Module2-quiz-SP23

Due Feb 5 at 11:59pm **Points** 10 **Questions** 10
Available Jan 22 at 12am - Feb 6 at 2:59am **Time Limit** 300 Minutes

Attempt History

	Attempt	Time	Score
LATEST	Attempt 1	4 minutes	10 out of 10

ⓘ Correct answers will be available on Feb 6 at 11pm.

Score for this quiz: **10** out of 10
Submitted Jan 27 at 2:30pm
This attempt took 4 minutes.

Question 1

1 / 1 pts

What are the free variables in the below Formula F1?

F1: $\exists x\, P(x) \rightarrow \forall\, y\, Q(y)$

- x
- x, y
- y
- None (selected)

There are no free variables. Both x and y are bounded variables. With the help of parse tree you can find bound and free variables.

Question 2

1 / 1 pts

What will be the Herbrand model for the below formula whose signature is {a, b, P}?

$\neg P(a) \wedge P(b) \wedge (\exists x P(x))$

- $P^I(a) = f , P^I(b) = f$
- (selected) $P^I(a) = f , P^I(b) = t$

  For $\neg P(a)$ to be true, $P^I(a)$ will be false and for P(b) to be true, $P^I(b)$ has to be true. And there exists some x that P can be True

- $P^I(a) = t , P^I(b) = t$
- $P^I(a) = t , P^I(b) = f$

Question 3

1 / 1 pts

Suppose σ = {a, P, Q}, where a is object constant, P is Unary and Q is binary predicate constant.

Statement: Q(a) is a Formula. True or False?

- True
- (selected) False

  As Q is binary predicate constant, the above statement is not a formula because it has only one predicate and syntactically not allowed.

Question 4

1 / 1 pts

The following 3 questions use the function *MapColor* and predicates *In(x,y)*, *Borders(x,y)*, and *Country(x)*, whose arguments are geographical regions, along

with constant symbols for various regions.

For this question, consider the English sentence "There is a country that borders both Iraq and Pakistan."

Choose the correct answer for the possible equivalent logical statement

$\exists c\, Country(c) \Rightarrow [Borders(c, Iraq) \wedge Borders(c, Pakistan)]$

- has correct syntax and accurately expresses the English sentence
- syntactically valid but does not express the meaning of the English sentence

  This incorrectly reads: If there is a country, then that country borders Iraq and Pakistan.

  The correct expression would be: $\exists c$ $Country(c) \wedge Borders(c, Iraq) \wedge Borders(c, Pakistan)$
- syntactically invalid and therefore meaningless

Question 5

1 / 1 pts

Choose the correct logical expression for the following English sentence: "Paris and Marseilles are both in France."

- $In(Paris, France) \vee In(Marseilles, France)$
- $In(Paris, France) \wedge In(Marseilles, France)$

  this expression correctly expresses the English sentence
- $In(Paris \wedge Marseilles, France)$

Question 6

1 / 1 pts

Choose the correct logical expression for the following English sentence: "No two adjacent countries have the same map color."

- ◉ $\forall x \forall y$ $(Country(x) \land Country(y) \land Borders(x, y) \land \neg(x = y)) \Rightarrow \neg(MapColor(x) = MapColor(y)$

  this accurately expresses the English sentence. Notice that we also need to make sure that x and y are not the same country

- ○ $\forall x \forall y$ $Country(x) \land Country(y) \land Borders(x, y) \land \neg(MapColor(x) = MapColor(y))$

- ○ $\forall x \forall y$ $\neg Country(x) \lor \neg Country(y) \lor \neg Borders(x, y) \lor \neg(MapColor(x) = MapColor(y))$

- ○ $\forall x \forall y \ (Country(x) \land Country(y) \land Borders(x, y)) \Rightarrow MapColor(x \neq y)$

Question 7

1 / 1 pts

Let the underlying signature be {a, P, Q}, where a is an object constant, P is a unary predicate constant, and Q is a binary predicate constant. Assume object variables range over the set N of nonnegative integers, and the signature is interpreted as follows:

- a represents the number 10,
- P(x) represents the condition “x is a prime number,”
- Q(x, y) represents the condition “x is less than y.”

Which of the following first-order logic formulas express the following English sentence?

"x equals 9."

Choose all that apply.

- ☐ Q(a, x)∧¬P(x)

- [x] Q(x, a)∧¬∃y[Q(x, y)∧Q(y, a)]
- [x] Q(x, a)∧∀y[Q(x, y)->(y=a∨Q(a, y))]
- [ ] Q(a, x)

Question 8

1 / 1 pts

Statement: Following first-order formula is satisfiable. True or False?

∀xy(x = y)

- (•) True
- ( ) False

Question 9

1 / 1 pts

Assume that the signature consists of the object constant Me, the unary predicate constant Male, and the binary predicate constant Parent, and nothing else. Which of the following first-order logic formulas express the following English sentence?

"I have no daughters"

Choose all that apply. (Hint: there are 2 correct answers.)

- [x] ¬∃x(¬Male(x) ∧ Parent(Me, x))
- [ ] ∀x (Male(x) ∧ ¬Parent(Me, x))
- [ ] ∃x(Male(x) ∧ Parent(Me, x))
- [x] ∀x (Parent(Me, x) -> Male(x))

Question 10

1 / 1 pts

Which of the following statements are true for any first-order formula F and G, and for any interpretation I?

$(F \wedge G)^I = \wedge(F, G)$

$(\neg F)^I = \neg\left(F^I\right)$

$\exists w F(w)^I = t$ **iff, for some object constant** $c, F(c)^I = t$

- 3
- 2
- 1,3
- 1,2

Quiz Score: **10** out of 10