**1. Determine whether the proposition is TRUE or FALSE**

a. 1 + 1 = 2 and 2 + 2 = 1.

1. 1 + 1 = 2 or 3 + 4 = 1
2. True, True
3. True, False
4. False, False
5. False, True

Answer: d

**2. Write in symbol the sentence**

“It is not true that if you study, then you get good grade”

using the propositions:

g: you study

r: you get good grade

1. ¬(g → r)
2. (g → ¬r)
3. ¬(g →¬ r)
4. (g → r)

Answer: a

**3. Find the proposition corresponding to the given truth table:**

|  |  |  |
| --- | --- | --- |
| p | r | ? |
| T | T | F |
| T | F | T |
| F | T | F |
| F | F | F |

1. p ∧ ¬r
2. ¬p ∧ r
3. ¬p ∧ ¬r
4. p ∧ r

Answer: a

**4. Let p and r denote proposition. Which of the following statements is/are TRUE?**

(i) p → r ≡ ¬p ∨ r

(ii) p ∨ r ≡ ¬r → p

1. (i) only
2. (ii) only
3. Both (i) and (ii)
4. Neither (i) nor (ii)

Answer: c

**5. Find the negation of the statement “If it is sunny, then it is hot."**

1. It is sunny but not hot.
2. If it is sunny, then it is not hot.
3. If it is not sunny, then it is not hot.
4. It is not sunny and it is not hot.

Answer: a

**6. Suppose the variable x represents students and y represents courses, and:**

**T(x,y): x is taking y.**

Write the statement “Leo is not taking any course” using this predicate and any needed quantifiers.

1. ∃y¬T(Leo,y)
2. ¬∀yT(Leo,y)
3. ¬∃yT(Leo,y)
4. None of the others

Answer: c

**7. (i) How many bit strings are there of length eight?**

**(ii) How many bit strings of length eight both begin and end with a 1?**

1. (i) 28 (ii) 2.26
2. (i) 64 (ii) 36
3. (i) 16 (ii) 12
4. (i) 28 (ii) 26

Answer: d

**8. How many subsets of the set {1, 2, 3, 4, 5, 6} that contain 2 and 3?**

1. 4
2. 14
3. 64
4. 16

Answer: d

**9. The power set of the set {2,5,6,7} has \_\_\_\_ elements.**

1. 3
2. 9
3. 8
4. 16

Answer: d

**10. If B = {0, 1}, how many different functions are there from the set BxB to the set B?**

1. 4
2. 6
3. 16
4. 8

Answer: c

**11. Which of the following statements is/are TRUE?**

(i) N<2n for all positive intergers n.

(ii) 2n < n! for all positive intergers n.

1. (i)only
2. Both (i) and (ii)
3. Neither (i) nor (ii)
4. (ii) only

Answer: a

**12. Give the “best” big-oh notation to describe the complexity of the algorithm that prints all bit strings of length n.**

1. O (nlogn)
2. O(n2)
3. O(n)
4. O(2n)

Answer: d

**13. Find 79 mod 51 and -79 mod 51**

1. 28, 23
2. -28, 23
3. 28, -23
4. -28, -23

Answer: a

**14. If a = -37 mod 7 and b = 37 mod 7, what is the value of a + b?**

1. 0
2. 2
3. 7
4. 4

Answer: c

**15. Which of the following integers is/are congruent to 7 modulo 11?**

1. 27
2. 28
3. 29
4. 30

Answer: c

**16. Find f(1), f(2), f(3), and f(4) if f is deﬁned recursively by f(0) = 1 and for n =1, 2,...**

**f(n) = n - f(n-1).**

1. -1, 1, -1, 1
2. 0, 2, 1, 3
3. 0, 1, 2, 3
4. -1, 3, 0 , 4

Answer: b

**17. Which of the following statements is/are TRUE?**

(i) The bubble sort has O(n2) time complexity.

(ii) The merge sort has O(nlogn) time complexity.

1. Both (i) and (ii)
2. (ii) only
3. Neither (i) nor (ii)
4. (ii) Only

Answer: a

**18. Given a recursive algorithm**

procedure calcu(a: real number, n: positive integer)

     if n = 1 then calcu(a, n):= a

     else calcu(a, n) := a + calcu(a, n - 1)

What is the output after calling calcu(2.4, 5)?

1. 12
2. 7.4
3. 6.4
4. 2.4

Answer: a

**19. Consider the following algorithm:**

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

**if** n = 1 **then**

**return** 3

**else**

**return** *thuattoan*(n-1)

What is the output of the algorithm if n = 5?

1. 3
2. 18
3. 22
4. 4

Answer: a

**20. Give a recursive definition of the function f(n) = 2019, n = 1, 2, 3, ...**

1. f(n) = f(n-1) if n > 0, and f(1) = 2019
2. f(n) = f(n-1) if n > 1, and f(1) = 2019
3. f(n) = f(n-1) - 1 if n > 1, and f(1) = 2019
4. f(n) = 2019 if n > 1, and f(1) = 2019

Answer: b

**21. Give a recursive definition of the function f(n) = -2n, for n = 1, 2, 3, ….**

1. f(n) = f(n-1) -2 if n > 1 and f(1) = -2.
2. f(n) = f(n-1) -2 if n > 0 and f(1) = -2.
3. f(n) = f(n-1) if n > 1 and f(1) = -2.
4. f(n) = -2 if n > 1 and f(1) = -2.

Answer: a

**22. Convert 154 to a binary expansion**

1. 10011010
2. 10001101
3. 10001111
4. 10000010

Answer: a

**23. Convert 71 to a base 7 expansion**

1. (131)7
2. (351)7
3. (111)7
4. (660)7

Answer: a

**24. Convert (104)5 expansions to decimal expansion.**

1. 12
2. 22
3. 19
4. 29

Answer: d

**25. How many vertices does a full 5-ary tree with 100 internal vertices have?**

1. 67
2. 501
3. 105
4. 76

Answer: b

**26. How many leaves does a full 3-ary tree with 100 vertices have?**

1. 67
2. 501
3. 105
4. 76

Answer: a

**27. Using alphabetical order, construct a binary search tree for the words in the sentence “doing nothing is doing ill”.**

How many comparisons are needed to locate the word “ill”?

1. 1
2. 2
3. 3
4. 4

Answer: d

**28. Using alphabetical order, construct a binary search tree for the words EAGLE, ANT, BAT, DUCK, BEAR, PIG, CAT and DOG .**

How many comparisons are needed to locate the word “BEAR”?

1. 5
2. 6
3. 7
4. 8

Answer: a

**29. Using alphabetical order, construct a binary search tree for the words EAGLE, ANT, BAT, DUCK, BEAR, PIG, CAT and DOG .**

How many comparisons are needed to locate the word “DOG”?

1. 5
2. 6
3. 7
4. 8

Answer: c

**30. Use Huffman coding to encode the word “success”. What is the average number of bits required to encode a symbol?**

Answer: b

**31. Use Huffman coding algorithm to encode the word “tomato”. What is the average number of bits required for each character?**

1. 1
2. 2
3. 3
4. 4

Answer: b

**32. Write the expression (x + y)\*(x - y) in postfix notation.**

1. \*  +  x  y  -  x  y
2. x  y  -  x  y  +  \*
3. +  x  y  -  x  y  \*
4. x  y  +  x  y  -  \*

Answer: d

**33. Construct the binary search tree for the sequence:**

12, 14, 5, 3, 8, 15, 10, 6, 9

Given the pre-order traversal. of numbers after applying.

1. 12, 5, 3, 8, 6, 10, 9, 14, 15
2. 3, 5, 6, 8, 9, 10, 12, 14, 15
3. 3, 6, 9, 10, 8, 5, 15, 14, 12
4. 12, 13, 5, 3, 8, 15, 10, 6, 9

Answer: a

**34. Construct the binary search tree for the sequence:**

12, 14, 5, 3, 8, 15, 10, 6, 9

Given the In-order traversal of numbers after applying.

1. 12, 5, 3, 8, 6, 10, 9, 14, 15
2. 3, 5, 6, 8, 9, 10, 12, 14, 15
3. 3, 6, 9, 10, 8, 5, 15, 14, 12
4. 12, 13, 5, 3, 8, 15, 10, 6, 9

Answer: b

**35. Construct the binary search tree for the sequence:**

12, 14, 5, 3, 8, 15, 10, 6, 9

Given the post-order traversal of numbers after applying.

1. 12, 5, 3, 8, 6, 10, 9, 14, 15
2. 3, 5, 6, 8, 9, 10, 12, 14, 15
3. 3, 6, 9, 10, 8, 5, 15, 14, 12
4. 12, 13, 5, 3, 8, 15, 10, 6, 9

Answer: c

**36. What is the value of the expressions?**

5 6 3 − − 1 3 2 + + ∗

1. 12
2. 22
3. 32
4. 42

Answer: a

**37. What is the value of the expressions?**

∗ + 3 + 3 - 5 + 1 2 3

1. 21
2. 22
3. 23
4. 24

Answer: d

**38. What is the value of the expressions?**

2 2 ∗ 2 ↑ 5 5 – 8 2 / ∗ −

a) 14

1. 15
2. 16
3. 17

Answer: c

**39. Find the value of the postfix expression?**

4 3 ↑ 2 1 \* 4 + -

1. 75
2. 74
3. 73
4. 72

Answer: a

**40. Given the coding scheme:**

a: 0, b: 100, c: 111, e: 110, t: 101.

Find the word represented by 1010100.

1. tab
2. cet
3. tee
4. tea

Answer: a