) }

- { ¬Ab(avinash), ¬Ab(sangeeta), ¬Ab(sneha) }
- { Ab(avinash), ¬Ab(sangeeta), ¬Ab(sneha) }
- { Ab(sneha), ¬Ab(avinash), Ab(sangeeta) }
- { Ab(sangeeta), ¬Ab(avinash), Ab(sneha) }
- { Ab(avinash), Ab(sneha), ¬Ab(sangeeta) }
- { Ab(avinash), Ab(sangeeta), ¬Ab(sneha) }
- { Ab(sangeeta), Ab(sneha), ¬Ab(avinash) }
- { Ab(avinash), Ab(sangeeta), Ab(sneha) }

No, the answer is incorrect.
Score: 0
Accepted Answers:
{ Ab(avinash), ¬Ab(sangeeta), ¬Ab(sneha) }

7) Which of the following sets of statements are true in some model of the KB in Question 6? *1 point*

- { CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(sneha), CovidFree(avinash), CovidFree(sangeeta) }
- { ¬CovidFree(sangeeta), CovidFree(avinash), CovidFree(sneha) }
- { ¬CovidFree(avinash), ¬CovidFree(sneha), CovidFree(sangeeta) }
- { ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(sangeeta), ¬CovidFree(sneha), CovidFree(avinash) }
- { ¬CovidFree(avinash), ¬CovidFree(sangeeta), ¬CovidFree(sneha) }

No, the answer is incorrect.
Score: 0
Accepted Answers:
{ ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
{ ¬CovidFree(avinash), ¬CovidFree(sneha), CovidFree(sangeeta) }
{ ¬CovidFree(avinash), ¬CovidFree(sangeeta), CovidFree(sneha) }
{ ¬CovidFree(avinash), ¬CovidFree(sangeeta), ¬CovidFree(sneha) }

8) Which of the following sets of statements are true under Circumscription with the KB from Question 6? *1 point*

- { CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(sneha), CovidFree(avinash), CovidFree(sangeeta) }
- { ¬CovidFree(sangeeta), CovidFree(avinash), CovidFree(sneha) }
- { ¬CovidFree(avinash), ¬CovidFree(sneha), CovidFree(sangeeta) }
- { ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }
- { ¬CovidFree(sangeeta), ¬CovidFree(sneha), CovidFree(avinash) }
- { ¬CovidFree(avinash), ¬CovidFree(sangeeta), ¬CovidFree(sneha) }

No, the answer is incorrect.
Score: 0
Accepted Answers:
{ ¬CovidFree(avinash), CovidFree(sangeeta), CovidFree(sneha) }

9) What is the Frame Problem in the context of Event Calculus? *1 point*

- The problem of deciding which fluents remain true or become true at future time instances
- The problem of determining the effects of stochastic actions
- The problem of determining which actions are needed to make a fluent true
- All of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
The problem of deciding which fluents remain true or become true at future time instances

10) Circumscribing a Simple Event Calculus KB with respect to the Happens predicate means *1 point*

- saying that effects of actions are only the ones stated in the narrative
- saying that the only events that happened are the ones stated in the narrative
- saying that some random effects of stochastic actions (like Spin) may happen
- saying that no action that is unstated in the narrative has happened
- saying that once an event has happened it cannot happen again
- none of the above

No, the answer is incorrect.
Score: 0
Accepted Answers:
saying that the only events that happened are the ones stated in the narrative
saying that no action that is unstated in the narrative has happened

11) Consider the Simple Event Calculus (reproduced below) from Assignment 5 Question 43. *1 point*

HoldsAt[f, t] ⊂ { Initially(f) ∧ ¬Clipped[f, 0, t] }
HoldsAt[f, t2] ⊂ { Happens[e, t1] ∧ Initiates[e, f, t1] ∧ (t1 < t2) ∧ ¬Clipped[f, t1, t2] }
Clipped[f, t1, t2] ⊂ ∃e ∃t (Happens[e, t] ∧ (t1 < t < t2) ∧ Terminates[e, f, t] }
¬HoldsAt[f, t2] ⊂ { Happens[e, t1] ∧ Terminates[e, f, t1] ∧ (t1 < t2) ∧ ¬Declipped[f, t1, t2] }
Declipped[f, t1, t2] ⊂ ∃e ∃t (Happens[e, t] ∧ (t1 < t < t2) ∧ Initiates[e, f, t] }

And consider the fluents and instantaneous actions for a eating-in-canteen domain:

Fluents:

at(Person, Location)	Person is at Location.
hasMoney(Person, Amount)	Person has money Amount.
hungry(Person)	Person is hungry.

Actions (instantaneous, non durative):

walk(Person, Location-1, Location-2)	Person walks from Location-1 to Location-2.
buy(Person, Stuff)	Person buys Stuff.
eat(Person, Food)	Person eats Food.

Given the narrative: "Sneha was hungry. She walked to the canteen at 1200 hrs, and had lunch there. At 1300 hours she walked to the AI-lab."

What can one say about the statement "HoldsAt[At(sneha, AI-lab), 1800]"?

- The statement is entailed by the KB. That means, it is true in all models of the KB
- The statement is true under Circumscription where the Happens, Initiates, and Terminates predicates are circumscribed
- The statement is true under Circumscription where the Happens predicate is circumscribed
- The statement is true under Circumscription where the Initiates, and Terminates predicates are circumscribed

No, the answer is incorrect.
Score: 0
Accepted Answers:
The statement is true under Circumscription where the Happens, Initiates, and Terminates predicates are circumscribed