Review Chapter 1

1. Find the **negation** of the proposition "$p \to (\neg q \vee r)$".

A. $\neg p \to (q \wedge \neg r)$

B. $\neg p \to (q \wedge \neg r)$

C. $p \wedge q \wedge \neg r$

D. None of these

2. Write the statement "Studying is sufficient for passing" in the form **if-then**

A. If you study, then you pass

B. If you pass, then you study

C. If you don't study, then you don't pass

D. None of these

3. Find a proposition **equivalent** to the proposition $p \vee \neg q \to \neg p$

A. $\neg p$

B. $\neg p \wedge \neg q$

C. $\neg p \to p \vee \neg q$

D. $\neg(p \vee \neg q) \to p$

E. None of these

4. Let x be a real number, consider the statements:

(i) $\forall x(x > 1 \to x^2 > 1)$

(ii) $\forall x(x > 1 \wedge x^2 > 1)$

(iii) $\forall x(x > 1 \vee x^2 > 1)$

Which are true?

A. (i) only

B. (ii) only

C. (iii) only

D. (i) and (ii)

E. (ii) and (iii)

5. Consider the arguments:

i) If Nam knows discrete math, then he is smart. Nam is smart. Therefore, he knows discrete math.

ii) If Nam knows discrete math, then he is smart. Nam doesn't know discrete math. Therefore, he isn't smart.

The statement i) is ___ and ii) is ___

A. True, false

B. False, true

C. false, false

D. True, true

6. Which propositions are tautologies?

i. $(p \rightarrow \neg q) \rightarrow (q \rightarrow \neg p)$

ii. $(p \rightarrow \neg q) \rightarrow (\neg p \rightarrow q)$

A. i only

B. ii only

C. Both

D. None

KEY:	1C	2A	3A	4A	5C	6A

Review chapter 2

1. Let U = {a, b, c, d, e, f, g} and A, B are set represented by strings 111 01 01 and 101 10 10. What is the set A - $\bar{B}$?

A. {a, c}

B. {a, d}

C. {a, d, f}

D. {b, c, g}

E. None of these

2. Find the **power set** of the set {∅, a, b}

A. {∅, {a}, {b}, {∅, a, b}}

B. {∅, {a}, {b}, {a, b}, {∅, a, b}}

C. {∅, a, {a}, {b}, {a, b}, {∅, a, b}}

D. {∅, {a}, {∅}, {b}, {a, ∅}, {∅, b}, {a, b}, {∅, a, b}}

E. None of these

3. Given f(x) = x^3 and g(x) = cosx, find the **composite function fog defined by (fog)(x) = f(g(x)).**

A. cos(x^3)

B. x^3cosx

C. $\cos^3$(x)

D. cos(x^4)

4. Which functions are **one-to-one**?

f(x) = (x-3)(x+5)

g(x) = 7 for all x

A. f only

B. g only

C. Both

D. None

5. Find the sum $\sum_{k=11}^{99}(2k)$

A. 4895

B. 14685

C. 9900

D. 7342.5

E. None of these

6. Find the **inverse function** of the function f = {(2, 3), (1, 5), (2, 1), (4, 4)} if any

A. f^{-1} = {(3, 2), (5, 1), (1, 2), (4, 4)}

B. f is not a function

C. f has no an inverse

D. f-1 = {(1, 1), (2, 2), (3, 3), (4, 4), (5, 5)}

KEY:	1A	2D	3C	4D	5E	6B

REVIEW CHAPTER 3

1. Which functions are O(xlogx)

$F(x) = 2017x + 2^{2017}$

$G(x) = \log(x^3 + 2^x)$

A. F only
B. G only
C. Both
D. None

2. Which pair of integers are **relatively prime**?

A. (270, 27!)
B. (1024, 2049)
C. (1024, 2048)
D. None of these

3. **Encrypt** the string "OK" using the function **f(x) = (13x + 7) mod 26**

A. HH
B. KO
C. LV
D. IX
E. None of these

4. Suppose a = 147 **div** 39 and b = -147 **div** 39. What is a – b?

A. 6
B. 7
C. 0
D. -6
E. None of these

5. Suppose **a ≡ b (mod m)** where a, b are integers and m is a positive integer. Which one is always true?

A. m |(a – b)
B. (a-b) | m
C. m | (a + b)
D. (a + b) | m

6. Which integers below are **congruent to -23 modulo 7**?

A. -11
B. 11
C. -16
D. 16

KEY: 1C 2B 3A 4B 5A 6C

Review chapter 4

1. To show the statement P(n) is true for all positive integers n, which method is called mathematical induction?

A. Show that the statement "P(k) $\rightarrow$ P(k+1)" is true for all positive integers k.

B. Show that "P(1) is true" and "P(k) $\wedge$ P(k+1)" is true for all positive integers k.

C. Show that "P(1) is true" and "P(k) $\rightarrow$ P(k+1)" is true for all positive integers k.

D. None of these

2. Which of the following is a **recursive definition** of the sequence $a_n = (-1)^n + 1$, n = 0, 1, 2, …

A. $a_n = \begin{cases} 2 \text{ if } n \text{ is even} \\ 0 \text{ if } n \text{ is odd} \end{cases}$

B. $a_1 = 2$ and $a_n = 2 - a_{n-1}$ $for\ n = 2, 3, \ldots$

C. $a_0 = 2$ and $a_n = 2 - a_{n-1}$ $for\ n = 1, 2, 3, \ldots$

D. All of the others

3. Find f(5) if f(1) = 1 and f(n) = n - f(n-1) for n =2, 3, …

A. 1

B. 2

C. 3

D. 4

E. 5

4. Give a **recursive definition** for the set of string S = {10, 100, 1000, 10000, …}

A. 10 $\in$ S and if 10 $\in$ S, 100 $\in$ S

B. If x $\in$ S, x0 $\in$ S

C. 10 $\in$ S and if x $\in$ S, x0 $\in$ S

D. 10 $\in$ S and if x $\in$ S, x00 $\in$ S

5. Consider the statements:

i. $1 + 2 + 3 + \ldots + n = n(n+1)/2$

ii. $1 + 3 + 5 + \ldots + (2n-1) = n^2$

Which statements are true for all integers n > 0?

A. i only

B. ii only

C. Both

D. None

6. Consider the algorithm:

procedure **conx**(n: positive integer)

if n = 1 return 1

else if n = 2 return 2

else if n = 3 return 3

else return **-conx**(n-3)

end

What is the output if input n = 7?

A. 1
B. 2
C. 3
D. -1
E. -2
F. -3

KEY: 1C 2C 3C 4C 5C 6A

Review chapter 5

1. How many functions are there from the set {1, {1}, {2, 3, 4}} to the set {∅, a, b, a, {a, b}}?

A. 4^3

B. 3^4

C. 4^5

D. 5^4

E. None of these

2. How many ways to choose a pair of integers where the first is in {1, 2, 3, 4, 5} and the second in {6, 7, 8, 9}?

A. 9

B. 20

C. 4^5

D. 5^4

3. To count the number of functions from a set to a set, we use ___

A. The product rule

B. The sum rule

C. The principle of inclusion-exclusion

D. None of these

4. Given the set A, B such that |A| = 7, |B| = 11 and |A U B| = 15, then |B - A| equals to ___

A. 5

B. 6

C. 7

D. 8

E. None of these

5. How many bit strings of length ten start with 10 **or** end with 111 but **not both**?

A. $2^8 + 2^7 – 2^5$

B. $2^8 + 2^7$

C. $2^8 + 2^7 + 2^5$

D. $2^8 + 2^7 – 2^6$

E. None of these

KEY: 1A 2B 3A 4D 5D