CSE541 INTUITIVE PREDICATE LOGIC TEST
Due April 26, in class
(10 extra points)

NAME **ID#**

Please read LECTURE NOTES 1, 2 on Predicate Logic. I wrote them for you as a REVIEW of what you should know.

Circle proper answer. WRITE short JUSTIFICATION.)
Give a counter example where needed. If a formula is listed in the Lecture Notes as tautology- just write Basic tautology (or logical equivalence)

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),
$\neg \forall x (A(x) \cap B(x)) \equiv (\exists x \neg A(x) \cup \exists x \neg B(x))$.
Justify:

y n

3. For any predicates A(x), B, (this means that B does not contain the variable x)
$\neg \exists x (A(x) \cap B) \equiv \forall x \neg (A(x) \cap \neg B)$.
Justify:

y n

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

y n

5. $\forall x (A(x) \cap B(x)) \equiv (\forall x A(x) \cap \forall x B(x))$
Justify:

y n

6. $\exists x (A(x) \cup B(x)) \equiv (\exists x A(x) \cup \exists x B(x))$
Justify:

y n

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

y n

8. $\forall x \in R (x^2 < 0) \Rightarrow \forall x \in R (x^2 \geq 0)$
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 $\forall x(C(x) \Rightarrow F(x))$ **represents sentence: *All trees can fly* in a domain** $X \neq \emptyset$**.**
Justify:

y n

15. The formula $\exists x(C(x) \cap B(x) \cap F(x))$ **represents sentence: *Some blue flowers are yellow* in a domain** $X \neq \emptyset$**.**
Justify:

y n

16. For any predicates 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 in a set of Natural numbers.**
Justify:

y n

24. $x + y > 0$**, for** $x, y \in N$ **is a (mathematical) predicate with the domain N.**
Justify:

y n

25. $\forall x \in R(x^2 < 0) \Rightarrow \exists x \in R(x^2 > 0)$ **is a true mathematical statement.**
Justify:

y n

26. $\neg \forall n \exists x(x < \frac{1+n}{n+1}) \equiv \exists n \forall x(x \geq \frac{1+n}{n-1}))$
Justify:

y n

27. $x + y > 0$**, for** $x, y \in N$ **is a true (mathematical) predicate with the domain N.**
Justify:

y n

28. $(\exists x(A(x) \cup B(x))) \equiv (\exists x A(x) \cup \exists x B(x))$
Justify:

y n

29. $\forall x \in R(x^2 > 0) \Rightarrow \exists x \in R(x^2 > 0)$ **is a true mathematical statement.**
Justify:

y n

30. $\neg \exists n \exists x(x < \frac{1+n}{n+1}) \equiv \forall n \exists x(x \geq \frac{1+n}{n-1}))$
Justify:

y n

31. **The formula** $\forall x(C(x) \cap F(x))$ **represents sentence:** ***All birds can fly*** **in in the domain** $X \neq \emptyset$**.**
Justify:

y n

32. **For any propositional function A(x) the formula** $(\forall x A(x) \Rightarrow \exists x A(x))$ **is a predicate tautology.**
Justify:

y n

33. **For any predicates A(x), B, (this means that B does not contain the variable x) the formula** $(\forall x(A(x) \Rightarrow B) \Rightarrow (\exists x A(x) \Rightarrow B))$ **is a predicate tautology.**
Justify:

y n

34. **For any predicates A(x), B(x), the formula** $(\exists x((A(x) \cap B(x)) \Rightarrow (\exists x A(x) \cap \exists x B(x)))$ **is a predicate tautology.**
Justify:

y n

35. **For any propositional functions A(x), B(x), the formula** $(\forall x(A(x) \cup B(x)) \Rightarrow (\forall x A(x) \cup \forall x B(x)))$ **is a predicate tautology.**
Justify:

y n

36. For any predicates A(x), B(x), the formula
$(\forall x(A(x) \Rightarrow B(x)) \Rightarrow (\forall x A(x) \Rightarrow \forall x B(x)))$ **is a predicate tautology.**
Justify:

y n

37. For any predicates A(x), B(x), the formula
$(\exists x(A(x) \Rightarrow B(x)) \Rightarrow (\forall x A(x) \Rightarrow \exists x B(x)))$ **is a predicate tautology.**
Justify:

y n

38. For any predicates A(x), B(x), the formula
$(\forall x((A(x) \cap B(x)) \Rightarrow (\exists x A(x) \cap \exists x B(x)))$ **is a predicate tautology.**
Justify:

y n

39. For any propositional function A(x) the formula
$(\forall x A(x) \Rightarrow \forall A(x))$ **is a predicate tautology.**
Justify:

y n

40. For any predicates A(x), B, (this means that B does not contain the variable x) the formula
$\forall x(A(x) \Rightarrow B) \Rightarrow (\exists x A(x) \Rightarrow B)$ **is a predicate tautology.**
Justify:

y n

41. For any predicates A(x), B(x), the formula
$(\exists x((A(x) \cap B(x)) \Rightarrow (\exists x A(x) \cap \exists x B(x)))$ **is a predicate tautology.**
Justify:

y n

42. For any predicates A(x), B(x), the formula
$\forall x(A(x) \cup B(x)) \Rightarrow (\forall x A(x) \cup \forall x B(x))$ **is a predicate tautology.**
Justify:

y n

43. For any predicates A(x), B(x), the formula
$(\forall x(A(x) \Rightarrow B(x)) \Rightarrow (\forall x A(x) \Rightarrow \forall x B(x)))$ **is a predicate tautology.**
Justify:

y n

44. For any predicates A(x), B(x), the formula

$((\exists x A(x) \cap \exists x B(x)) \Rightarrow \exists x(A(x) \cap B(x)))$ **is a predicate tautology.**
Justify:

y n