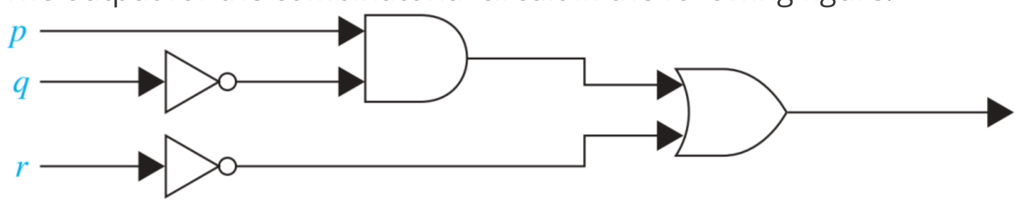
Discrete Mathematic – Revision (1) – 20201 - Chapter one		
1.	A propositions (or statement) is a declarative sentence that is either true or false , but not both a) False b) True	B
2.	The following statement “x+3=7, for$x$=4” is a proposition? a) False b) True	B
3.	The following statement “x+3=7” is a proposition? a) False b) True	A
4.	The following statement “Read this carefully.” is a proposition? a) False b) True	A
5.	The following statement “Cairo is the capital of Egypt” is a proposition? a) False b) True	B
6.	The truth value of given proposition ‘4+3=7’. a) False b) True	B
7.	The truth value of given proposition ‘5+7=10’. a) False b) True	A
8.	Which of the following statement is a proposition? a. Get me a glass of milkshake b. God bless you! c. What is the time now? d. The only odd prime number is 2	D
9.	Which of the following statement is not a proposition? a) Today is Friday b) x+3=7,for$x$=4 c) Cairo is the capital of Egypt d) x+3=7	D

10.	The negation of the proposition “Cairo is not the capital of Egypt” is “Cairo is the capital of Egypt”. a) True. b) False.	A
11.	If P then Q is called _________ statement a) Conjunction b) disjunction c) conditional d) bi conditional	C
12.	Let P: “Cairo is the capital of Egypt”. Then “Cairo is not the capital of Egypt”. is best represented by: a) ~P V ~Q b) P ∧ ~Q c) $\neg p$	C
13.	Let P: “This is a great website”, Q: “You should not come back here”. Then **“This is a great website and you should come back here”** is best represented by: a) ~P V ~Q b) P ∧ ~Q c) P V Q d) P∧ Q	B
14.	Let P: “Today is Friday”, Q: “It is raining today”. Then **“Today is Friday or it is raining today”** is best represented by: a) ~P V ~Q b) P ∧ ~Q c) P V Q d) P∧ Q	C
15.	Let P: “Today is Friday”, Q: “It is raining today”. Then **“ If it is raining then today is Friday ”** is best represented by: a) ~P V ~Q b) P ∧ ~Q c) P → Q d) P∧ Q	C

16.	Let P: "We should be honest" Q: "We should be dedicated" R: "We should be overconfident" Then **"We should be honest or dedicated but not overconfident."** is best represented by: a) ~P V ~Q V R b) P ∧ ~Q ∧ R c) P V Q ∧ R d) P V Q ∧ ~R	D
17.	The truth value of given statement is '4+3=7 or 5 is not prime'. a) False b) True	B
18.	How many rows appear in a truth table for the following compound proposition $P \rightarrow \neg p$ a) 1 b) 2 c) 3 d) 4	B
19.	How many rows appear in a truth table for the following compound proposition P ∧ ~Q ∧ R a) 0 b) 2 c) 4 d) 8	D
20.	The bitwise *OR* of these pairs of bit strings "1111100000" and "1010101010" is ___________ a) 1010100000 b) 1010101101 c) 1111111100 d) 1111101010	D
21.	The bitwise *AND* of these pairs of bit strings "1111100000" and "1010101010" is ___________ a) 1010100000 b) 1010101101 c) 1111111100 d) 1111101010	A

22.	The bitwise *XOR* of these pairs of bit strings “1111100000” and “1010101010” is ___________ a) 1010100000 b) 0101001010 c) 1111111100 d) 1111101010	B
23.	The Applications of Propositional Logic .... a) Translating English Sentences. b) System Specifications. c) Boolean Searches. d) Logic Puzzles. e) Logic Circuits. f) All of the above.	F
24.	The output for the combinatorial circuit in the following figure.  a) $(P \wedge \sim q) \vee \sim r$ b) $(P \vee \sim q) \wedge \sim r$ c) $(P \vee q) \wedge \sim r$ d) $(P \vee \sim q) \wedge r$	A
25.	Tautology is a compound proposition that is always true. a) True. b) False.	A
26.	Contradiction is a compound proposition that is always false. a) True. b) False.	A
27.	Contingence is a compound proposition that is sometimes true and sometimes false. a) True. b) False.	A
28.	.... is a compound proposition that is always true. a) a tautology b) a contradiction c) a contingence d) All of the above.	A

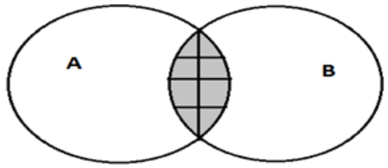
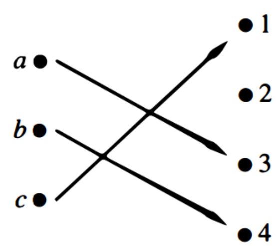
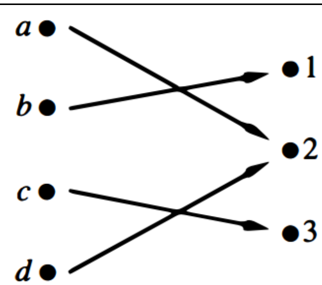
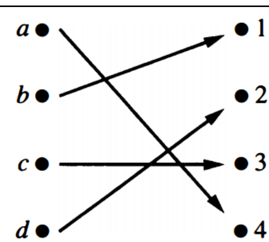
29.	The following conditional statement $(p \wedge q) \rightarrow p$ is ……… a) a tautology b) a contradiction c) a contingence	<table><tr><td>p</td><td>q</td><td>$p \wedge q$</td><td>$(p \wedge q) \rightarrow p$</td></tr><tr><td>T</td><td>T</td><td>T</td><td>**T**</td></tr><tr><td>T</td><td>F</td><td>F</td><td>**T**</td></tr><tr><td>F</td><td>T</td><td>F</td><td>**T**</td></tr><tr><td>F</td><td>F</td><td>F</td><td>**T**</td></tr></table>	A
30.	Compound propositions that have the same truth values in all possible cases are called logically equivalent. a) True. b) False.		A
31.	Compound propositions that have the same truth values in all possible cases are called …… a) Logically equivalent. b) Tautology. c) contradiction d) contingence		A
32.	Let P(x) denoted the statement "x > 3." What is the truth value of P (2)? a) False. b) True.		A
33.	Let Q(x, y) denoted the statement "x = y + 3." What is the truth value of Q (3, 0)? a) False. b) True.		B
34.	Let P(x) be the statement "x+1 > x." **What is the truth value of the quantification $\forall x P(x)$, where the domain consists of all real numbers?** a) True b) False		A
35.	**Let $Q(x)$ be the statement "$x < 2$." What is the truth value of the quantification $\forall x Q(x)$, where the domain consists of all real numbers?** a) True b) False		B
36.	**Let $P(x)$ denote the statement "$x > 3$." What is the truth value of the quantification $\exists x P(x)$, where the domain consists of all real numbers?** a) True b) False		A

37.	**What is the truth value of $\exists x\, P(x)$, where $P(x)$ is the statement "$x^2 > 10$" and the universe of discourse consists of the positive integers not exceeding 4?** a) True b) False	A
38.	Let $P(x)$ is the statement " x has taken a course in calculus" and the domain consists of the students in your class. Express the $\boldsymbol{\forall x P(x)}$ qunatification in English? a) " Every student in your class has taken a course in calculus". b) " Every student in your class has not taken a course in calculus". c) " At least one student in your class has taken a course in calculus". d) " At least one student in your class has not taken a course in calculus".	A
39.	Let $P(x)$ is the statement " x has taken a course in calculus" and the domain consists of the students in your class. Express the $\boldsymbol{\neg\forall x P(x) \equiv \exists x \neg P(x)}$ qunatification in English? a) " Every student in your class has taken a course in calculus". b) " At least one student in your class has not taken a course in calculus". c) " At least one student in your class has taken a course in calculus". d) " Every student in your class has not taken a course in calculus".	B
40.	Let $P(x)$ is the statement " x has taken a course in calculus" and the domain consists of the students in your class. Express the $\boldsymbol{\exists x P(x)}$ qunatification in English? a) " Every student in your class has taken a course in calculus". b) " At least one student in your class has not taken a course in calculus". c) " At least one student in your class has taken a course in calculus". d) " Every student in your class has not taken a course in calculus".	C
41.	Let $P(x)$ is the statement " x has taken a course in calculus" and the domain consists of the students in your class. Express the $\neg\exists \boldsymbol{x P(x)} \equiv \forall \boldsymbol{x} \neg \boldsymbol{P(x)}$ qunatification in English? a) " Every student in your class has taken a course in calculus". b) " At least one student in your class has not taken a course in calculus". c) " At least one student in your class has taken a course in calculus". d) " Every student in your class has not taken a course in calculus".	D
42.	In proving √5 as irrational, we begin with assumption √5 is rational in which type of proof? a) Direct proof b) Proof by Contradiction c) Mathematical Induction d) Proof by Contraposition	B

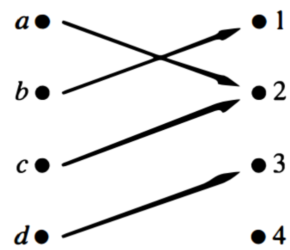
Discrete Mathematic – Revision (1) – 20201 - Chapter Two – (Sets && Functions)		
43.	A __________ is an unordered collection of objects. a) Relation b) Function c) Set d) Proposition	C
44.	Power set of empty set has exactly _________ subset. a) One b) Two c) Zero d) Three	A
45.	What is the Cartesian product of A = {1, 2} and B = {a, b}? a) {(1, a), (1, b), (2, a), (b, b)} b) {(1, 1), (2, 2), (a, a), (b, b)} c) {(1, a), (2, a), (1, b), (2, b)} d) {(1, 1), (a, a), (2, a), (1, b)}	C
46.	The Cartesian Product B x A is equal to the Cartesian product A x B. a) True b) False	B
47.	$(\boldsymbol{A} \subseteq \boldsymbol{B}) \equiv (\boldsymbol{B} \supseteq \boldsymbol{A})$ a) True. b) False.	A
48.	The set A is a subset of the set B but that $A \neq B$, We write $A \subset B$ And say that A is a **proper subset** of B. a) True. b) False.	A
49.	What is the cardinality of the set of odd positive integers less than 10? a) 10 b) 5 c) 20	B

50.	Which of the following two sets are equal? a) A = {1, 2} and B = {1} b) A = {1, 2} and B = {1, 2, 3} c) A = {1, 2, 3} and B = {2, 1, 3} d) A = {1, 2, 4} and B = {1, 2, 3}	C
51.	What is the Cardinality of the Power set of the set {0, 1, 2}? a) 8 b) 6 c) 7 d) 3	A
52.	The union of the sets {1, 2, 5} and {1, 2, 6} is the set ______________ a) {1, 2, 6, 1} b) {1, 2, 5, 6} c) {1, 2, 1, 2} d) {1, 5, 6, 3}	B
53.	The intersection of the sets {1, 2, 5} and {1, 2, 6} is the set ____________ a) {1, 2} b) {5, 6} c) {2, 5} d) {1, 6}	A
54.	Two sets are called disjoint if there ____________ is the empty set. a) Union b) Difference c) Intersection d) Complement	C
55.	Which of the following two sets are disjoint? a) {1, 3, 5} and {1, 3, 6} b) {1, 2, 3} and {1, 2, 3} c) {1, 3, 5} and {2, 3, 4} d) {1, 3, 5} and {2, 4, 6}	D

56.	The difference of {1, 2, 3} and {1, 2, 5} is the set ____________ a) {1} b) {5} c) {3} d) {2}	C
57.	The complement of the set A is _____________ a) A – B b) U – A c) A – U d) B – A	B
58.	The set difference of the set A with null set is __________ a) A b) null c) U d) B	A
59.	Let the set A is {1, 2, 3} and B is {2, 3, 4}. Then the number of elements in A U B is? a) 4 b) 5 c) 6 d) 7	A
60.	Let the set A is {1, 2, 3} and B is { 2, 3, 4}. Then number of elements in A ∩ B is? a) 1 b) 2 c) 3 d) 4	B
61.	Let the set A is {1, 2, 3} and B is {2, 3, 4}. Then the set A – B is? a) {1, -4} b) {1, 2, 3} c) {1} d) {2, 3}	C
62.	In which of the following sets A – B is equal to B – A? a) A = {1, 2, 3}, B = {2, 3, 4} b) A = {1, 2, 3}, B = {1, 2, 3, 4} c) A = {1, 2, 3}, B = {2, 3, 1} d) A = {1, 2, 3, 4, 5, 6}, B = {2, 3, 4, 5, 1}	C

63.	7. If A is {{Φ}, {Φ, {Φ}}}, then the power set of A has how many element? a) 2 b) 4 c) 6 d) 8	B
64.	The shaded area of figure is best described by?  a) A ∩ B b) A U B c) A d) B	A
65.	a. Into b. onto c. one to one d. one one onto  	C
66.	a. onto b. into c. one to one d. one one onto  	A
67.	A. bijective B. injective C. surjective D. composite function  	A

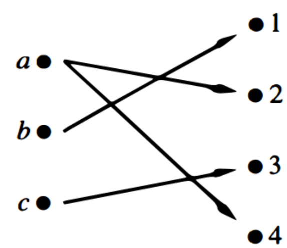
68.



A. bijective
B. injective
C. surjective
D. Not bijective

D

69.



A. bijective
B. injective
C. surjective
D. Not a function

D

70. Surjective function is also called ________.

A. onto B. into C. one to one D. one one onto

A

71. One to one onto function is also called __________.

A. bijective B. injective C. surjective D. composite function

A

72. The composition f∘g cannot be defined unless the range of g is a subset of the domain of f.

a) True. b) False.

A

73. Find the value of

Question #		Answer
A	$\lfloor -0.7 \rfloor$	-1
B	$\lfloor \lceil -0.7 \rceil \rfloor$	0
C	$\lceil -2.7 \rceil$	-2
D	$\lfloor 2 + 0.1 \rfloor$	2

74. For each of the following sets, determine whether 3 is an element of the set.

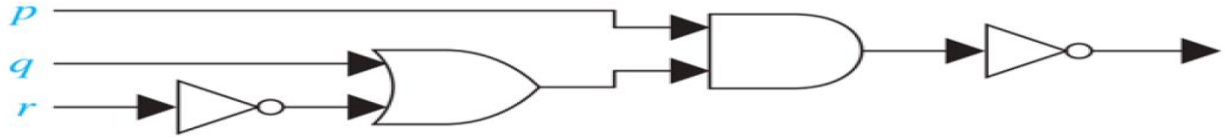
A={1 ,2 ,3 ,4}	$3 \in A$
B={ {1}, {2}, {3}, {4} }	$3 \notin B$
C={1, 2, {1, 3} }	$3 \notin C$

Review 2021	
MCQ	**True & False**
1. P → R is a. Tautology b. Contradiction **c. Contingency** d. none of the above	1. p ↔ q ≡ (p → q) ∧ (q → p) **A. [True]** B. [False]
2. A ⊆ B if and only if the quantification **A. ∀x(x ∈ A →x ∈ B)** B. ∀x(x ∈ B →x ∈ A) C. None	2 If A and B are sets with A ⊆ B, then A ∪ B = A A. [True] **B. [False]**
3. If P(x) is **"x spends more than five hours every weekday in class"**. Then the statement **"There are no students who spends more than five hours every weekday in class"** is equivalent to which quantification? A. ∃x¬P(x) B. ∀xP(x) C. ∃xP(x) **D. ∀x¬P(x)**	3. The conditional statement p→(p ∨ q) is a tautology **A. [True]** B. [False]
4. The proposition (p⊕q)∧(p↔q) is: A. Tautology **B. Contradiction** C. Contingency D. None of the above	4. ¬∃xQ(x) ≡∀x Q(x) A. [True] **B. [False]**
5. Let P: "We should be honest", Q: "We should be dedicated", R: "We should be overconfident" Then **"We should be honest or dedicated but not overconfident."** is best represented by? A. ¬P v ¬Q v R B. P ^ ¬Q ^ R C. P v Q ^ R **D. P v Q ^ ¬R**	5. ¬∀xP(x) ≡∃x P(x). A. [True] **B. [False]**
6. What is the power set of the empty set? **A. P(∅) = {∅}** B. P(∅) = {∅,{∅}} C. P(∅) = ∅ D. None	6. A direct proof of a conditional statement p → q is constructed when the first step is the assumption that p is true **A. [True]** B. [False]

7. If P then Q is called __________ statement A. Conjunction B. disjunction **C. conditional** D. bi conditional	7. Proofs by contraposition make use of the fact that the conditional statement $p \to q$ is equivalent to its contrapositive, $\neg q \to \neg p$ **A. [True]** B. [False]
8. Let p, q, and r be the propositions p: "You have the flu" q: "You miss the final examination." r: "You pass the course." **"If you have the flu then you'll not pass the course OR If you miss the final examination then you'll fail the course"** A. $(p \to \neg r) \vee (q \to \neg r)$ B. $(p \leftrightarrow \neg r) \vee (q \to \neg r)$ C. $(p \to \neg r) \wedge (q \to r)$ D. $(p \to \neg r) \vee (q \to r)$	8. Proofs by contraposition make use of the fact that the conditional statement $p \to q$ is equivalent to its contrapositive, $q \to \neg p$ A. [True] **B. [False]**
9. Which of the following propositions is tautology? A. $(p \vee q) \to q$ B. $p \vee (q \to p)$ **C. $p \vee (p \to q)$** D. Both (b) & (c)	9. Let p and q be propositions. The disjunction of p and q, denoted by $p \vee q$ **A. [True]** B. [False]
10. $p \vee q$ is logically equivalent to A. $\neg q \to \neg p$ B. $q \to p$ C. $\neg p \to \neg q$ **D. $\neg p \to q$**	10. The biconditional $p \leftrightarrow q$ is true when p and q have the same truth values, and is false otherwise **A. [True]** B. [False]
11. Let p and q be the propositions p: "It is below freezing." q: "It is snowing." Then the statement **" It is either snowing or below freezing (or both) "** is equivalent to which propositions A. $\neg p \to \neg q$ B. $\neg p \wedge q$ **C. $p \vee q$** D. $p \to q$	11. $p \to q$ and $\neg p \vee q$ are logically equivalent **A. [True]** B. [False]
12. $(p \to q) \wedge (p \to r)$ is logically equivalent to **A. $p \to (q \wedge r)$** B. $p \to (q \vee r)$ C. $p \wedge (q \vee r)$ D. $p \vee (q \wedge r)$	12. $\neg(p \vee q)$ and $\neg p \wedge \neg q$ are logically equivalent **A. [True]** B. [False]
13. If A is any statement, then which of the following is a tautology? **A. $A \vee \neg A$** B. $A \wedge F$ C. $P \vee F$ D. $A \wedge T$	13. $p \to q$ and $\neg p \vee q$ are logically equivalent **A. [True]** B. [False]

14. Let P (x) be the statement "x spends more than five hours every weekday in class," where the domain for x consists of all students. **Express ∃xP(x)** quantifications in English **A. There is a student who spends more than five hours every weekday in class.** B. Every student spends more than five hours every weekday in class. C. There is a student who does not spend more than five hours every weekday in class. D. No student spends more than five hours every weekday in class.	14. The conditional statement ¬p→(p → q) is a tautology **A. [True]** B. [False]
15. Let's consider a propositional language where p :"Paola is happy", q :"Paola paints a picture", r :"Renzo is happy". Formalize the following sentence: **"if Paola is happy and paints a picture then Renzo isn't happy"** Then which of these choices express that : A. p∧q→¬r B. p∧¬q→¬r C. p∨q→¬r D. ¬p∨q→¬r	15. ¬∃xQ(x) ≡∀x ¬Q(x) **A. [True]** B. [False]

16. What is the output of the following combinatorial circuit?



A. (¬p ∧ (q ∨ r)) ∧ ((¬p ∨ ¬r) ∧ ¬q)
B. (p ∧ ¬r) ∨ (¬q ∧ r)
C. ¬ (p ∧ (q ∨ ¬r))
D. (p ∨ ¬r) ∧ (¬p ∨ (q ∨ ¬r))

I. Choose The Correct Answer

1- (01 1011 0110) AND (11 0001 1101) is

(A) 00 1001 0110
(B) 00 0011 0100
(C) 01 0001 0100
(D) 01 0011 0100

2- Let p and q be the propositions

p : You drive over 90 kilometer per hour.

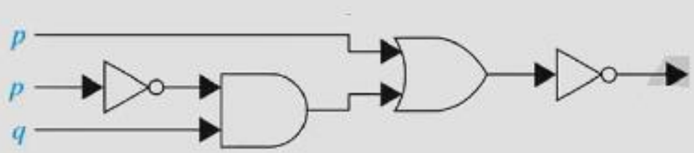
q : You get a speeding ticket.

Write the following proposition using p and q and logical connectives.

- You drive over 90 kilometer per hour, but you do not get a speeding ticket.

(A) $p \to q$
(B) $p \wedge \neg q$
(C) $p \wedge q$
(D) $p \leftrightarrow q$

4- Find the output of the following combinatorial circuit



(A) $\neg(p \vee (p \wedge q))$
(B) $(p \vee (\neg p \wedge q))$
(C) $\neg p \wedge (p \vee \neg q)$
(D) $(p \vee (\neg p \vee \neg q))$

6- The cardinality of the power set for $\{a, \{b, d, e\}, c\}$ is .... elements.

(A) 2
(B) 8
(C) 16
(D) 32

II. State True or False

1- 2 + 3 = 5 is not a proposition.

Ⓐ [True]

Ⓑ [False]

2- If p is true and q is false, then $p \oplus q$ is true.

Ⓐ [True]

Ⓑ [False]

3- If p is false and q is true, then $(p \vee \neg q) \rightarrow (p \wedge q)$ is false.

Ⓐ [True]

Ⓑ [False]

4- $p \vee (p \wedge q) \equiv p$

Ⓐ [True]

Ⓑ [False]

5- $(\neg q \wedge (p \rightarrow q)) \rightarrow \neg p$ is a tautology

Ⓐ [True]

Ⓑ [False]

6- The hypotheses " George studies well, " " If George study well then he will succeed," and " George will graduate" imply the conclusion " George will succeed and graduate." **is not a valid argument.**

Ⓐ [True]

Ⓑ [False]

7- $A \subset B \leftrightarrow \forall x(x \in A \rightarrow x \in B)$

Ⓐ [True]

Ⓑ [False]

8- A one-to-one correspondence is called **invertible** because we can define an inverse of this function.

Ⓐ [True]

Ⓑ [False]

9- The composition $f \circ g$ cannot be defined unless the range of f is a subset of the domain of g.

Ⓐ [True]

Ⓑ [False]

Logical Equivalences (1/3)

Logical Equivalences.

Equivalence	*Name*
$p \wedge \mathbf{T} \equiv p$ $p \vee \mathbf{F} \equiv p$	Identity laws
$p \vee \mathbf{T} \equiv \mathbf{T}$ $p \wedge \mathbf{F} \equiv \mathbf{F}$	Domination laws
$p \vee p \equiv p$ $p \wedge p \equiv p$	Idempotent laws
$\neg(\neg p) \equiv p$	Double negation law
$p \vee q \equiv q \vee p$ $p \wedge q \equiv q \wedge p$	Commutative laws

Logical Equivalences (2/3)

Logical Equivalences.

$(p \vee q) \vee r \equiv p \vee (q \vee r)$ $(p \wedge q) \wedge r \equiv p \wedge (q \wedge r)$	Associative laws
$p \vee (q \wedge r) \equiv (p \vee q) \wedge (p \vee r)$ $p \wedge (q \vee r) \equiv (p \wedge q) \vee (p \wedge r)$	Distributive laws
$\neg(p \wedge q) \equiv \neg p \vee \neg q$ $\neg(p \vee q) \equiv \neg p \wedge \neg q$	De Morgan's laws
$p \vee (p \wedge q) \equiv p$ $p \wedge (p \vee q) \equiv p$	Absorption laws
$p \vee \neg p \equiv \mathbf{T}$ $p \wedge \neg p \equiv \mathbf{F}$	Negation laws

Logical Equivalences (3/3)

Logical Equivalences Involving Conditional Statements.

$$p \rightarrow q \equiv \neg p \vee q$$
$$p \rightarrow q \equiv \neg q \rightarrow \neg p$$
$$p \vee q \equiv \neg p \rightarrow q$$
$$p \wedge q \equiv \neg(p \rightarrow \neg q)$$

Logical Equivalences Involving Biconditional Statements.

$$p \leftrightarrow q \equiv (p \rightarrow q) \wedge (q \rightarrow p)$$
$$p \leftrightarrow q \equiv \neg p \leftrightarrow \neg q$$
$$p \leftrightarrow q \equiv (p \wedge q) \vee (\neg p \wedge \neg q)$$
$$\neg(p \leftrightarrow q) \equiv p \leftrightarrow \neg q$$

Best Wishes