

CANDIDATE

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TEST

Quiz 7

Subject code	
Evaluation type	
Test opening time	03.04.2024 07:00
End time	10.04.2024 08:00
Grade deadline	
PDF created	13.08.2024 06:36

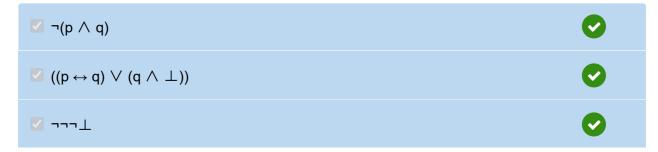
Question	Status	Marks	Question type
1.1	Correct	1/1	Multiple Choice
1.2	Correct	1/1	Multiple Response
1.3	Correct	1/1	Multiple Response
1.4	Correct	1/1	True / False
1.5	Correct	1/1	Multiple Response
2.1	Correct	1/1	Multiple Response
2.2	Correct	1/1	Numeric Entry
2.3	Correct	1/1	Multiple Response
2.4	Correct	1/1	Multiple Response
2.5	Correct	1/1	Multiple Response

- 1.1 What is the value of (!x) || (y && (x || z)) when x=1, y=1 and z=0?
 - None of these options



1.2 Assume $\{p,q\} \subseteq Prop$. Which of the following are well-formed formulas under the strictest definition given in lectures (i.e. no conventional omissions)?

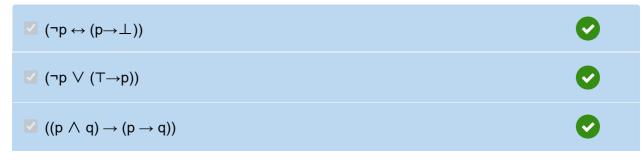
Select all that apply:



- (⊥ ∨ (¬T))
- \square p $\rightarrow \neg \top$

1.3 Which of the following propositional formulas are tautologies?

Select all that apply:



- $(((p \rightarrow q) \land (q \rightarrow r)) \leftrightarrow (p \rightarrow r))$
- $((p \to q) \to (p \land q))$

1.4 True or false:

$$(p \land r), (q \rightarrow \neg p) \models (r \lor q)$$

Select one alternative:

True	

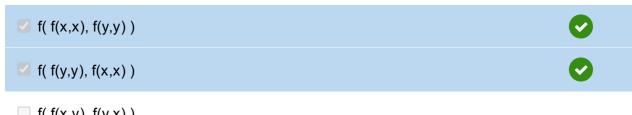
- False
- **1.5** Which of the following are logically equivalent to: $(((a \rightarrow \bot) \land (b \rightarrow \bot)) \rightarrow \bot)$? Select all that apply:
 - \Box (a \leftrightarrow b)
 - \Box (a \rightarrow b)
 - None of the other options
 - □ (a ∧ b)
 - ✓ (a ∨ b)

2.1 Let $f:\{0,1\}^2 \to \{0,1\}$ be the following binary boolean function:

Х	у	f(x,y)	
0	0	1	
0	1	0	
1	0	0	
1	1	0	

Which of the following binary boolean functions are the same as g(x,y) = (x & y)? Select all that apply:

- None of these options
- \Box f(f(x,y), f(x,y))



f(f(x,y), f(y,x))

2.2 The *minority function*, **minority**(x,y,z), is a 3-ary Boolean function that returns 1 if and only if at most one of x,y,z is 1.

How many minterms are there in the canonical DNF for minority? 4

How many clauses are there in an optimal DNF for **minority** (i.e. what is the minimum number of covering rectangles in a Karnaugh map for minority)?

2.3 Which of the following sets, operations and constants can be used to define a Boolean algebra? Select all that apply:

```
T = \{n : n>0 \text{ and } n|8\}
    Meet: x \wedge y := gcd(x,y)
   Join: x \lor y := lcm(x,y)
    Complement: x' := 8/x
    Zero: 1
    One: 8
   T = \{n : n > 0 \text{ and } n | 30\}
    Meet: x \land y := gcd(x,y)
   Join: x \lor y := lcm(x,y)
    Complement: x' := 30/x
   Zero: 1
    One: 30
    T = \{X \subseteq \mathbb{N} : X \text{ is finite}\} \cup \{X \subseteq \mathbb{N} : \mathbb{N} \setminus X \text{ is finite}\}
    Meet: x \land y := x \cap y
Join: x \lor y := x \cup y
    Complement: x' := \mathbb{N} \setminus x
    Zero: Ø
    One: N
   T = Pow(\{a,b,c\})
    Meet: x \land y := x \cup y
Join: x∨y := x∩y
    Complement: x' := \{a,b,c\}\x
    Zero: {a,b,c}
    One: Ø
    T = \{0,1\}
    Meet: x \wedge y := (xy)\%2
   Join: x \lor y := (x+y)\%2
    Complement: x' := 1-x
    Zero: 0
    One: 1
    T = [0,7] \cap \mathbb{N}
    Meet: x \wedge y := min(x,y)
   Join: x \lor y := max(x,y)
    Complement: x' := 7-x
    Zero: 0
    One: 7
```

2.4 Let F represent the set of all well-formed formulas. Define the relation R⊆F×F as follows:

 $(\phi,\!\psi) \in \mathsf{R} \text{ if and only if } \phi \models \psi$

Which of the following properties does R satisfy?

Select all that apply:

Anti-symmetric

Transitive



Symmetric

D	\sim f	lex	iv,	,
-			ıv	



Anti-reflexive

2.5 Suppose $\theta, \psi \models \neg \phi$.

Which of the following hold:

Select all that apply:

$$\bigvee \psi \models (\phi \rightarrow \neg \theta)$$



$$\Rightarrow \phi \rightarrow (\theta \rightarrow \psi)$$

$$\nabla \phi \models \neg(\theta \land \psi)$$



