QN=1	How many quadruples (p, q, r, s) are there that make the compound proposition false? $(p \rightarrow q) \rightarrow (r \rightarrow s)$
a.	12
b.	6
c.	5
d.	4
e.	3

QN=2	Let p = "You passed this class" q = "Your average course grade is above 5" Translate the sentence into a logical expression "*To pass this class, it is necessary that your average course grade is above 5*" (i) $\neg p \rightarrow \neg q$ (ii) $q \rightarrow p$ (iii) $p \wedge q$ (iv) $p \rightarrow q$
a.	(i)
b.	(ii)
c.	(iii)

d.	(iv)
e.	None of the other choices is correct

QN=3	Find a proposition that is logically equivalent to $(p \rightarrow q) \wedge (p \rightarrow \neg q)$ (i) $\neg$q (ii) F (iii) $\neg$p (iv) T
a.	(i)
b.	(ii)
c.	(iii)
d.	(iv)

QN=4	Let x represent a student in a university. Let A(x) = "x is a student of class 1A" B(x) = " x has visited Brazil" C(x) = "x has visited Columbia" Translate the sentence into a logical expression "**Every student of class 1A has visited both Brazil and Columbia**" (i) $\exists x(A(x) \wedge (B(x) \vee C(x)))$ (ii) $\forall x(A(x) \rightarrow (B(x) \wedge C(x)))$ (iii) $\forall x(A(x) \rightarrow (B(x) \vee C(x)))$ (iv) $\forall x(A(x) \vee (B(x) \wedge C(x)))$
a.	(i)

b.	(ii)
c.	(iii)
d.	(iv)

QN=5	Assume that the domain of x consists of all integer numbers. Which proposition is true? (i) $\forall x(x > 2x)$ (ii) $\forall x(x > -x)$ (iii) $\forall x(x^2 \geq x)$ (iv) $\forall x(x^2 \geq 2x)$
a.	(i)
b.	(ii)
c.	(iii)
d.	(iv)

QN=6	

	Let P(x) = "x is a student" Q(x, y) = "x knows the programming language y" Translate the sentence into a logical expression "*Every student knows some programming language*" (i) $\forall x(P(x) \rightarrow Q(x, y))$ (ii) $\forall x \exists y(P(x) \rightarrow Q(x, y))$ (iii) $\forall x(P(x) \wedge Q(x, y))$ (iv) $\forall y \exists x(P(x) \wedge Q(x, y))$
a.	(iii)
b.	(i)
c.	(ii)
d.	(iv)
e.	None of the other choices is correct

QN=7	The proposition $\forall x \; \exists y \; (x = y^2)$ is True if the domain of x, y is…
a.	the set of positive real numbers
b.	the set of integers
c.	the set of positive integers

d.	the set of real numbers
e.	None of the other choices is correct

QN=8	Given the premises: “Every student in this class is either a Computer Science major or a Math major”, “Every Computer Science major studies Discrete Mathematics”, “Every Math major studies Calculus”, “An, a student in this class, studies Discrete Mathematics”, “Binh, a student in this class, studies Calculus”. Which conclusion can be drawn? (i) An is a Computer Science major (ii) An is a Math major. (iii) Binh is a Computer Science major (iv) Binh is a Math major.
a.	(i) and (iii)
b.	(ii) and (iii)
c.	(i) and (iv)
d.	(ii) and (iv)
e.	None of the other choices is correct.

QN=9	Let U={0, 1, 2, 3, 4, 5, 6, 7, 8, 9}. Find the subset of U whose bit string representation is 0101010101.
a.	{1, 2, 3, 5, 7}
b.	{1, 3, 5, 7, 9}
c.	{0, 1, 2, 5, 9}
d.	{0, 2, 4, 6, 8}

QN=10	Let A, B, C be sets such that |A|-|B| = 1. Assume that the set A x B x C has 22 elements. Find |C|.
a.	None of the other choices is correct
b.	11
c.	3
d.	7
e.	8

f.	10

QN=11	Let X, Y, Z be sets. Which statements are FALSE? (i) $(X \cap Y) \cup (X \cap \overline{Y}) = X$ (ii) $(X \cap Y) \cup Z = X \cap (Y \cup Z)$ (iii) $X \cap (Y \cup Z) = (X \cap Y) \cup (X \cap Z)$ (iv) $(X \cap Y) \cap Z = X \cap (Y \cap Z)$
a.	(i)
b.	(ii)
c.	(iii)
d.	(iv)

QN=12	Which of the following is a function? (i) $f: \mathbf{R} \to \mathbf{R}$ where $f(x) = \sqrt{x}$ (ii) $f: \mathbf{Z} \to \mathbf{R}$ where $f(x) = \frac{1}{x^2 - 2}$ (iii) $f: \mathbf{R} \to \mathbf{R}$ where $f(x) = \frac{1}{x - 2}$ (iv) $f: \mathbf{R} \to \mathbf{R}$ where $f(x) = \frac{1}{x + 2}$
a.	(i)
b.	(ii)

c.	(iii)
d.	(iv)

QN=13	Let $f: \mathbf{Z} \to \mathbf{N}$ be the function defined as follows $f(n) = \begin{cases} -2n, & n \leq 0 \\ 2n-1, & n > 0 \end{cases}$ Choose the correct answer.
a.	f is one-to-one but not onto.
b.	f is onto but not one-to-one.
c.	f is both one-to-one and onto.
d.	f is neither one-to-one nor onto.

QN=14	Find the sum $\sum_{i=0}^{10} \sum_{j=1}^{20} ij$
a.	15620
b.	22500
c.	17100
d.	11550
e.	None of the other choices is correct

QN=15	Given the Binary search algorithm (See picture)

	If input = 2, 4, 5, 7, 8, 9, 10, 13 and x = 8, after the third time of dividing into sublists, the sublist to be considered is_____ Procedure **Binarysearch**(a_1<a_2<…<a_n, x: integer) i:=1 j:=n while (i<j) m:=$\lfloor (i+j)/2 \rfloor$ if x > a_m then i: = m+1 else j:=m if x = a_i then location: = i else location: = 0
a.	8
b.	8, 9
c.	7, 8
d.	7, 8, 9

QN=16	Given the algorithm
	
	Procedure LN(m, n : integers)
	while (m ≠ n)
	if m > n then m:=m-n
	else n:=n-m;
	Print(m)
	
	If m=36, n=44, what is the output of the algorithm?

a.	4
b.	5

c.	6
d.	7
e.	8

QN=17	Find the smallest integer n such that the following function is $O(x^n)$ $x^2 + x^2 \log x$
a.	3
b.	2
c.	4
d.	1
e.	0

QN=18

Given the algorithm

```
procedure TT(n: integer)
sum:=0
i:=0
j:=0
while (i<√n )
    sum:=sum+1
        i:=i+1
while (j<√n /2)
            j:=j+1
        sum:=sum+1
Print(sum)
```

If n=9, how many additions are required ?

a.	10
b.	8
c.	6
d.	12
e.	14

QN=19	Let a = 132 mod 37 and b = -132 mod 37. Find a - b.
a.	5
b.	-3
c.	7
d.	12
e.	1

QN=20	Consider an encryption scheme using the function f(p) = 7p+3 mod 26. Encrypt the message “LN”
a.	AX
b.	ZW
c.	CX
d.	CQ
e.	ZG

QN=21	For two positive integers a and b, we say that a is relatively prime to b if GCD(a,b) = 1. How many positive integers that are less than 15 and relatively prime to 15?
a.	6
b.	8
c.	12
d.	10
e.	None of the other choices is correct

QN=22	Find the decimal expansion of the binary number 101011.
a.	53
b.	49
c.	47
d.	43
e.	None of the other choices is correct

QN=23	Find gcd(851, -931).
a.	7
b.	19
c.	23

d.	37
e.	None of the other choices is correct

QN=24	Let $P(n)$ be the statement "$f(n)$ is odd", where $f(n)=n^2+9n+2$. The domain consists of all positive integers. A proof of $\forall n P(n)$ is as follows: (i) $P(1)$ is clearly true. (ii) Assume that $P(k)$ is true for some positive integer k, which means that $f(k)$ is odd. (iii) We have: $f(k+1) = (k+1)^2+9(k+1)+2 = (k^2+9k+2)+(2k+10)$ $= f(k)+2(k+5)$ is odd, as it is a sum of an odd integer and an even integer. Thus $P(k+1)$ is true. By induction, we conclude $\forall n P(n)$. Which step is wrong in this proof?
a.	(i)
b.	(ii)
c.	(iii)
d.	None of the other choices

QN=25	Find f(4) if f(0) = -1, f(1) = 2, and f(n+1) = f(n) + 3f(n-1) for n = 0, 1, 2,...
a.	2
b.	5
c.	-3
d.	4

e.	None of the other choices is correct

QN=26	Given the set $S \subseteq Z$ defined recursively as follows: Basis step: $4, 6 \in S$, Recursive step : If $m, n \in S$ then $\begin{cases} -m \in S \\ m+n \in S \end{cases}$. Find S. (i) $S = \{a \in Z \mid a \text{ is divisible by } 2\}$ (ii) $S = \{a \in Z \mid a \text{ is divisible by } 3\}$ (iii) $S = \{a \in Z \mid a \text{ is divisible by } 4\}$ (iv) $S = \{a \in Z \mid a \text{ is divisible by } 6\}$
a.	(i)
b.	(ii)
c.	(iii)
d.	(iv)
e.	None of the other choices is correct

QN=27	How many comparisons are needed to merge the two lists 1, 3, 5, 7, 8 and 2, 4, 6, 9, 10 ?
a.	7
b.	8
c.	10
d.	9
e.	6

QN=28	Find the number of positive integers that do not exceed 2016 and are divisible by 7 or 9.
a.	512
b.	288
c.	224
d.	480
e.	64
f.	None of the other choices is correct

QN=29	A person deposited 10 millions VND in a saving account at the rate of 12% a year. After 10 years, how much money will be in the account?
a.	22 millions VND
b.	12 millions VND
c.	31.06 millions VND
d.	27.7 millions VND
e.	None of the other choices is correct

QN=30	Find $f(16)$ if $f(2) = 5$ and $f(n) = (f(\sqrt{n}))^2$
a.	5
b.	390625
c.	625
d.	25
e.	None of the other choices is correct

QN=31	Let R be the relation on the set of real numbers such that a R b if a-b is an integer. Which of the properties (reflexive, symmetric, anti-symmetric, transitive) does R have?
a.	transitive
b.	Reflexive, transitive
c.	Reflexive
d.	Reflexive , symmetric, transitive
e.	None of the other choices is correct

QN=32	Let R and S be relations on {a, b, c, d} with

	R = {(c,d), (b,c), (b,a)} and S = {(a,d), (b,c), (d,b)}. Find the composite relation RoS.
a.	{(b,d), (c,b)}
b.	{(b,d), (d,a), (d,c)}
c.	{(a,a), (a,d), (d,c)}
d.	None of the other choices is correct

QN=33	Let R={(a, b, c)| a+b+c<5} be the 3-ary relation on the set {1, 2, 3}. Find the cardinality of R.
a.	4
b.	8
c.	3
d.	6
e.	None of the other choices is correct

QN=34	Let R be the relation on the set {1, 2, 3} represented by the matrix $M_R = \begin{pmatrix} 1 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \end{pmatrix}$ Which statement is **FALSE**?
a.	R is antisymmetric
b.	R is reflexive
c.	R is symmetric
d.	R is transitive

QN=35	

	Which relations are equivalence relations on the set of integers? $R = \{(a,b) \mid a+b \equiv 0 (mod\, 2)\},$ $S = \{(a,b) \mid a+b \equiv 0 (mod\, 3)\},$ $T = \{(a,b) \mid a^2 = b^2\}.$
a.	None of the other choices is correct
b.	S and T
c.	R and S
d.	R and T
e.	T

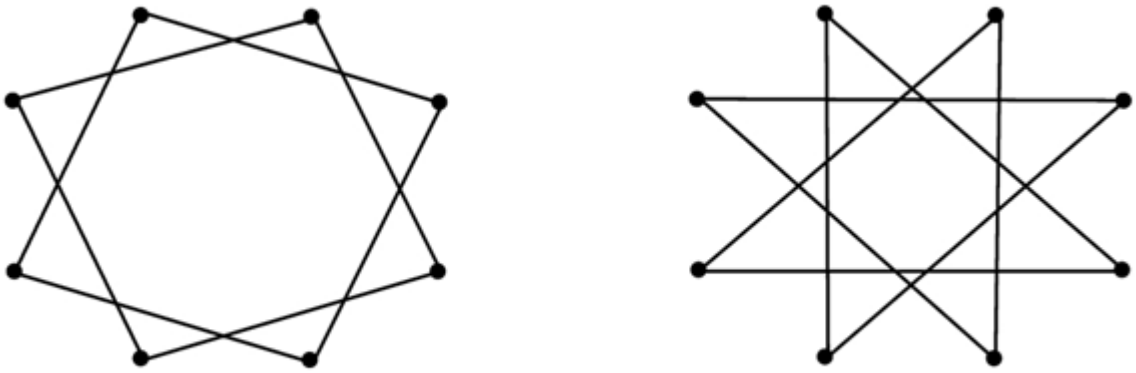
QN=36	Let A = {a, b, c, d} and consider a partition of A consisting of the subsets {a}, {c}, {b,d}. Find the equivalence relation that corresponds to this partition.
a.	R={(a,b), (a,d), (c,b), (c,d)}
b.	R={(a,c), (b,d)}
c.	R={(a,a), (c,c), (b,b), (b,d), (d,b), (d,d)}
d.	R={(a,a), (c,c), (b,b), (d,d)}
e.	None of the other choices is correct

QN=37	Let G be a simple graph. The complementary graph of G is the graph G' having the same set of vertices, and there is an edge connecting u and v in G' if and only if there is no edge connecting u and v in G. If G has 10 vertices and 20 edges, how many edges does G' have?
a.	25
b.	20
c.	70
d.	45
e.	None of the other choices is correct

QN=38	Which of the following sequences is a degree sequence of a simple graph?
a.	0, 2, 2, 3, 2
b.	3, 1, 2, 3

c.	2, 2, 3, 4, 3, 3
d.	2, 1, 1, 4
e.	None of the other choices

QN=39	Which of the following graphs has the most number of edges? (i) $K_{2,7}$ (ii) W_8 (iii) K_7 (iv) C_{14}
a.	(i)
b.	(ii)
c.	(iii)
d.	(iv)
e.	None of the other choices is correct

QN=40	Are these two graphs isomorphic? If not, what is the reason? 
a.	No, they are not isomorphic because they do not have the same number of connected components
b.	No, they are not isomorphic because they do not have the same number of vertices of degree 2
c.	No, they are not isomorphic because they do not have the same number of edges
d.	Yes, they are isomorphic
e.	None of the other choices is correct

QN=41	

	Let G be an undirected graph of four vertices A, B, C, D with the incidence matrix $\begin{bmatrix} 1 & 0 & 1 & 1 & 0 & 0 & 0 \\ 1 & 1 & 1 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 1 & 0 & 0 & 1 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 \end{bmatrix}$ Which of the following statements is true?
a.	G is a simple graph.
b.	G is a multigraph.
c.	G has no multiple edges.
d.	G has loops.

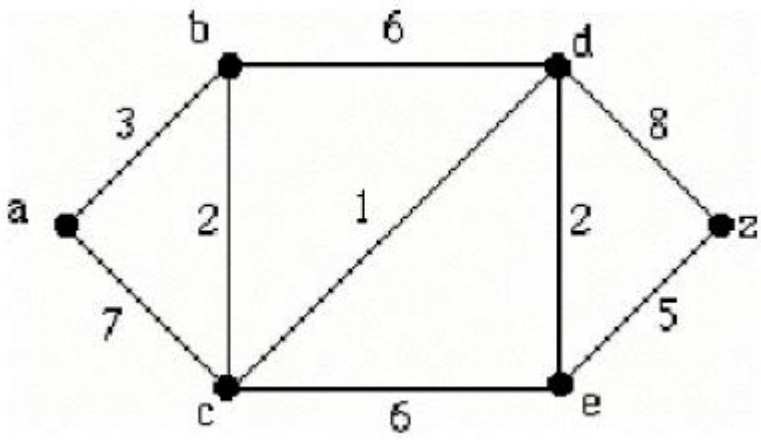
QN=42	Let G be an undirected graph with 3 vertices A, B, C and the incident matrix (in that order of vertices) $\begin{bmatrix} 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$ How many paths of length 2 from B to C?
a.	3
b.	2
c.	1
d.	4
e.	None of the other choices is correct

QN=43	

	Which graphs have Euler circuits? (i) K_4 (ii) C_4 (iii) C_5 (iv) Q_5
a.	(i)
b.	(iv)
c.	(ii) and (iii)
d.	(i) and (ii)

QN=44	Which of the following propositions is TRUE: (i) If $K_{1,2}$ has a Hamilton path, then K_2 has an Hamilton circuit (ii) If W_4 has a Hamilton path, then $K_{4,3}$ has an Euler path (iii) If $K_{4,5}$ has an Euler path, then Q_3 has a Hamilton circuit
a.	(i)
b.	(ii)
c.	(iii)
d.	None of the other choices

QN=45	Find the length of the shortest path from a to z.

	
a.	None of the other choices is correct
b.	9
c.	8
d.	13
e.	11

QN=46	Find the least number of leaves of a balanced full 4-ary tree of height 3.
a.	19
b.	13
c.	54
d.	37

QN=47	Let T be a full m-ary tree of height 4 with 63 leaves. Find m.
a.	3
b.	4
c.	5
d.	6
e.	2

QN=48	Give the coding scheme A: 001, B: 1011, C: 11, D: 0000, E: 0100, F: 011, G: a01b01. Find a and b such that we have a prefix code.
a.	a=1, b= 1
b.	a=1, b= 0
c.	a=0, b= 1
d.	a=0, b= 0

QN=49	How many comparisons are needed to search for the word "hoa" in the binary search tree for the sentence "Canh le trang diem mot vai bong hoa" ?
a.	2
b.	6
c.	8
d.	None of the other choices is correct
e.	4

QN=50	Find the value of the postfix expression 2 1 ↑ 3 + 4 5 - - 6 7 8 + + -
a.	-15
b.	-16
c.	4
d.	7
e.	8