

CSE541 Intuitive Predicate Logic SELF TEST

VERY SHORT QUESTIONS

Some of them will appear on MIDTERM

Circle proper answer. Write one sentence justification

This Self Test is created to make you practice what you know and how well and quick you can justify it.

It also will help you to remember basic Laws of Quantifiers. All of them and their counter examples are in the book.

Study also restricted domain quantifiers laws and counter examples. There are only

few of them and I didn't include them here but you must know them too.

For known basic laws of quantifiers you write "basic tautology" or the name- like - "distributivity law".

If it is not a tautology justification is mathematical statement that is a counter example.

HAVE FUN!

1. $(\exists x A(x) \Rightarrow \forall x A(x))$ is a predicate tautology.

JUSTIFY:

y n

2. For any predicates $A(x), B(x),$

$\neg \forall x (A(x) \cap B(x)) \equiv (\exists x \neg A(x) \cup \exists x \neg B(x))$ is a predicate tautology.

JUSTIFY:

y n

3. For any formulas $A(x), B,$ (this means that B does not contain the variable x)

$\neg \exists x (A(x) \cap B) \equiv \forall x \neg (A(x) \cap B)$ is a predicate tautology. JUSTIFY:

y n

4. $(A(x) \Rightarrow A(x))$ is a predicate tautology.

JUSTIFY:

y n

5. $\forall x (A(x) \cap B(x)) \equiv (\forall x A(x) \cap \forall x B(x))$ is a predicate tautology.

JUSTIFY:

y n

6. $\exists x (A(x) \cup B(x)) \equiv (\exists x A(x) \cup \exists x B(x))$ is a predicate tautology.

JUSTIFY:

y n

is

7. $\forall x (x < 0) \Rightarrow 2 + 2 \neq 4$ a true statement in a set of natural numbers.

JUSTIFY:

y n

8. $\forall x \in R (x^2 < 0) \Rightarrow \forall x \in R (x^2 \geq 0)$ is a true statement

JUSTIFY:

y n

9. $x + y > 0$, for $x, y \in N$ is a (mathematical) predicate with the domain N .
JUSTIFY: y n
10. $\exists x(x < 1) \cup 2 + 2 = 4$ is a true statement in a set of natural numbers numbers.
JUSTIFY: y n
11. $\forall x \in R(x^2 \geq 0) \Rightarrow \exists x \in R(x^2 \geq 0)$ is a true mathematical statement.
JUSTIFY: y n
12. $\neg \exists n \exists x(x < \frac{1+n}{n+1}) \equiv \forall n \exists x(x \geq \frac{1+n}{n-1})$
JUSTIFY: y n
13. $\neg \exists n \exists x(x < \frac{1+n}{n+1}) \equiv \forall n \forall x(x \geq \frac{1+n}{n-1})$
JUSTIFY: y n
14. The formula $\forall x(C(x) \Rightarrow F(x))$ can represents sentence: *All trees can fly* in a domain $X \neq \emptyset$. JUSTIFY: y n
15. The formula $\exists x(C(x) \cap B(x) \cap F(x))$ can represent a sentence: *Some blue flowers are yellow* in a domain $X \neq \emptyset$.
JUSTIFY: y n
16. For any formulas $A(x), B(x)$, the formula $((\forall x A(x) \cup \forall x B(x)) \Rightarrow \forall x(A(x) \cup B(x)))$ is a predicate tautology.
JUSTIFY: y n
17. $\exists x A(x) \Rightarrow \forall x A(x)$ is a predicate tautology.
JUSTIFY: y n
18. $\neg \forall x(A(x) \cap B(x)) \equiv (\neg \forall x A(x) \cup \exists x \neg B(x))$.
JUSTIFY: y n
19. $\neg \exists x(A(x) \cap B) \equiv \forall x \neg(A(x) \cup \neg B)$.
JUSTIFY: y n
20. $(A(x) \Rightarrow A(x))$ is a predicate tautology.
JUSTIFY: y n
21. $\forall x(A(x) \cap B(x)) \equiv (\forall x A(x) \cup \forall x B(x))$
JUSTIFY: y n
22. $\exists x(A(x) \cup B(x)) \equiv (\exists x A(x) \cup \exists x B(x))$
JUSTIFY: y n

23. $(\forall x(x < 1) \cup 2 + 2 \neq 4)$ is a true statement.
JUSTIFY: y n
24. $\forall x \in R(x^2 < 0) \Rightarrow \exists x \in R(x^2 > 0)$ is a true mathematical statement.
JUSTIFY: y n
25. $\neg \forall n \exists x(x < \frac{1+n}{n+1}) \equiv \exists n \forall x(x \geq \frac{1+n}{n-1})$
JUSTIFY: y n
26. $(\exists x(A(x) \cup B(x))) \equiv (\exists xA(x) \cup \exists xB(x))$
JUSTIFY: y n
27. $(\forall x(x < 1) \cup 2 + 2 \neq 4)$ is a true statement.
JUSTIFY: y n
28. $\forall x \in R(x^2 < 0) \Rightarrow \exists x \in R(x^2 > 0)$ is a true mathematical statement.
JUSTIFY: y n
29. The formula $\forall x(C(x) \cap F(x))$ can represents sentence: *All birds can fly* in in the domain $X \neq \emptyset$.
JUSTIFY: y n
30. For any formula $A(x)$, the formula
 $(\forall xA(x) \Rightarrow \exists xA(x))$ is a predicate tautology.
JUSTIFY: y n
31. For any formulas $A(x)$, B , (this means that B does not contain the variable x) the formula
 $(\forall x(A(x) \Rightarrow B) \Rightarrow (\exists xA(x) \Rightarrow B))$ is a predicate tautology.
JUSTIFY: y n
32. For any formulas $A(x)$, $B(x)$, the formula
 $(\exists x((A(x) \cap B(x)) \Rightarrow (\exists xA(x) \cap \exists xB(x)))$ is a predicate tautology.
JUSTIFY: y n
33. For any formulas $A(x)$, $B(x)$, the formula
 $(\forall x(A(x) \cup B(x)) \Rightarrow (\forall xA(x) \cup \forall xB(x)))$ is a predicate tautology.
JUSTIFY: y n
34. For any formulas $A(x)$, $B(x)$, the formula
 $(\forall x(A(x) \Rightarrow B(x)) \Rightarrow (\forall xA(x) \Rightarrow \forall xB(x)))$ is a predicate tautology.
JUSTIFY: y n
35. For any formulas $A(x)$, $B(x)$, the formula
 $(\exists x(A(x) \Rightarrow B(x)) \Rightarrow (\forall xA(x) \Rightarrow \exists xB(x)))$ is a predicate tautology.
JUSTIFY: y n

36. For any formulas $A(x)$, $B(x)$, the formula $(\forall x(A(x) \cap B(x)) \Rightarrow (\exists xA(x) \cap \exists xB(x)))$ is a predicate tautology.
JUSTIFY: **y n**
37. For any formula $A(x)$, the formula $(\forall xA(x) \Rightarrow \forall A(x))$ is a predicate tautology.
JUSTIFY: **y n**
38. For any formulas $A(x)$, B , (this means that B does not contain the variable x) the formula $\forall x(A(x) \Rightarrow B) \Rightarrow (\exists xA(x) \Rightarrow B)$ is a predicate tautology.
JUSTIFY: **y n**
39. For any formulas $A(x)$, $B(x)$, the formula $(\exists x((A(x) \cap B(x)) \Rightarrow (\exists xA(x) \cap \exists xB(x))))$ is a predicate tautology.
JUSTIFY: **y n**
40. For any formulas $A(x)$, $B(x)$, the formula $\forall x(A(x) \cup B(x)) \Rightarrow (\forall xA(x) \cup \forall xB(x))$ is a predicate tautology.
JUSTIFY: **y n**
41. For any formulas $A(x)$, $B(x)$, the formula $(\forall x(A(x) \Rightarrow B(x)) \Rightarrow (\forall xA(x) \Rightarrow \forall xB(x)))$ is a predicate tautology.
JUSTIFY: **y n**
42. For any formulas $A(x)$, $B(x)$, the formula $((\exists xA(x) \cap \exists xB(x)) \Rightarrow \exists x(A(x) \cap B(x)))$ is a predicate tautology.
JUSTIFY: **y n**