

Subject: LANM

Time: 1 hr 30 min

Instruction:

- 1) Scientific calculator is allowed.
- 2) All questions are compulsory.

Date: 14 / 10 / 2022

Max. Marks: 30

1. a) Define inverse of a matrix. (2)

Show that matrices A and B are inverses of each other.

$$A = \begin{bmatrix} 1 & 0 & 2 \\ 2 & -1 & 3 \\ 4 & 1 & 8 \end{bmatrix}, B = \begin{bmatrix} -11 & 2 & 2 \\ -4 & 0 & 1 \\ 6 & -1 & -1 \end{bmatrix}$$

b) $A = \begin{bmatrix} 1 & 2 & 3 \\ 2 & 4 & 5 \\ 3 & 5 & 6 \end{bmatrix}$ (3)

Define and find the values of the following (i) A^T (ii) $\text{tr}A$ (iii) $A \odot A$

$$\left[\begin{array}{ccc|c} 1 & 0 & 3 \\ 1 & 1 & 2 \\ 1 & 1 & 2 \end{array} \right] \xrightarrow{\text{Row operations}}$$

2. Find the solution using Gauss-Jordan elimination

$$x + 2y + z = 3$$

$$2x + 5y - z = -4$$

$$3x - 2y - z = 5$$

3. a) Define a linear transformation (2)

Assume that T is a linear transformation. Find the standard matrix of T.

$T : \mathbb{R}^2 \rightarrow \mathbb{R}^2$ reflects a vector in the y-axis

$$\left[\begin{array}{cc|c} 1 & 0 & 3 \\ 0 & 1 & 2 \\ 1 & 1 & 2 \end{array} \right] \xrightarrow{\text{Row operations}} \left[\begin{array}{cc|c} 1 & 0 & 3 \\ 0 & 1 & 2 \\ 0 & 0 & 0 \end{array} \right]$$

b) Explain ill-conditioned matrices. (3)

Let $A = \begin{bmatrix} 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$, and $b = \begin{bmatrix} 3 \\ 2 \end{bmatrix}$, $p = \begin{bmatrix} 7 \\ -1 \\ 2 \end{bmatrix}$. (5)

Determine if b is in the column space of A.

Determine if p is in Nul A.

5. $A = \begin{bmatrix} 3 & -4 \\ 2 & -6 \end{bmatrix}$ (5)

(a) Find all eigenvalues and corresponding eigenvectors. (5)

(b) Diagonalize the matrix A. (5)

Department of Computer Science
Gujarat University
MSc AI&ML - I
Sessional - II

Subject: LANM

Time: 1 hr 30 min

Instruction:

- 1) All questions are compulsory.

Date: 7/12/2022

Max. Marks: 25

1. The SVD of a matrix was given as:

(7)

$$U = \begin{bmatrix} 0.65 & -0.75 & 0 \\ 0 & 0 & 1 \\ 0.75 & 0.65 & 0 \end{bmatrix}$$

$$\Sigma = \begin{bmatrix} 15.91 & 0 & 0 \\ 0 & 3.26 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$V^T = \begin{bmatrix} -0.52 & -0.62 & -0.57 \\ -0.27 & 0.76 & -0.57 \\ -0.8 & 0.14 & 0.57 \end{bmatrix}$$

- (a) Which columns form a basis for the null space of A?
- (b) Which columns form a basis for the column space of A?
- (c) Which columns form a basis for the row space of A?
- (d) What are the singular values?
- (e) What is the rank of A?
- (f) What is the condition number of A?
- (g) Is A ill-conditioned?

2. (a) Show that $f(x) = x^4 + x - 1$ has a real root in the interval [0.5, 1.0]

(6)

- (b) Starting with the interval [0.5, 1.0], use the bisection method to find the root
- (c) Taking 0.75 as the first approximation, apply the Newton Raphson method to get a root accurate upto 3 decimal places.

3. Consider a school of fish hunting for food in three adjoining lakes L1, L2, and L3. Each day, the fish select a different lake to hunt in than the previous day, with probabilities given in the transition matrix below.

(4)

Current Day:

L1	L2	L3	Next Day:
[0.5 0.25 0.25]	[L1]		
[0.25 0.5 0.25]	[L2]		
[0.25 0.25 0.5]	[L3]		

The stochastics matrix is given by P =

Can we determine what percentage of time the fish will spend in each lake in the long run?

4. Explain the travelling Salesman Problem. Prove that it is NP-Complete.
5. Explain any one application of PCA

(5)

(3)

**Department of Computer Science
Gujarat University
M.Sc.(AI&ML) theory examination
Semester I**

Subject: Python Programming

Total Marks: 30

Time: 1.5 hour

SECTION I

Q1.(a)

Answer the following:

- I. Explain the Python Execution model. List the popular tools to write and run Python scripts
- II. Give the rules of naming a valid Identifier with examples. What is the method for checking if a name is valid one
- III. Python presents dynamic typing. Comment.
- IV. Numeric data types in Python are immutable. Justify this statement through the `id()` method.
- V. The output of `print(1.1+2.2)` will be `3.30000000000003`. Give reasons and how you can resolve it.
- VI. How can you extract real and imaginary parts of complex number ?

Q1.(b)

Draw flowchart and write pseudo code for ANY FOUR given loop exercises:

- I. Write a Python program which iterates the integers from 1 to 50. For multiples of three print "Fizz" instead of the number and for the multiples of five print "Buzz". For numbers which are multiples of both three and five print "FizzBuzz".
- II. Write a Python program to find numbers between 100 and 400 (both included) where each digit of a number is an even number
- III. Write a Python program to sum of two given integers. However, if the sum is between 15 to 20 it will return 20.
- IV. Write a Python program to create the multiplication table (from 1 to 10) of a number
- V. Write a Python program to remove and print every third number from a list of numbers
- VI. Write a Python program to get the third side of right angled triangle from two given sides

Q2.(a)

Give output of :

```
str = "suchitpurushit"  
age=50
```

- a) `print(str[1:4])` c,h
- b) `print(str[:4])` s,u,c
- c) `print(str[4:-1])` k,t
- d) `print(str[:])`
- e) `print("Hello, {}. You are {}".format(str, age))`
- f) `print(str.upper())` S

Input & Output

Ques. 1

i = 1
while (i < 30)
if (i % 3 == 0)
print("Fizz")
if (i % 5 == 0)
print("Buzz")
else:
print(i)

Ques. 2

q = 2
for (q < 30)
if (q % 2 == 0)
print(q)
q = q + 3

[12]

[12]

[12]

GUJARAT UNIVERSITY

M.Sc. (Artificial Intelligence & Machine Learning) - Defense Specific

Semester - I

Sessional - II

Subject Name: Mathematical Foundation

Time : 1.5 Hours

Date: 02-12-22

Total Marks : 40

Q-1

- a) Find the domain and range of the function: $h(x) = \frac{x}{\sqrt{x^2 - 9}}$ [5]
 b) Check whether the expression: $x^2 + y^2 = 4$ is a function or not.

Q-2

- Given $f(x) = 3x^2 - x + 10$ and $g(x) = 1 - 2x$. Find $(f \circ g)(5)$. [5]

Q-3

- Given the function $h(w) = \begin{cases} 2w^2 & w \leq 6 \\ w - 8 & w > 6 \end{cases}$ [5]

Evaluate the following limits if they exist. a) $\lim_{w \rightarrow 6} h(w)$ b) $\lim_{w \rightarrow 2} h(w)$

Determine whether the given function is continuous at $x = 0$.

Q-4

- $g(x) = \begin{cases} \sin(x) & x < 0 \\ x^2 & x \geq 0 \end{cases}$ [5]

Q-5

- Write the gradient vector and the hessian matrix of the following multi-variable function: $f(x,y,z) = z^3 y^2 \ln(x)$. [5]

Q-6

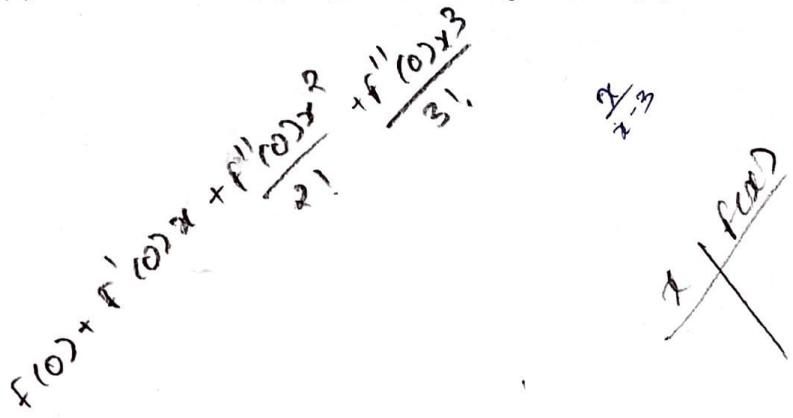
- We need to enclose a rectangular field with a fence. We have 500 feet of fencing material available, and there's a building on one side of the field. Determine the dimensions of the field that will enclose the largest area.

Q-7

- Express the function $f(x) = \cos(x)$ as a sum of infinite series about $x = 0$. [5]

Q-8

- Determine where the function $f(x) = 4x^3 - 18x^2 - 336x + 27$ is increasing and decreasing.



Department of Computer Science

Gujarat University

M.Sc. I theory examination

Semester I

Sessional -II

Subject: Problem solving with Python

Total Marks: 30

Time: 1.5 hours

- Q1.** Give difference between error and exception. What are the different types of exceptions? [10]
- Q2.** What do you understand by scope of a variable? Give difference between local and global variable. What is the use of key word global while used in a function [5]
- Q3.** Define recursion. Give an example of each [3]
- Q4.** Define file. what are the different types of files? What are the different modes in which a file can be opened in python [3]
- Q5.** What is difference between list and tuple? Why are tuples immutable? [4]
- Q6.** Define anonymous function. How and where it is used? [5]

17th October, 2022

Q1. Answer in Short.

- (1) What is the difference between structure and union?
- (2) What is friend function?
- (3) Write syntax to define destructor in class?
- (4) What is the use of new operator?
- (5) Define the significance of private members of the class?
- (6) What do you mean by default arguments in function?

Q2. Attempt the following Questions. (Any Two)

- (1) Explain Different data type in c++.
- (2) Why we required to overload the function? Explain with example.
- (3) What is MIL? What is the sequence of initialization of data members in class while using MIL. Explain with an example.

Q3. Attempt the following Questions. (Any Two)

- (1) What is operator overloading? How to overload binary operator?
- (2) Explain static data members in detail.
- (3) What is constructor? Mention the rules to define the constructor. When and how constructor is called?

Q4. Attempt the following Questions.

- (1) What is array? Explain 1-D array in detail.
- (2) What will be the output of following code?

```
#include<iostream>
using namespace std;
int main()
{
    int a=63;
    cout<<a++;
    cout<<++a;
    cout<<a--;
    cout<<a--;
    cout<<(a++=a-);
    return 0;
}
```

- (3) What is difference between call by value and call by reference? (2 Marks)

Date: 13th October 2022

Time: 10:30-12:00 pm

Q1. Answer the following questions

- a) Write any two definitions of AI.
- b) What is the relation between Data, Information, and Knowledge?
- c) Write characteristics of AI problems.
- d) What is Heuristic and Heuristic function?
- e) What is State Space Search?

Q2. Answer the following questions

- a) Explain different task domains of AI.
- b) Write a production rule for 3-Water Jug (8L, 5L, 3L) problem.
- c) Explain State Space Representation using Tic-Tac-Toe.

Q3. Answer the following questions (Attempt any Three)

- a) What is AI Technique? Write your own AI technique to solve a 3x3 Tic-Tac-Toe strategy-2.
- b) Analyze seven problem characteristics for the 8-puzzle problem.
- c) Explain the production system in detail with a proper example.
- d) Explain and compare DFS and BFS with proper examples.

Q-1

- a) Find the domain and range of the function: $h(x) = \frac{x}{\sqrt{x^2 - 9}}$ [5]
 b) Check whether the expression: $x^2 + y^2 = 4$ is a function or not.

Q-2 Given $f(x) = 3x^2 - x + 10$ and $g(x) = 1 - 2x$. Find $(f \circ g)(5)$. [5]

Q-3 Given the function $h(w) = \begin{cases} 2w^2 & w \leq 6 \\ w - 8 & w > 6 \end{cases}$ [5]
 Evaluate the following limits if they exist. a) $\lim_{w \rightarrow 6} h(w)$ b) $\lim_{w \rightarrow 2} h(w)$

Q-4 Determine whether the given function is continuous at $x = 0$.

$$g(x) = \begin{cases} \sin(x) & x < 0 \\ x^2 & x \geq 0 \end{cases} \quad [5]$$

Q-5 Write the gradient vector and the hessian matrix of the following multi-variable function: $f(x,y,z) = z^3 y^2 \ln(x)$. [5]

Q-6 We need to enclose a rectangular field with a fence. We have 500 feet of fencing material available, and there's a building on one side of the field. Determine the dimensions of the field that will enclose the largest area. [5]

Q-7 Express the function $f(x) = \cos(x)$ as a sum of infinite series about $x = 0$. [5]

Q-8 Determine where the function $f(x) = 4x^3 - 18x^2 - 336x + 27$ is increasing and decreasing. [5]

9th December, 2022

Time: 1 hr 30 min
Max. Marks: 30

Q1. Answer the followings. 12

- (1) What is pure virtual function? Write syntax.
- (2) What is the use of this pointer?
- (3) What is the use of following I/O Modes?
 1. ios::in
 2. ios::app
- (4) Does namespace introduce any overhead? Give reason of your answer.
- (5) What are the advantages of inheritance?
- (6) How many ways to open a file in C++? Write syntax for all ways.

Q2. Attempt the following Questions. (Any Three) 18

- (1) What is inheritance? Explain different types of inheritance. Also explain derivation using different access modifier.
- (2) What is multiple Inheritance and discuss the problem with the multiple inheritance and how to solve that?
- (3) Write down the difference between ios functions and manipulators.
- (4) Explain the components of Standard Template Library.
- (5) What is Template? Explain function template and class template in detail.

Date: 6th December 2022

Time: 10:30-12:00 pm

Max. Marks:

Q1. Answer the following questions

[10]

- a) List basic steps to develop an expert system.
- b) What are Monotonic and Non-monotonic reasoning?
- c) Represent the following sentence into Conceptual Dependency.

Sentence: John gave Mary the book yesterday.

- d) Represent the following sentence into Partitioned Semantic Net.

Sentence: Everyone loves to eat the noodles. *insecr*

- e) Represent the following sentence into the Intersection Search method.

Sentence: The greedy dog jumped at the bone.

Q2. Answer the following questions

[0]

- a) Brief the architecture of an Expert System.
- b) Discuss in detail prominent problems present in the hill climbing techniques.
- c) Explain environment types for an automated bank teller.

Q3. Answer the following questions (Attempt any Three)

- a) What is an AI Agent? Explain its different components.
- b) Explain the Steepest-Ascent hill climbing technique with a proper example.
- c) Explain various issues in knowledge representation with appropriate example
- d) Represent the following set of sentences into First-Order Predicate Logic.

1. Lucy is a professor.

2. All professors are people.

3. Alex is the dean.

4. Deans are professors.

5. All professors consider the dean a friend or don't know him.

6. Everyone is a friend of someone.

7. People only criticize people that are not their friends.