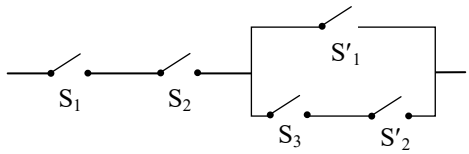
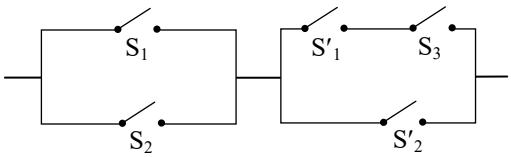
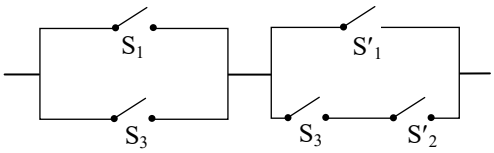
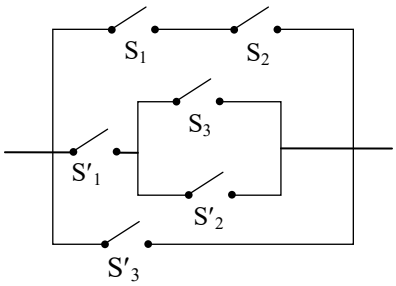
(B) 

(C) 

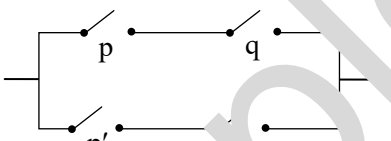
(D) 

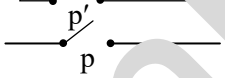
52. The symbolic form of logic for the following circuit is

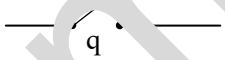


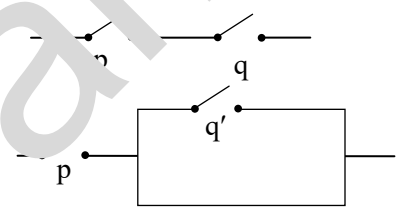
(A) $(p \vee q) \wedge (\sim p \wedge r \vee \sim q) \vee \sim r$
(B) $(p \wedge q) \wedge (\sim p \vee r \wedge \sim q) \vee \sim r$
(C) $(p \wedge q) \vee [\sim p \wedge (r \vee \sim q)] \vee \sim r$
(D) $(p \vee q) \wedge [\sim p \vee (r \wedge \sim q)] \vee \sim r$

53. The simplified circuit for the following circuit is

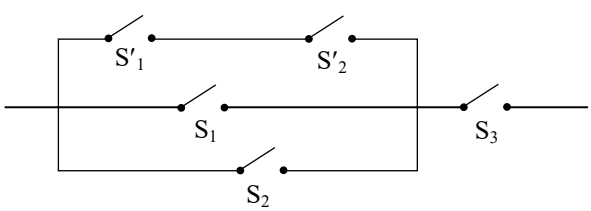


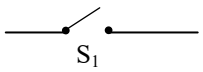
(A) 

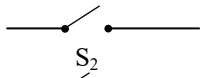
(B) 

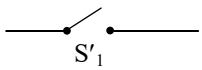
(C) 

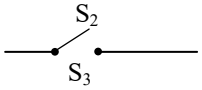
(D) The simplified circuit for the following circuit is



(A) 

(B) 

(C) 

(D) 

Competitive Thinking

1.1 Statement, Logical Connectives, Compound Statements and Truth Table

1. Which of the following statement is not a statement in logic? **[MH CET 2015]**
(A) Earth is a planet.
(B) Plants are living object.
(C) $\sqrt{-9}$ is a rational number.
(D) I am lying

2. Which of the following is not a correct statement? **[Karnataka CET 2014]**
(A) Mathematics is interesting.
(B) $\sqrt{3}$ is a prime.
(C) $\sqrt{2}$ is irrational.
(D) The sun is a star.

3. If p: Rahul is physically disable. q: Rahul stood first in the class, then the statement "In spite of physical disability Rahul stood first in the class in symbolic form is **[MHT CET 2019]**
(A) $p \wedge q$ (B) $p \vee q$
(C) $\sim p \vee q$ (D) $p \rightarrow q$

4. p : A man is happy
q : The man is rich.
The symbolic representation of "If a man is not rich then he is not happy" is **[MH CET 2004]**
(A) $\sim p \rightarrow \sim q$ (B) $\sim q \rightarrow \sim p$
(C) $p \rightarrow q$ (D) $p \rightarrow \sim q$

5. p: Ram is rich
q: Ram is successful
r: Ram is talented
Write the symbolic form of the given statement.
Ram is neither rich nor successful and he is not talented **[MH CET 2008]**
(A) $\sim p \wedge \sim q \vee \sim r$ (B) $\sim p \vee \sim q \wedge \sim r$
(C) $\sim p \vee \sim q \vee \sim r$ (D) $\sim p \wedge \sim q \wedge \sim r$

6. Let p be the proposition : Mathematics is interesting and let q be the proposition : Mathematics is difficult, then the symbol $p \wedge q$ means **[Karnataka CET 2001]**
(A) Mathematics is interesting implies that Mathematics is difficult.
(B) Mathematics is interesting implies and is implied by Mathematics is difficult.

(C) Mathematics is interesting and Mathematics is difficult.
(D) Mathematics is interesting or Mathematics is difficult.

7. Let p: roses are red and q : the sun is a star. Then the verbal translation of $(\sim p) \vee q$ is **[Kerala (Engg.) 2011]**
(A) Roses are not red and the sun is not a star.
(B) It is not true that roses are red or the sun is not a star.
(C) It is not true that roses are red and the sun is not a star.
(D) Roses are not red or the sun is a star.

8. Let p : Boys are playing
q : Boys are happy
the equivalent form of compound statement $\sim p \vee q$ is **[MH CET 2013]**
(A) Boys are not playing or they are happy.
(B) Boys are not happy or they are playing.
(C) Boys are playing or they are not happy.
(D) Boys are not playing or they are not happy.

9. If p and q are true statements in logic, which of the following statement pattern is true? **[MH CET 2007]**
(A) $(p \vee q) \wedge \sim q$ (B) $(p \vee q) \rightarrow \sim q$
(C) $(p \wedge \sim q) \rightarrow q$ (D) $(\sim p \wedge q) \wedge q$

10. If truth values of p, $p \leftrightarrow r$, $p \leftrightarrow q$ are F, T, F respectively, then respective truth values of p, q and r are **[MHT CET 2019]**
(A) F, T (B) T,
(C) F, F (D) T, F

11. If $p \rightarrow (\sim p \vee q)$ is false, the truth values of p and q are respectively **[Karnataka CET 2002]**
(A) F, T (B) T, F
(C) T, T (D) T, T

12. If $(p \wedge \sim q) \rightarrow (\sim p \vee r)$ is a false statement, then respective truth values of p, q and r are **[MH CET 2010]**

OR

If $(p \wedge \sim r) \rightarrow (\sim p \vee q)$ is false, then the truth values of p, q and r are respectively **[Assam CEE 2018]**
(A) T, F, F (B) F, T, T
(C) T, T, T (D) F, F, F

13. If p : Every square is a rectangle
q : Every rhombus is a kite then truth values of $p \rightarrow q$ and $p \leftrightarrow q$ are _____ and _____ respectively. **[MH CET 2016]**
(A) F, F (B) T, F
(C) F, T (D) T, T

14. The converse of the contrapositive of $p \rightarrow q$ is **[Karnataka CET 2005]**
(A) $\sim p \rightarrow q$ (B) $p \rightarrow \sim q$
(C) $\sim p \rightarrow \sim q$ (D) $\sim q \rightarrow p$

15. If Ram secures 100 marks in maths, then he will get a mobile. The converse is **[Orissa JEE 20]**
(A) If Ram gets a mobile, then he will not secure 100 marks in maths.
(B) If Ram does not get a mobile, then he will secure 100 marks in maths.
(C) If Ram will get a mobile, then he secures 100 marks in maths.
(D) None of these

16. Let p : A triangle is equilateral, q : A triangle is equiangular, the inverse of $q \rightarrow p$ is **[MH CET 2013]**
(A) If a triangle is not equilateral then it is not equiangular.
(B) If a triangle is not equiangular then it is not equilateral.
(C) If a triangle is equiangular then it is not equilateral.
(D) If a triangle is equiangular then it is equilateral.

17. If it is raining, then I will not come. The contrapositive of this statement will be **[Orissa JEE 2011]**
(A) If I will come, then it is not raining
(B) If I will not come, then it is raining
(C) If I will not come, then it is not raining
(D) If I will come, then it is raining

18. The contrapositive statement of the statement "If x is prime number, then x is odd" is **[Karnataka CET 2017]**
(A) If x is not a prime number, then x is not odd.
(B) If x is a prime number, then x is not odd.
(C) If x is not a prime number, then x is odd.
(D) If x is not odd, then x is not a prime number.

19. The contrapositive of the statement: "If the weather is fine then my friends will come and we go for a picnic." is **[MHT CET 2018]**
(A) The weather is fine but my friends will not come or we do not go for a picnic.
(B) If my friends do not come or we do not go for a picnic then weather will not be fine.
(C) If the weather is not fine then my friends will not come or we do not go for a picnic.
(D) The weather is not fine but my friends will come and we go for a picnic.

20. The contrapositive of the statement "If you are born in India, then you are a citizen of India", is **[JEE (Main) 2019]**
(A) If you are a citizen of India, then you are born in India.
(B) If you are born in India, then you are not a citizen of India.
(C) If you are not a citizen of India, then you are not born in India.
(D) If you are not born in India, then you are not a citizen of India.

1.2 Statement Pattern, Logical Equivalence, and Algebra of Statements

21. The logically equivalent statement of $p \leftrightarrow q$ is **[Karnataka CET 2000]**
(A) $(p \wedge q) \vee (q \rightarrow p)$
(B) $(p \wedge q) \rightarrow (p \vee q)$
(C) $(p \rightarrow q) \wedge (q \rightarrow p)$
(D) $(p \wedge q) \vee (p \wedge q)$

22. The statement $p \rightarrow (\sim q)$ is equivalent to **[Kerala (Engg.) 2011]**
(A) $q \rightarrow p$ (B) $\sim q \vee \sim p$
(C) $p \wedge \sim q$ (D) $\sim q \rightarrow p$

23. $\sim p \wedge q$ is logically equivalent to **[Karnataka CET 2004]**
(A) $p \rightarrow q$ (B) $q \rightarrow p$
(C) $\sim(p \rightarrow q)$ (D) $\sim(q \rightarrow p)$

24. The statement pattern $(\sim p \wedge q)$ is logically equivalent to **[MH CET 2017]**
(A) $(p \vee q) \vee \sim p$ (B) $(p \vee q) \wedge \sim p$
(C) $(p \wedge q) \rightarrow p$ (D) $(p \vee q) \rightarrow p$

25. $(p \wedge q) \vee (\sim q \wedge p) \equiv$ **[MH CET 2009]**
(A) $q \vee p$ (B) p
(C) $\sim q$ (D) $p \wedge q$

26. The Boolean Expression $(p \wedge \sim q) \vee q \vee (\sim p \wedge q)$ is equivalent to **[JEE (Main) 2016]**
(A) $p \wedge q$ (B) $p \vee q$
(C) $p \rightarrow q$ (D) $\sim p \wedge q$

27. The statement $p \rightarrow (q \rightarrow p)$ is equivalent to **[AIEEE 2008]**
(A) $p \rightarrow (p \wedge q)$ (B) $p \rightarrow (p \leftrightarrow q)$
(C) $p \rightarrow (p \rightarrow q)$ (D) $p \rightarrow (p \vee q)$

1.3 Tautology, Contradiction, Contingency

28. Which of the following is not true for any two statements p and q? **[Kerala PET 2007]**
(A) $\sim[p \vee (\sim q)] \equiv \sim p \wedge q$
(B) $(p \vee q) \vee (\sim q)$ is a tautology
(C) $\sim(p \wedge \sim p)$ is a tautology
(D) $\sim(p \vee q) \equiv \sim p \vee \sim q$

29. The statement pattern $p \wedge (\sim p \wedge q)$ is **[MHT CET 2018]**
(A) a tautology
(B) a contradiction
(C) equivalent to $p \wedge q$
(D) equivalent to $p \vee q$

30. $(p \wedge \sim q) \wedge (\sim p \wedge q)$ is a **[Karnataka CET 2003]**
(A) Tautology
(B) Contradiction
(C) Tautology and contradiction
(D) Contingency

31. Which of the following statements is a tautology? **[KCET 2009]**
(A) $(\sim q \wedge p) \wedge q$
(B) $(\sim q \wedge p) \wedge (p \wedge \sim p)$
(C) $(\sim q \wedge p) \vee (p \vee \sim p)$
(D) $(p \wedge q) \wedge (\sim(p \wedge q))$

32. The only statement among the following i.e., a tautology is **[AIEEE 2011]**
(A) $A \wedge (A \vee B)$
(B) $A \vee (A \wedge B)$
(C) $[A \wedge (A \rightarrow B)] \rightarrow B$
(D) $B \rightarrow [A \wedge (A \rightarrow B)]$

33. Which of the following statement pattern is a tautology? **[MHT CET 2017]**
(A) $p \vee (q \rightarrow p)$
(B) $\sim q \rightarrow \sim p$
(C) $(q \rightarrow p) \vee (\sim p \leftrightarrow q)$
(D) $p \wedge \sim p$

34. The following statement $(p \rightarrow q) \rightarrow [(\sim p \rightarrow q) \rightarrow q]$ is **[JEE (Main) 2017]**
(A) A fallacy
(B) A tautology
(C) Equivalent to $\sim p \rightarrow q$
(D) Equivalent to $p \rightarrow \sim q$

35. The false statement in the following is **[Karnataka CET 2002]**
(A) $p \wedge (\sim p)$ is a contradiction
(B) $p \vee (\sim p)$ is a tautology
(C) $\sim(\sim p) \leftrightarrow p$ is tautology
(D) $(p \rightarrow q) \leftrightarrow (\sim q \rightarrow \sim p)$ is a contradiction

1.4 Quantifiers and Quantified Statements Duality

36. Which of the following quantified statement is true ? **[MH CET 2016]**
(A) The square of every real number is positive
(B) There exists a real number whose square is negative
(C) There exists a real number whose square is not positive
(D) Every real number is rational

37. If c denotes the contradiction then dual of the compound statement ~ p ∧ (q ∨ c) is **[MHT CET 2017]**
(A) ~ p ∨ (q ∧ t) (B) ~ p ∧ (q ∨ t)
(C) p ∨ (~q ∨ t) (D) ~ p ∨ (q ∧ c)

1.5 Negation of compound statements

38. The negation of (p ∨ ~q) ∧ q is **[Kerala (Engg.) 2011]**
(A) (~p ∨ q) ∧ ~q (B) (p ∧ ~q) ∨ q
(C) (~p ∧ q) ∨ ~q (D) (p ∧ ~q) ∨ ~q

39. The negation of ~s ∨ (~r ∧ s) is equivalent to **[JEE (Main) 2015]**
(A) s ∧ ~r (B) s ∧ (r ∧ ~s)
(C) s ∨ (r ∨ ~s) (D) s ∧ r

40. The Boolean expression ~ (p ∨ q) ∨ (~ p ∧ q) is equivalent to **[JEE (Main) 2018]**
(A) p (B) q
(C) ~ q (D) ~ p

41. The negation of p → (~p ∨ q) is **[Karnataka CET 2011]**
(A) p ∨ (p ∨ ~q) (B) p → ~(p ∨ q)
(C) p → q (D) p ∧ ~q

42. Negation of (~p → q) is **[MH CET 2009]**
(A) ~ p ∨ ~q (B) ~p ∧~ q
(C) p ∧ ~ q (D) ~ p ∨ q

43. Negation of (p ∧ q) → (~ p ∨ r) is **[MH CET 2005]**
(A) (p ∨ q) ∧ (p ∧ ~ r)
(B) (p ∧ q) ∨ (p ∧ ~ r)
(C) (p ∧ q) ∧ (p ∧ ~ r)
(D) (p ∨ q) ∨ (p ∧ ~ r)

44. Negation of p ∧ q is **[MH CET 2005]**
(A) (p ∧ q) ∨ (p ∧ q)
(B) (p ∧ q) ∨ (q ∧ p)
(C) (p ∧ q) ∧ (q ∧ p)
(D) (p ∨ q) ∨ (q ∧ p)

45. The statement ~(p ↔ ~q) is **[JEE (Main) 2014]**
(A) a tautology
(B) a fallacy
(C) equivalent to p ↔ q
(D) equivalent to ~p ↔ q

46. Negation of the statement 'A is rich but silly' is **[MH CET 2006]**
(A) Either A is not rich or not silly.
(B) A is poor or clever.
(C) A is rich or not silly.
(D) A is either rich or silly.

47. The negation of the statement given by "He is rich and happy" is **[MH CET 2006]**
(A) He is not rich and not happy
(B) He is rich but not happy
(C) He is not rich but happy
(D) Either he is not rich or he is not happy

48. The negation of the statement "72 is divisible by 2 and 3" is **[Karnataka CET 2018]**
(A) 72 is not divisible by 2 or 72 is not divisible by 3.
(B) 72 is divisible by 2 or 72 is divisible by 3.
(C) 72 is divisible by 2 and 72 is divisible by 3.
(D) 72 is not divisible by 2 and 3.

49. Let p : 7 is not greater than 4
and q : Paris is in France
be two statements. Then ~(p ∨ q) is the statement **[Kerala (Engg.) 2010]**
(A) 7 is greater than 4 or Paris is not in France.
(B) 7 is not greater than 4 and Paris is not in France.
(C) 7 is not greater than 4 and Paris is in France.
(D) 7 is greater than 4 and Paris is not in France.

50. The negation of the proposition "If 2 is prime, then 3 is odd" is **[Karnataka CET 2007]**
(A) If 2 is not prime, then 3 is not odd.
(B) 2 is prime and 3 is not odd.
(C) 2 is not prime and 3 is odd.
(D) If 2 is not prime then 3 is odd.

51. The negation of the statement: "Getting above 95% marks is necessary condition for Hema to get admission in good college" is **[MHT CET 2018]**
(A) Hema gets above 95% marks but she does not get admission in good college.
(B) Hema does not get above 95% marks and she gets admission in good college.
(C) If Hema does not get above 95% marks then she will not get admission in good college.
(D) Hema does not get above 95% marks or she gets admission in good college.

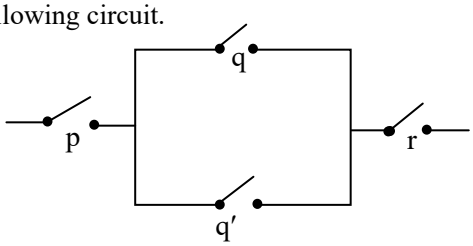
52. The negation of the statement "some equations have real roots" is **[MHT CET 2019]**
(A) All equations do not have real roots
(B) All equations have real roots
(C) Some equations do not have real roots
(D) Some equations have rational roots

53. The negation of the statement "All continuous functions are differentiable" **[Karnataka CET 2019]**
(A) Some continuous functions are differentiable
(B) All differentiable functions are continuous
(C) All continuous functions are not differentiable
(D) Some continuous functions are not differentiable

54. Let S be a non-empty subset of R. Consider the following statement:
p : There is a rational number $x \in S$ such that $x > 0$.
Which of the following statements is the negation of the statement p? **[AIEEE 2010]**
(A) There is a rational number $x \in S$ such that $x \leq 0$
(B) There is no rational number $x \in S$ such that $x \leq 0$
(C) Every rational number $x \in S$ satisfies $x \leq 0$
(D) $x \in S$ and $x \leq 0 \rightarrow x$ is not rational

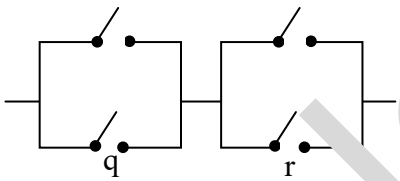
1.6 Switching circuit

55. When does the current flow through the following circuit.



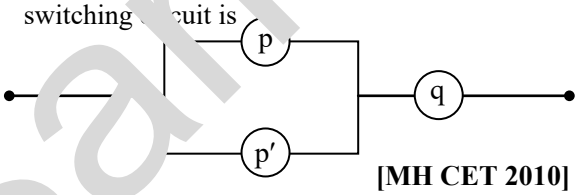
[Karnataka CET 2002]
(A) p, q should be closed and r is open
(B) p, q, r should be open
(C) p, q, r should be closed
(D) none of these

56. If

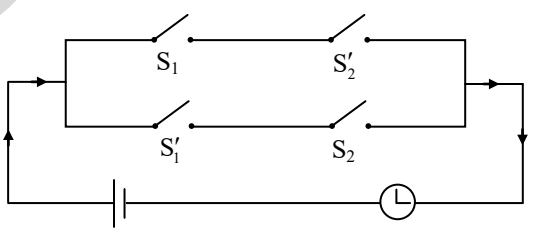


then the symbolic form is **[MH CET 2009]**
(A) $(p \vee q) \wedge (p \vee r)$
(B) $(p \wedge q) \vee (p \vee r)$
(C) $(p \wedge q) \wedge (p$
(D) $(p \wedge q) \wedge r$

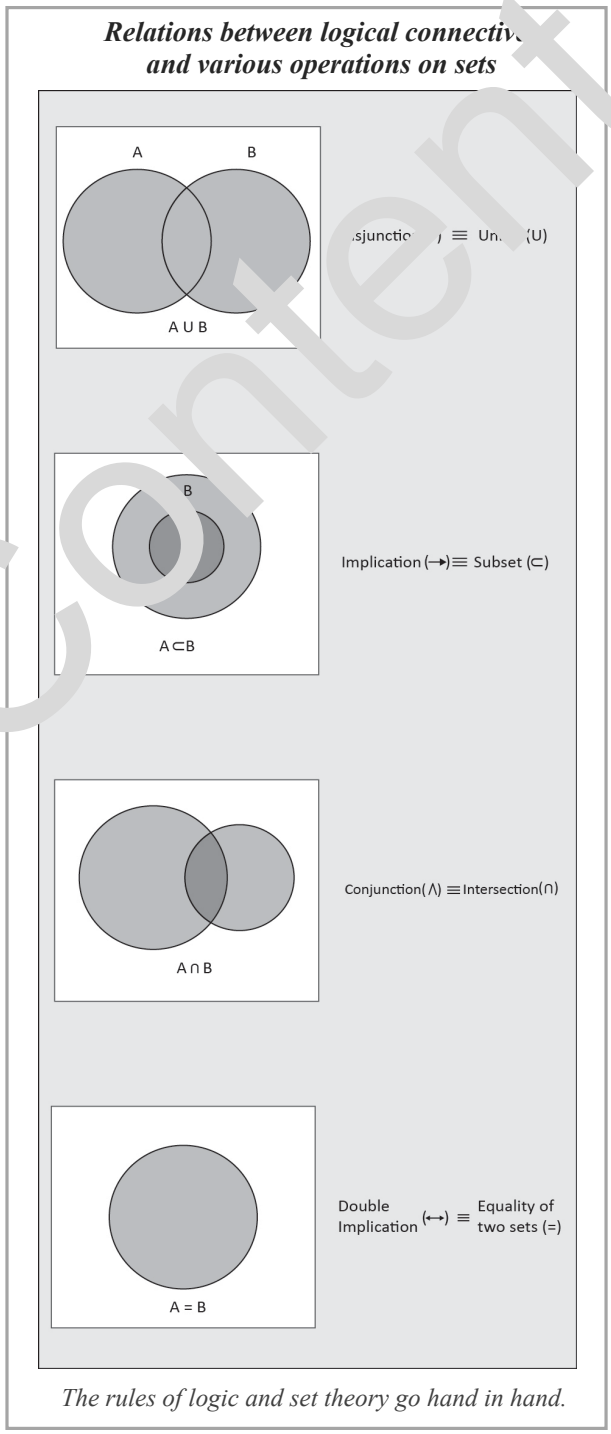
57. Simplified logical expression for the following switching circuit is



[MH CET 2010]
(A) p (B) q
(C) p′ (D) $p \wedge q$



Symbolic form of the given switching circuit is equivalent to _____ **[MH CET 2016]**
(A) $p \vee \sim q$ (B) $p \wedge \sim q$
(C) $p \leftrightarrow q$ (D) $\sim(p \leftrightarrow q)$



The rules of logic and set theory go hand in hand.

Answer Key

Classical Thinking

1.	(D)	2.	(D)	3.	(D)	4.	(D)	5.	(A)	6.	(C)	7.	(D)	8.	(A)	9.	(D)	10.	(B)
11.	(B)	12.	(C)	13.	(C)	14.	(B)	15.	(A)	16.	(B)	17.	(B)	18.	(A)	19.	(C)	[illegible]	(C)
21.	(A)	22.	(C)	23.	(B)	24.	(B)	25.	(A)	26.	(B)	27.	(D)	28.	(C)	29.	(B)	30.	(A)
31.	(A)	32.	(B)	33.	(C)	34.	(B)	35.	(B)	36.	(A)	37.	(D)	38.	(C)	39.	[illegible]	40.	[illegible]
41.	(D)	42.	(C)	43.	(A)	44.	(B)	45.	(B)	46.	(D)	47.	(D)	48.	(A)	49.	(C)	[illegible]	(B)
51.	(C)	52.	(D)	53.	(A)	54.	(A)	55.	(B)	56.	(A)								

Critical Thinking

1.	(B)	2.	(A)	3.	(C)	4.	(D)	5.	(B)	6.	(B)	7.	(A)	[illegible]	(C)	[illegible]	(A)	10.	(D)
11.	(A)	12.	(C)	13.	(C)	14.	(C)	15.	(B)	16.	(A)	17.	(A)	18.	[illegible]	19.	(A)	20.	(C)
21.	(D)	22.	(D)	23.	(D)	24.	(D)	25.	(A)	26.	(C)	27.	[illegible]	[illegible]	(C)	29.	(D)	30.	(C)
31.	(C)	32.	(B)	33.	(B)	34.	(B)	35.	(A)	36.	(C)	37.	(D)	38.	(A)	39.	(C)	40.	(A)
41.	(C)	42.	(A)	43.	(D)	44.	(B)	45.	(D)	46.	(C)	47.	[illegible]	48.	(C)	49.	(C)	50.	(B)
51.	(A)	52.	(C)	53.	(B)	54.	(D)												

Competitive Thinking

1.	(D)	2.	(B)	3.	(A)	4.	(B)	5.	[illegible]	6.	[illegible]	7.	(D)	8.	(A)	9.	(C)	10.	(D)
11.	(D)	12.	(A)	13.	(D)	14.	(C)	15.	[illegible]	16.	[illegible]	17.	(A)	18.	(D)	19.	(B)	20.	(C)
21.	(C)	22.	(B)	23.	(D)	24.	(B)	25.	[illegible]	26.	[illegible]	27.	(D)	28.	(D)	29.	(B)	30.	(B)
31.	(C)	32.	(C)	33.	(C)	34.	(B)	35.	(D)	[illegible]	(C)	37.	(A)	38.	(C)	39.	(D)	40.	(D)
41.	(D)	42.	(B)	43.	(C)	44.	[illegible]	45.	(C)	46.	(B)	47.	(D)	48.	(A)	49.	(D)	50.	(B)
51.	(B)	52.	(A)	53.	(D)	54.	[illegible]	[illegible]	(C)	56.	(A)	57.	(B)	58.	(D)				

Evaluation Test

1. Which of the following is not a statement in logic?
   (A) Every set is a finite set.
   (B) $2 + 3 = 5$
   (C) $x + 3 = 10$
   (D) Zero is a complex number.

2. If $p \to (q \vee r)$ is false, then the truth values of p, q and r are respectively
   (A) T, F, F (B) F, F, F
   (C) T, T, F (D) T, T, F

3. The contrapositive of $(\sim p \wedge q) \to \sim r$ is
   (A) $(p \wedge q) \to r$
   (B) $(p \vee q) \to r$
   (C) $r \to (p \vee \sim q)$
   (D) none of these

4. The converse of the statement, "If $\sqrt{x}$ is a complex number, then x is a negative number" is
   (A) If $\sqrt{x}$ is not a complex number, then x is not a negative number.
   (B) If x is a negative number, then $\sqrt{x}$ is a complex number.
   (C) If x is not a negative number, then $\sqrt{x}$ is not a complex number.
   (D) If $\sqrt{x}$ is a real number, then x is a positive number.

5. The inverse of the proposition $(p \wedge \sim q) \to r$ is
   (A) $\sim r \to \sim p \vee q$ (B) $\sim p \vee q \to \sim r$
   (C) $r \to p \wedge \sim q$ (D) $\sim p \wedge q \to \sim r$

6. The negation of the statement $\forall x \in N, x + 1 > 2$ is
   (A) $\forall x \notin N, x + 1 < 2$
   (B) $\exists x \in N$, such that $x + 1 > 2$
   (C) $\forall x \in N, x + 1 \leq 2$
   (D) $\exists x \in N$, such that $x + 1 \leq 2$