M. Sc. (AI & ML)

Department of Computer Science

Rollwala Computer Center

Gujarat University

Mathematical Foundations

Date: 30/11/2019 Maximum Marks: 40 Time: 10.30 a.m. to 12.00 noon

Instructions: (1) Figure to the right indicates full marks of the respective question.
(2) Intermediate calculation steps and results are to be shown.

Q.1. Answer the following (Any Two) **18**

(a) Define linearly independent vectors and linearly dependent sets. Are the vectors $u_1 = (1,1,1,3), u_2 = (1,2,3,4), u_3 = (2,3,4,0)$ linearly dependent? If so find the relation between them. Also, extend it as a basis of the vector space $\mathbb{R}^4$.

(b) Let

$$A = \begin{bmatrix} 2 & 4 & -2 & 1 \\ -2 & -5 & 7 & 3 \\ 3 & 7 & -8 & 6 \end{bmatrix}$$

1. If the column space of A ($Col\, A$) is subspace of $\mathbb{R}^k$, what is k?
2. If the null space of A ($Nul\, A$) is subspace of $\mathbb{R}^k$, what is k?
3. Find nonzero vector in $Nul\, A$.
4. Is $(3,-1,3) \in Col\, A$?

(c) Define orthonormal set of a vector space V. Explain Gram-Schmidt process to construct orthonormal set.

Q.2. Answer the following (Any Two) **12**

(a) Give geometric description of the linear transformation corresponding to the following matrices.

1. $\begin{bmatrix} 1 & 0 \\ 0 & 2 \end{bmatrix}$ 2. $\begin{bmatrix} 0 & 1 \\ -1 & 0 \end{bmatrix}$

(b) Define $[S]$ (span) for a non-empty subset S of a vector space V. Examine whether the vector $(7,2,-9) \in [S]$ for $S = \{(1,2,1),(1,1,-1),(0,3,5)\}$.

(c) Obtain orthonormal basis from the given basis $(1,0,1),(1,2,-1),(1,1,1)$ in $\mathbb{R}^3$.

Q.3. Answer the following (Any Two) **10**

(a) Suppose u, v are nonzero vectors in $\mathbb{R}^2$. Prove that $\langle u,v\rangle = \|u\|\,\|v\|\cos\theta$. Using this relation, find the measure of the angle between the vectors $u = (2,5,6)$ and $v = (-2,-4,4)$.

(b) Define subspace of a vector space. Show that $U = \{(a_1,a_2,a_3) \in \mathbb{R}^3 | 3a_1 - 5a_2 + a_3 = 0\}$ is a subspace of $\mathbb{R}^3$.

(c) Find vectors $u, v \in \mathbb{R}^2$ such that u is scalar multiple of $(1,3)$, v is orthogonal to $(1,3)$, and $(1,2) = u + v$.

********** Good Luck **********

Department of Computer Science
Rollwala Computer Centre
Gujarat University
M.Sc. (AI & ML) – I
Sessional – II

Subject: Computer Oriented Numerical Methods Linear Algebra **Date: 28 / 11 / 2019**
Time: 1 hr & 30 min. **Max. Marks: 30**

Attempt Any FOUR questions:

Q-1 Illustrate Gauss Seidel method by performing first three iterations for the system of equations given by **[6]**

$$20x + 2y + 6z = 28$$
$$x + 20y + 9z = -23$$
$$2x - 7y - 20z = -57$$

Q-2 **Attempt Any FOUR:** **[8]**

(a) Is $\lambda = -2$ an eigen value of $\begin{bmatrix} 7 & 3 \\ 3 & -1 \end{bmatrix}$? Why or why not ?

(b) Define characteristic equation of a matrix.

(c) Find eigen values of the matrix $\begin{bmatrix} 2 & 7 \\ 7 & 2 \end{bmatrix}$

(d) Prove that A and A^T have the same eigen values.

(e) Show that similar matrices have the same eigen values.

Q-3 Orthogonally diagonalize the matrix $A = \begin{bmatrix} 7 & 2 \\ 2 & 4 \end{bmatrix}$ **[8]**

Q-4 Explain singular value decomposition and construct singular value decomposition of $A = \begin{bmatrix} 1 & 0 \\ 0 & -3 \end{bmatrix}$ **[8]**

Q-5 Explain PCA and list some of its applications. **[6]**

GUJARAT UNIVERSITY
DEPARTMENT OF COMPUTER SCIENCE
M. Sc. (AI & ML) - I
PROBLEM SOLVING WITH PYTHON
SESSIONAL-II

Date : 29 /11/2019
Time : 10.30 a.m. - 12.30 noon
Maximum Marks : 30

Note : (1) Make necessary assumptions wherever necessary.
(2) Write precise and to the point answers.

Q.1 Answer the following (Any Two) [12]

(a) What is Exception? How can exception be handled in python? Explain giving suitable examples.

(b) How is inheritance beneficial in creating application? How we can achieve multiple inheritances in python? Explain giving suitable examples.

(c) What do you understand by polymorphism? Explain different ways in which polymorphism is achieved in python.

Q.2 Do as directed.

(a) What is the output of the following piece of code? Justify your answer. [6]

```
class A():
  def disp(self):
    print("A disp()")
class B(A):
  pass
obj = B()
obj.disp()
```

(b) What is the output of the following piece of code? Justify your answer.

```
class Demo:
  def __init__(self):
    self.x = 1
  def change(self):
    self.x = 10
class Demo_derived(Demo):
  def change(self):
    self.x=self.x+1
    return self.x
def main():
  obj = Demo_derived()
  print(obj.change())

main()
```

Q.3 Answer the following

(a) What is the difference text file and binary file? Explain. [2]

(b) Write python code for the following (Any three) [6]

(i) Knowing current working directory
(ii) To create sub directory
(iii) To compress the contents of a file
(iv) To remove directory

Q.4 Explain the following (Any Two) [4]

(i) Abstract class
(ii) Super method()
(iii) Assertion

DEPARTMENT OF COMPUTER SCIENCE
ROLLWALA COMPUTER CENTER GUJARAT UNIVERSITY
MSC (AI & ML) SEM I
Subject: Object Oriented Concept and Programming using c++
Sessional Examination – II

Time : 1hr 30min **Time: 10:30 to 12:00**
Max. Marks: 30

Q1. Attempt the following Questions. (Any Three) **[15]**

(a) Explain Polymorphism in detail.

(b) Explain difference between Manipulators and IOS member functions?

(c) Explain the use of following functions with the help of suitable examples.
- (I) seekg()
- (II) write()
- (III) fail()

(d) How C++ compiler implements Run Time Polymorphism.

Q2. Attempt the following Questions.(Any Three) **[09]**

(a) What is naming conflict? How can it be resolved using namespace? What is nested namespace? What is the syntax for nested namespace?

(b) What are the issues one must consider while dealing with multiple inheritance? How to avoid it.

(c) Write a short note on STL.

(d) Explain difference between Concrete class and Abstract class.

Q3. Define following terms (Any Three). **[06]**
- i) pure virtual function
- ii) Composite object
- iii) this pointer
- iv) Namespace aliases