Module 1 Practice Quiz

Due No due date **Points** 10 **Questions** 10
Available after Jan 10 at 11:59pm **Time Limit** None
Allowed Attempts Unlimited

Take the Quiz Again

Attempt History

	Attempt	Time	Score
KEPT	Attempt 2	6 minutes	9.33 out of 10
LATEST	Attempt 2	6 minutes	9.33 out of 10
	Attempt 1	less than 1 minute	2.33 out of 10

Submitted Mar 1 at 8:33pm

Question 1

1 / 1 pts

A propositional formula of signature σ is defined recursively as follows:

- Every atom is a formula

- Both 0-place connectives are formulas

- If F is a formula then ¬F is a formula

- For any binary connective $\odot$, if F and G are formulas then (F$\odot$G) is a formula

How many of the following strings are propositional formulas under the signature σ = {eat, a, b, c} according to the definition?

- $(\bot \wedge \top)$
- eat
- a $\wedge$ b $\vee$ c

- 0
- 3
- 1

Correct!

- 2

According to the signature, there are 4 atoms: eat, a, b, c. Since each atom is a formula (from bullet 1), at least "eat" is a formula.

Since both 0-place connectives (i.e., $\top$ and $\bot$) are formulas (from bullet 2), and due to bullet 4, "$(\bot \wedge \top)$" is a formula.

The last option "$a \wedge b \vee c$" is not a formula since, due to bullet 4, each time a binary connective is included, a pair of parentheses has to be also included.

Question 2

1 / 1 pts

Apply unit propagation on the formula $p \wedge (\neg p \vee \neg q) \wedge (\neg q \vee r) \wedge (q \vee \neg r)$ starting with an empty set U of literals. What are the resulting formulas F from the first three iterations?

- $F_1 = p \wedge \neg r$, $F_2 = p$, $F_3 = T$

Correct!

- $F_1 = \neg q \wedge (\neg q \vee r) \wedge (q \vee \neg r)$, $F_2 = \neg r$, $F_3 = T$

The following table shows U_i and F_i for each iteration i.

Iteration i	**U_i**	**F_i**
0	{}	$p \wedge (\neg p \vee \neg q) \wedge (\neg q \vee r) \wedge (q \vee \neg r)$
1	{p}	$\neg q \wedge (\neg q \vee r) \wedge (q \vee \neg r)$
2	{p, ¬q}	$\neg r$
3	{p, ¬q, ¬r}	T

$F_1 = p \wedge \neg r$, $F_2 = \neg r$, $F_3 = T$

$F_1 = \neg q \wedge (\neg q \vee r) \wedge (q \vee \neg r)$, $F_2 = \neg r \wedge r$, $F_3 = T$

Question 3

1 / 1 pts

Apply unit propagation on the formula $p \wedge (\neg p \vee \neg q) \wedge (\neg q \vee r) \wedge (q \vee \neg r)$starting with an empty set U of literals. What are the resulting set U of literals from the first three iterations?

$U_1 = \{p\}$, $U_2 = \{p, \neg r\}$, $U_3 = \{p, q, \neg r\}$

$U_1 = \{p\}$, $U_2 = \{p, q\}$, $U_3 = \{p, \neg q, r\}$

$U_1 = \{p\}$, $U_2 = \{\neg q\}$, $U_3 = \{\neg r\}$

Correct!

$U_1 = \{p\}$, $U_2 = \{p, \neg q\}$, $U_3 = \{p, \neg q, \neg r\}$

The following table shows U_i and F_i for each iteration i.

Iteration i	**U_i**	**F_i**
0	{}	$p \wedge (\neg p \vee \neg q) \wedge (\neg q \vee r) \wedge (q \vee \neg r)$
1	{p}	$\neg q \wedge (\neg q \vee r) \wedge (q \vee \neg r)$
2	{p, ¬q}	$\neg r$
3	{p, ¬q, ¬r}	T

Question 4

0.33 / 1 pts

Which of the following propositional formulas or set of propositional formulas are satisfiable? Choose all that apply.

orrect Answer

- [ ] {p -> q, ¬p, ¬q}

orrect Answer

- [ ] $(p \wedge (\neg p \vee \neg q)) \wedge ((\neg q \vee r) \wedge (q \vee \neg r))$
- [ ] $(p \wedge q) \wedge (\neg p \vee \neg q)$

Correct!

- [x] {p -> q, q -> ¬p}

This is a set of 2 propositional formulas and it's satisfied by the interpretation I such that I(p)=false and I(q)=false.

Note that we can also simply write I={} (i.e., I is the empty set) to define interpretation I, which means "none of p or q is true".

Question 5

1 / 1 pts

Let F, G, H be propositional formulas. Which option is correct?

- $F \wedge (F \vee G) \wedge (\neg F \vee \neg G) \wedge (G \vee H) \wedge (\neg G \vee \neg H)$ is not satisfiable.

Correct!

- $F \vee (G \leftrightarrow H)$ is equivalent to $(F \vee G) \leftrightarrow (F \vee H)$

  There are 8 interpretations if you consider the truth value of F, G, and H. For each interpretation I of the 8 interpretations, you can check that the left formula is satisfied by I iff the right formula is satisfied by I.

- $\{\bot\}$ entails F iff F is a tautology.

- $\{F \rightarrow G, G \rightarrow H\}$ entails $H \rightarrow F$

Question 6

1 / 1 pts

Is the following statement true or false?

For any formulas F and G, if F ∨ G is a tautology, then F is a tautology or G is a tautology.

- True

Correct!

- False

  The statement is false since p ∨¬p is a tautology while neither p or ¬p is a tautology.

Question 7

1 / 1 pts

Which kind of reasoning is used in the following example?

All cats are mammals, all mammals have kidneys; therefore all cats have kidneys.

- Model finding
- Default reasoning

Correct!

- Deductive reasoning

This is deductive reasoning since we are deriving entailed facts from some given facts.

- Abductive reasoning

Question 8

1 / 1 pts

Suppose p and q are atoms. Which option is correct?

- $\{p \vee q\}$ entails at least one of p or q.
- $\{\}$ entails p.
- $\{p \vee q, \neg p \wedge \neg q\}$ is satisfiable.

Correct!

- $\{p \rightarrow q, q, p \rightarrow \neg q\}$ is satisfiable.

This is a set of 3 propositional formulas and it can be satisfied by the following interpretation.

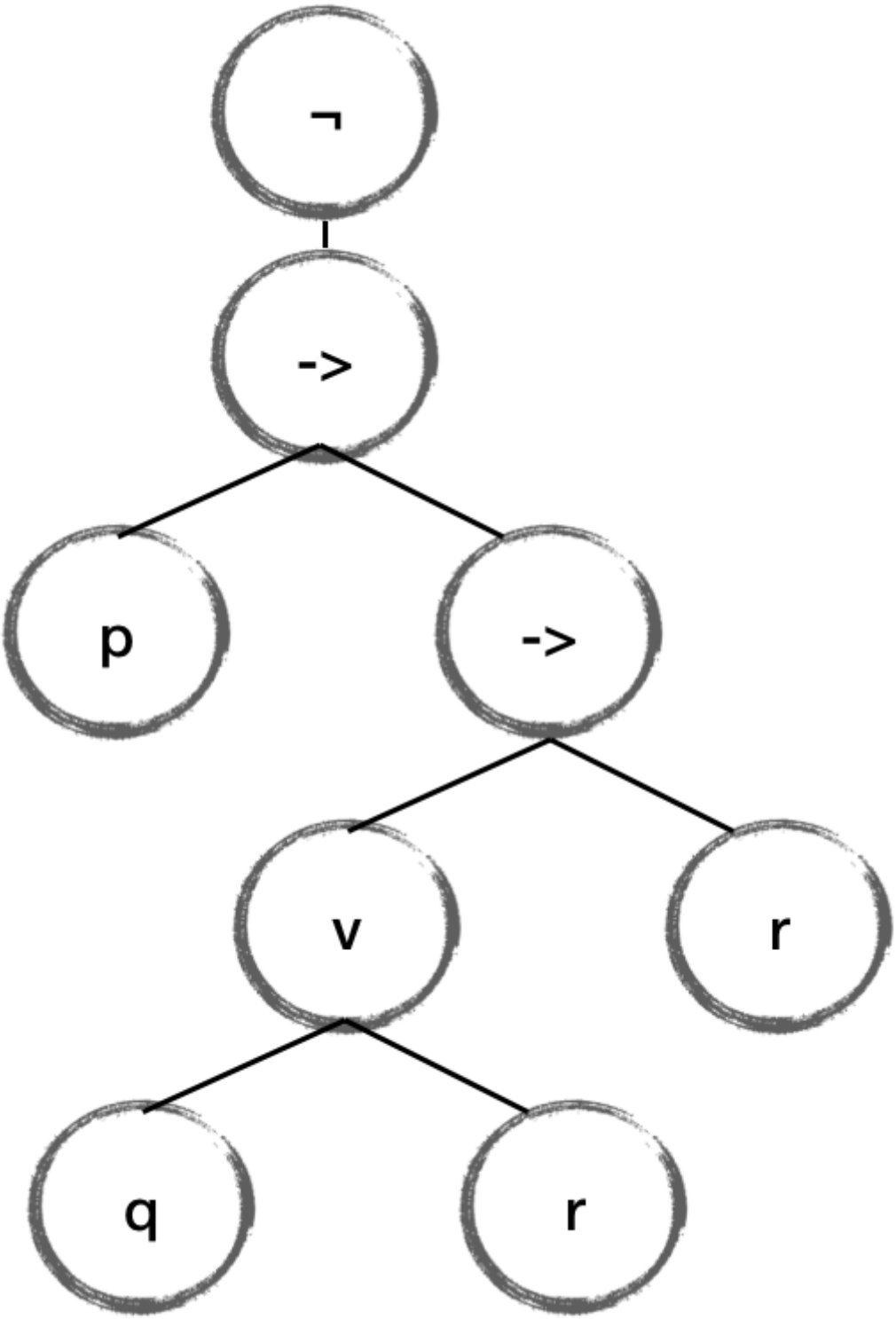
I = {q}

(Note that the above writing is the same as saying "I(p)=false, I(q)=true".)

Question 9

1 / 1 pts

Which interpretation I satisfies the propositional formula corresponding to the following parse tree?



I(p)=f, I(q)=t, I(r)=t

I(p)=f, I(q)=t, I(r)=f

Correct!

I(p)=t, I(q)=t, I(r)=f

This is correct. You may consider the truth value of each node in the parse tree directly, or you may first turn the parse tree into a propositional formula and then check what are the interpretations that could satisfy it.

The propositional formula is $\neg(p \rightarrow ((q \vee r) \rightarrow r))$. To make it to be true, $p \rightarrow ((q \vee r) \rightarrow r)$must be false. Thus

- p must be true, and
- $(q \vee r) \rightarrow r$ must be false.

Next,

- p must be true,
- $q \vee r$ must be true, and
- r must be false.

Next,

- p must be true,
- q must be true, and
- r must be false.

I(p)=t, I(q)=f, I(r)=t

Question 10

1 / 1 pts

Determine which of the following formulas are tautologies. Choose all that apply.

Correct!

$((p \rightarrow q) \rightarrow p) \rightarrow p$

There are 2 atoms thus there are 2^2 interpretations. You can check that all of them satisfy $((p \to q) \to p) \to p$

Correct!

- [x] $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$

There are 3 atoms thus there are $2^3 = 8$ interpretations. You can check that all of them satisfy $(p \to (q \to r)) \to ((p \to q) \to (p \to r))$.

- [ ] $(p \to q) \to (q \to p)$

Correct!

- [x] $(p \to q) \vee (q \to p)$

There are 2 atoms thus there are 2^2 interpretations. You can check that all of them satisfy $(p \to q) \vee (q \to p)$