

**PART 1: CIRCLE TRUE OR FALSE FOR EACH OF THE FOLLOWING STATEMENTS. (1 point each)**

1.        F     If the premises of an argument are all true in some particular world, the argument must be valid and sound for that world.
2.        T     The conclusion of an invalid argument may be true in some particular world.
3.        T     If an argument is truly sound in some particular world, it must be a valid argument.
4.        T      $\neg(P \wedge Q) \Leftrightarrow \neg P \vee \neg Q$
5.        F      $\neg\neg\neg P \Leftrightarrow P$
6.        F      $P \vee Q$  is a logical truth.
7.        T     If two sentences are tautologically equivalent to each other, then they are logically equivalent to each other.
8.        T     The FOL predicate **Larger** is transitive.
9.        F     The only way for the complex sentence  $P \wedge Q$  to be false in some world is for both **P** and **Q** individually to be false in that world.
10.       T     The sentence  $(\neg\text{Cube}(\mathbf{a}) \wedge \text{Tet}(\mathbf{b})) \vee \neg(\text{Cube}(\mathbf{a}) \wedge \neg\text{Tet}(\mathbf{b}))$  considered as a whole is a disjunction.
11.       T     A truth claim (sentence) is logically possible if it is true in one or more possible worlds.
12.       F     The proof rule 'Identity Introduction' is used to assert a new identity statement of the sort  $\mathbf{a} = \mathbf{b}$ .
13.       T     **SameSize(a,b)** is a logical consequence of **SameSize(b,a)** in virtue of the meaning of the predicate involved.
14.       T     The symbol  $\neg$  is a Boolean connective.

15. T A truth table is able to demonstrate instances of tautological consequence.
16. T The premise of a subproof requires no justification by a proof rule.
17. F The proof rule 'Disjunction Introduction' is also called 'Proof by Cases.'
18. T A sentence of FOL is demonstrably a tautology if in a truth table the truth-values directly under the sentence's main connective are true in all rows.
19. T Each row of a truth table represents one possible combination of truth-values of whatever distinct atomic sentences are contained within the complex sentence(s) being evaluated in the table.
20. F In the Tarski's World blocks language, 'RightOf' is a unary predicate.
21. T The following statement is an atomic sentence of FOL: **Between(a,b,c)**
22. F One way to demonstrate that an argument is invalid is to provide a counterexample world in which the premises of the argument are false but the conclusion is true.
23. F The following is a complex sentence of FOL: **SameSize(a  $\wedge$  b)**
24. T The following sentence is a contradiction as considered in the blocks language for Tarski's World: **FrontOf(d,e)  $\wedge$  SameRow(e,d)**
25. T The following set of four sentences constitutes a contradiction as considered in the blocks language for Tarski's World: (1) **Larger(a,b)** (2) **Larger(b,c)** (3) **Larger(c,d)** (4) **Larger(d,e)**
26. F Sentences may contradict each other only if each of the sentences individually is a contradiction.
27. F The proof rule  $\neg$ Intro is based on the fact that anything and everything follows from a contradiction.
28. T The proof rule  $\perp$  Intro provides a means of flagging a contradiction that has arisen in the course of the proof.
29. F Once a subproof has been discharged, any individual line of that subproof may serve as input to the proof rules that justify subsequent steps of the proof.

30. T One element of a good strategy for tackling proofs is to first think through whether the argument you intend to prove is really valid.

**PART 2: Write a good translation of each of the following sentences into FOL. (2 points each)**

31. "a is a small cube to the right of b"

Translation into FOL: Small(a)  $\wedge$  Cube(a)  $\wedge$  RightOf(a,b)

32. "a is neither small nor a tetrahedron, and it's in the same row as b"

Translation into FOL:  $\neg$ (Small(a)  $\vee$  Tet(a))  $\wedge$  SameRow(a,b)

33. "a and b are both in front of c"

Translation into FOL: FrontOf(a,c)  $\wedge$  FrontOf(b,c)

34. "a is small, but b is not"

Translation into FOL: Small(a)  $\wedge$   $\neg$ Small(b)

**Part 3: In the blank next to each of the following four sentences, put the *one capital letter* (from the accompanying diagram) that labels the innermost logical region to which the sentence belongs. You may use the same letter more than once. (2 points each)**

35. SameSize(b,a)  $\vee$   $\neg$ SameSize(b,a) C

36. SameSize(b,a)  $\vee$   $\neg$ SameSize(a,b) B

37. SameSize(b,a)  $\wedge$  SameSize(a,b) A

38.  $\neg$ SameSize(a,b)  $\wedge$   $\neg$ SameSize(b,a) A

