

Sister Nivedita University

Module 1: [2L]

Introduction to Computers: Computer Systems, Computing Environments, Computer Languages, Creating and Running Programs, Software Development.

Questions:

1. What is the difference between script & program?
2. What are the basic components of a digital computer?
3. Differentiate between compiler and interpreter.
4. Is RAM absolutely volatile?
5. What is the basic role of an Operating system?
6. Differentiate between Secondary memory (e.g. HDD), Primary memory (e.g. RAM), Cache Memory, and register?

Module 2: [4L]

Number Systems: Radix number representation, Binary Numbers, Octal Numbers, Hexadecimal Numbers, Decimal-Binary Conversion, Octal-Binary Conversion, Hexadecimal-Binary Conversion, Hexadecimal-Octal Conversion, Floating Point Representation of Numbers, Arithmetic Operation, 1's and 2's Complements, 9's Complements, 10's Complements.

Questions:

1. Convert the Hexadecimal number 9AC2 to the corresponding decimal number.
2. Explain r's complement and (r-1)'s complement with example.
3. Subtract $(1011)_2$ from $(101)_2$ using 1's complement method.
Subtract $(101)_2$ from $(1011)_2$ using 1's complement method.
4. Subtract $(1011)_2$ from $(101)_2$ using 2's complement method.
Subtract $(101)_2$ from $(1011)_2$ using 2's complement method.
5. Express -7.5 in IEEE 754 single-precision format.
6. Express 6.25 in IEEE 754 double-precision format.
7. What are the drawbacks of signed magnitude representation and signed 1's complement representation?
8. In IEEE 754 single and double precision format how 0, + infinity, and -infinity are represented?
9. Subtract $(85)_{10}$ from $(27)_{10}$ using both 10's complement and 9's complement methods.
10. Convert decimal number 17.75 to the corresponding binary number.

11. A floating-point number system uses 16-bit bits to represent a number. MSB is the sign bit. The least significant 9 bits are mantissa and the remaining 6 bits are exponent in excess 31 formats.

i) Represent -1.5×10^2 in this format.

ii) What is the value represented by 1 001110 110000000?

12. 7's complement of 375 will be _____ .

13. 8's complement of 375 will be _____ .

14. 8's complement of 370 will be _____ .

15. What will be the value of x, if x-1 is 377 in octal (base 8).

16. What will be the value of x, if x+1 is 2340 in base 5.

[Hints: Base 5 means probable values will be from 0 to 4. As $x+1 = 2340$ so $x = 2334$]

Module 3: [4L]

Boolean Algebra and Minimization Techniques: Introduction, Development of Boolean Algebra, Boolean Logical AND Operation, Boolean Logical OR Operation, Boolean Logical Complement Operation(Inversion), Basic Laws of Boolean Algebra, Boolean Addition, Boolean Multiplication, Properties of Boolean Algebra, Principle of Duality, Demorgan's Theorems, Sum of Products and Product of Sums, Minterm, Maxterm, Deriving Sum of Product(SOP), Deriving Product Sum of (POS).

AND

Module 4: [4L]

Logic Gates: Introduction, Logic Gates, Truth table, OR Gate, AND Gate, NOT Gate, NAND Gate, NOR Gate, Universal Gates, Exclusive-OR (Ex-OR) Gate, Exclusive-NOR (Ex-NOR) Gate.

Questions from Module 3 and 4:

1. State and prove De Morgan's Theorem.
2. What do you mean by Universal gate.
3. Explain why NAND and NOR gates are known as universal gates.
4. For a 4 variable Boolean function if the Min term representation is $\sum 2, 5, 6, 7$ then find the corresponding Max term representation.
5. Find the Min term and Max term representation of the Boolean function $f(A, B, C) = AB + BC + CA$
6. What is a Truth table?
7. For the N variable Boolean function, what is the total number of rows/tuples in a truth table? How many literals are possible?
8. For 1024 literals how many variables are there?
9. Design XNOR gate using only NAND gate.

10. Design XOR gate using only NAND gate.
11. Design XNOR gate using only NOR gate.
12. Design XOR gate using only NOR gate.
13. What will the answer be if you reduced logic function $(A' + B)(A + B)$
14. What is the principle of duality related to Boolean algebra?
15. Explain absorption law and consensus theorem in Boolean algebra. Obtain the alternative expression for both of these using the principle of duality.
16. For an n-variable XOR logic what is an arithmetic expression for output?
17. For an n-variable XNOR logic what is an arithmetic expression for output?

Module 5: [3L]

Problem-solving approach: Algorithm and flowchart, the structure of the algorithm, running time, formulate a simple algorithm for arithmetic and logical problems.

Questions:

1. Differentiate between algorithm, program, and flowchart. Give a suitable example to explain your answer.
2. Define algorithm and its properties.
3. Define Time and Space complexity with an example.
4. Explain best, worst, and average-case time complexity with a suitable example.
5. Define asymptotic time complexity. Explain Big-O, Big-Omega, and Big-Theta time complexity with examples.
6. Write a small iterative algorithm for finding the length of a given number (length denotes no of digits). Also, explain the time complexities for your algorithm.
7. Find out the time complexity of the following algorithm (with explanation)

```
int i, j, k = 0;
for (i = n / 2; i <= n; i++) {
    for (j = 2; j <= n; j = j * 2) {
        k = k + n / 2;
    }
}
```

Module 6: [3L]

Imperative languages: Introduction to python programming language; syntax and constructs of a specific language.

Questions:

1. How to print the following statement in python: <https://aeonixinnovations.com/research>

Module 7: [5L]

Types Operator and Expressions with discussion: Variable Names, Data Type and Sizes, Constants, Declarations, Arithmetic Operators, Relational Operators, Logical Operators, Type Conversion, Increment Decrement Operators, Bitwise Operators, Assignment Operators and Expressions, Precedence and Order of Evaluation.

Questions:

1. Difference between $5/2$ with $5//2$.
2. Difference between relational operators with logical operators

Module 8: [6L]

Control Flow: Statements and Blocks, If-elif-else statement, Loops: while, for. Concept of break, continue and pass statement.

Questions:

1. Differentiate between break, continue and pass with examples.
2. Differentiate between aliasing data, shallow copy, and deep copy with examples.
3. What is a for-else statement in python? Give a suitable example.
4. Differentiate between for and while loop with examples.

Module 9: [5L]

Functions and Program Structure with discussion on the standard library: Basics of functions, parameter passing and returning type, block structure, Initialization, Recursion, and return types. Concept of module and packages.

Questions:

1. How to convert an integer array into a float array? (Give a coding example on implicit & explicit type conversion)
2. How many ways you can create an array in NumPy? Give a suitable example with a one-line explanation of each technique.
3. How to create a multidimensional array? Give a suitable example of this.
4. Can I pass arguments from the console? If yes then plz write a code that will take 2 numbers from the command prompt and return the sum of them.
5. Write a program in python that will take three numbers and find out the smallest one from them.
6. Write a python code to check a number is prime or not.
7. Write a python program to print the following patterns

```
*
**
***
****
*****
*****
```

Half Pyramid

```
*****
****
***
**
*

```

Inverted
Half Pyramid

```
*****
*   *
*   *
*   *
*   *
*   *
*
```

Hollow Inverted
Half Pyramid

```
      *
     * *
    * * *
   * * * *
  * * * * *
 * * * * *
* * * * *
```

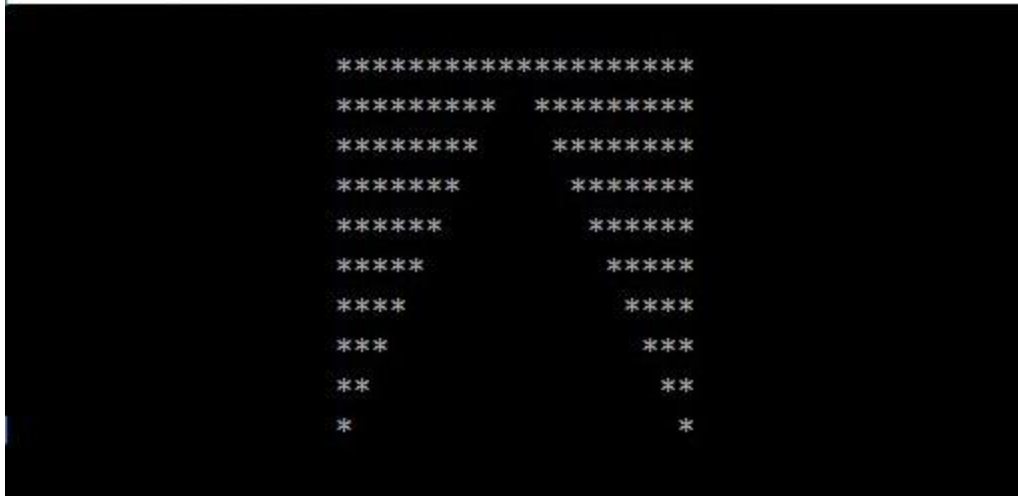
Full Pyramid

```
* * * * *
* * * * *
* * * *
* * *
* *
*
```

Inverted Full Pyramid

```
      *
     * *
    *   *
   *     *
  *       *
 *         *
* * * * *
```

Hollow Full Pyramid



8. Write a python code to check twin prime numbers within a range.
9. Write a python code to find GCD and LCM using the Euclidean theorem.
10. Write a program in Python to take two distinct integers as input and print the maximum number.
11. Write a program in Python to take two integers (maybe same) as input and print the maximum one if the numbers are distinct otherwise print "numbers are same".
12. WAP in python to take one integer as input and print whether it is even or odd.
13. WAP in python to check whether a year is leap year or not.
14. WAP in python to take total marks as input and print the corresponding grade as follows.

If marks : 90-100:	Grade is Outstanding
marks : 80-89:	Grade is Excellent
marks : 70-79:	Grade is Fine
marks : 60-69:	Grade is Good
marks : 50-59:	Grade is Average
marks : 40-49:	Grade is Just pass
marks : 0-9:	FAIL
otherwise print INVALID INPUT	

Don't use logical operator

15. WAP in python to take one integer as input and check the divisibility by 4 and (or 7).

Eg: number = 28 : Output: Number is divisible by both 4 and 7.

number = 21: Output: Number is divisible by 7 but not divisible 4.

number = 16: Output: Number is divisible by 4 but not divisible 7.

number = 15: Output: Number is neither divisible by 7 but nor divisible 4.

Don't use logical operator

16. Statement is same as Q13. Use logical operator.

17. Statement is same as Q14. Use logical operator.
18. WAP in Python to display 1st N natural numbers.
19. WAP in Python to display 1st N even numbers.
20. WAP in Python to display 1st N odd numbers.
21. WAP in Python to display even numbers between given range.
22. WAP in Python to display odd numbers between given range.
23. WAP in Python to calculate and print sum of 1st n members.
24. WAP in Python to calculate and print sum of 1st n even members.
25. WAP in Python to calculate and print sum of 1st n odd members.
26. WAP in Python to count the number of digits of a given number.
- 27.. WAP in Python to reverse a number.
28. WAP in Python to check whether a number is palindrome or not.
29. WAP in Python to check whether a number is an Armstrong or not.
30. WAP in Python to check whether a number is strong or not.
31. WAP in Python to check whether a number is perfect or not.
32. WAP in Python to print prime numbers between a given range.
33. WAP in Python to print Armstrong numbers within a given range.
34. WAP in Python to print strong numbers between a given range.
35. WAP in Python to print perfect numbers between a given range.
36. WAP in Python to calculate the series

$$e^x = \frac{x}{1!} + \frac{x^2}{2!} + \frac{x^3}{3!} + \dots \dots \frac{x^n}{n!}$$

37. WAP in Python to calculate the series

$$\sin(x) = x - \frac{x^3}{3!} + \frac{x^5}{5!} - \frac{x^7}{7!} + \dots \dots$$

38. WAP in Python to calculate the series

- 39.

Module 10: [4L]

Basic concepts of tuple, list, dictionary, and string. Linear and Binary Search, Selection, and Bubble Sort.

Questions:

1. What are the differences between tuple, list, dictionary, and string.
2. Write at least 2 differences between tuple and list.
3. Write down 4 different data types with their examples.
4. What are the primary requirements for doing a binary search.
5. Write a python code for bubble sort
6. Write a python code for modified bubble sort
7. Write a python code for Selection sort
8. Write a python code for Linear Search
9. What are the constraints of Linear Search?
10. Write a python code for Modified Linear Search
11. Why modified linear search is required? or What is the constraint(s) of linear search and How it can be resolved?
12. Write a python code for Iterative Binary Search
13. Write a python code for Recursive Binary Search
14. What are the Best, Worst, and Average Case Complexities for Bubble & Selection Sort?
15. What are the Best, Worst, and Average Case Complexities for Linear and Binary Search?
16. Sort the following set of data using Bubble sort, 28, 67, 11, 39, 25
17. Sort the following set of data using Selection sort, 28, 67, 11, 39, 25

Module 11: [4L]

File handling using python, different modes, data extraction from URL, data cleaning, and preprocessing.

Questions:

NO QUESTIONS FROM THIS MODULE