1712E1559

Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem.-1) Examination

Mathematical Foundation

December 2018

[Max. Marks : 100

3 Hours]

te : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.l
(3) Make necessary assumptions wherever necessary.

SECTION-I

Attempt any three: [18]

(a) When is a system of linear equations said to be consistent? [6]
Determine if the following system is consistent.

(i) $x - 2y + z = 0$
$2y - 8z = 8$
$-4y + 5y + 9z = -9$

(b) What is an echelon form of a matrix? Row reduce the matrix [6]
$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 5 & 6 & 7 \\ 6 & 7 & 8 & 9 \end{bmatrix}$ to echelon form.

(c) What are elementary row transformations? Explain each of them. [6]
How are they useful?

(d) Apply Gauss Elimination method to solve the system of equations: [6]

$x + y + 2z = 8$
$-x - 2y + 3z = 1$
$3x - 7y + 4z = 10$

(a) Define eigen values and eigen vectors of a matrix A. Show that 7 is an eigenvalue of the $A = \begin{bmatrix} 1 & 6 \\ 5 & 2 \end{bmatrix}$ and find the corresponding eigenvector. [8]

(b) Diagonalize the following matrix, if possible [8]

$A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$

That is, find an invertible matrix P and a diagonal matrix D such that $A = PDP^{-1}$.

OR

P. T. O.

Q.2 What is Singular Value decomposition of a matrix? Find the singular value decomposition of $\begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$. [16]

Q.3 **Attempt the following (Any Two):**

(a) In a population of workers, suppose that 40% are grade-school graduates, 50% are high-school graduates and 10% are college graduates. Among the grade-school graduates, 10% are unemployed, among the high-school graduates , 5% are unemployed, and among the college graduates, 2% are unemployed. [8]

If a worker is chosen at random and found to be unemployed, what is the probability that he or she is a college graduate?

(b) Explain (i) Mutually Exclusive events
(ii) Independent Events [8]

Suppose that the probability of a boy to be born is 60% and of a girl to be born is 40%. For a couple having three children , what are the probabilities of

(a) All 3 boys or all 3 girls?
(b) 2 girls and 1 boy ?

(c) Four defective light bulbs inadvertently got mixed with 6 good ones. [8]

(i) If 2 bulbs are chosen at random for a ceiling lamp (picked one after another), what is the probability that both are good?

(ii) If the first 2 are good, what is the chance that next 3 are good?

(iii) If we started all over again and chose 5 bulbs, what is the chance they all would be good?

SECTION-II

Q.4 **Attempt any three from the following:** [18]

(a) Show that the set W = { [x, y, z] | y = x + z } is a subspace of R^3 under usual addition and scalar multiplication.

(b) Define linear combination of vectors { $v_1, v_2, \dots, v_n$ }. Is $U = \begin{bmatrix} -6 & 0 \\ 3 & 8 \end{bmatrix}$ a linear combination of $A = \begin{bmatrix} 4 & 0 \\ -2 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} -12 & 2 \\ 1 & 4 \end{bmatrix}$?

(c) Show that the set S = { [1,2,3], [3,2,1], [3, 3, 3] } is linearly dependent set.

(d) Define basis of a Vector Space. Is the set S = {[1,1], [-1,1]} a basis of R^2 space?

(e) Define span of a Vector Space. Which of the following sets of vectors span R^3 ?

(i) S_1 = { [1, 0, 0] , [0, 1, 0], [0, 0, 1] }

(ii) S_2 = { [1, 1, 1] , [0, 1, 1], [0, 0, 1], [1, 2, 3] }

Attempt any two from the following: [16]

(a) Find the row space and column space of the matrix

$$A = \begin{bmatrix} 0 & 2 & 3 \\ -5 & 6 & 1 \\ 3 & 2 & -4 \end{bmatrix}$$

(b) Find the null space of matrix $A = \begin{bmatrix} -1 & 1 & 1 \\ 3 & -1 & 0 \\ 2 & -4 & -5 \end{bmatrix}$

(c) Find the rank and nullity of the matrix $A = \begin{bmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{bmatrix}$

OR

(c) Check the linearity of the following operator T: $R^2 \rightarrow R^2$ that maps each vector into its orthogonal projection on the y-axis, that is $T(x, y) = (0, y)$ is the operator.

Attempt any two from the following : [16]

(a) Find the associated matrix of the linear transformation T: $R^3 \rightarrow R^3$, $T(x_1, x_2, x_3) = (x_1 + x_2, x_2 + x_3, x_1 + x_3)$ with basis B = { [1, 0, 0], [1, 1, 0], [1, 1, 1] } and B' = { [1, 0, 1], [0, 1, 0], [1, 0, -1] } for the domain and codomain of T respectively.

(b) Verify the Cauchy-Schwarz inequality for the vectors $-4 + 2x + x^2$ and $8 - 4x - 2x^2$ in P_2 with respect to inner product $< p, q > = \int_{-1}^{1} p(x)q(x)dx$

OR

(b) Find the formulas of norm and distance in M_{22} with respect to an inner product $< A, B > = a_1 b_1 + a_2 b_2 + a_3 b_3 + a_4 b_4$ where $A = \begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix}$.

(c) Find the orthonormal basis from a basis { [1, 1,1], [1,2,1], [-1,1,0] for a Euclidean inner product space R^3.

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1812E1569 Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem.-1) Examination
Introduction to Programming with Python
December 2018

: 3 Hours] [Max. Marks : 100

1) Make necessary assumptions wherever necessary.

(2) Write precise and to the point answers.

SECTION – 1

Do as directed (Any Seven) [14]

a) What gets printed by the following expressions?
(i) `print(type(1/2))` (ii) `print(2*(123, 'hello'))`

b) What is the difference between == and `is` operator in Python?

c) List mutable and immutable built-in datatypes of Python.

d) What is purpose of `id()` function in Python.

e) What is the difference between `pass` and `continue` in Python?

(f) Write the syntax for dictionary comprehension.

(g) What are the different methods to copy an object in Python?

h) What is the difference between an `iterator` and `iterable`?

Answer the following (Any Two) [16]

(a) Consider a string `my_str = "GU is the best University"`. Give the output of the following commands.
(i) `my_str.rfind('t')` (ii) `my_str.replace('e', '*', 2)`
(iii) `my_str.capitalize()`
Also, write a command to extract the word '`University`' from `my_str`.

(b) Explain with example built-in function that used to iterate over number sequence.

(c) What is list in Python? Explain the List Accessing Methods and List Comprehension.

3 Answer the following (Any Two) [20]

(a) What is Python? What are the benefits of using Python?

P.T.O.

(b) What is the difference between `list.sort()` and `sorted(list)`? When they can be applied? Illustrate by an example at least two usage of `sorted(list)`.

(c) Differentiate between following:

1. `lambda` Vs. `def`
2. `d[key]` Vs. `d.get(key)`, where `d` is dictionary object.

SECTION – II

Q:4 Do as directed (Any Six)

(a) What is function call or callable object in Python?

(b) What is Pickling and how does it differ from Unpickling?

(c) What is class instantiation?

(d) What are the benefits of using exception handling?

(e) Differentiate between class variables and instance variables.

(f) Discuss the usage of following special methods in Python class.
(i) `__getitem__` (ii) `__iter__` (iii) `__ipow__`

(g) How to assign values for the class attributes at runtime?

Q:5 Answer the following (Any Two)

(a) What are the various file positions methods? Explain with example.

(b) What is Method Resolution Order (MRO)? Explain the principles followed by MRO with example.

(c) Discuss with an example exception with arguments in Python.

Q:6 Answer the following (Any Two)

(a) What is property decorator? Why it is used in Python class? Discuss with an example.

(b) Write a function called `oops` that explicitly raises an `IndexError` exception when called. Then write another function that calls `oops` inside a try/except statement to catch the error. What happens if you change `oops` to raise `KeyError` instead of `IndexError`? Where do the names `KeyError` and `IndexError` come from?

(c) How to implement method overriding in Python? Demonstrate with an example.

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M.Sc. (AI & ML) (Sem.-1) Examination
Introduction to Artificial Intelligence
December 2018

[Max. Marks : 100

e : 3 Hours]

nstructions:
1. Figures to the right indicate full marks
2. Each section should be written in a separate answer book
3. Be precise and to the point in your answer

SECTION-I

Answer the following: (Any Ten) [20]

i. Define Artificial Intelligence. List any two application areas of AI.
ii. What are the advantages of Predicate Logic over Prepositional Logic?
iii. Write any four properties of games, which makes them ideal subject for AI research.
iv. What is Heuristic Search? In which situations Heuristics are required?
v. Give one example each for Universal and Existential quantifiers.
vi. Define: State Space Search. Draw an example State Space for tic-tac-toe.
vii. What makes Best First Search algorithm better than DFS and BFS?
viii. Draw Search Graph and Search Tree for 3-water jug problem to indicate the difference clearly.
ix. What do you mean by Local Maxima with respect to search technique?
x. Write the four properties of knowledge representation.
xi. Distinguish between: Declarative and Procedural Knowledge.

Answer the following: (Any Four) [20]

A. Analyze the Seven problem characteristics for 8-Queen Problem.
B. Explain Simple Hill Climbing algorithm with the help of an example.
C. Discuss any 4 issues in Knowledge Representation faced by a good system.
D. Represent the following knowledge using Conceptual Dependency:
   i. John ate ice cream with a spoon.
   ii. The tall man stole the red book from the girl.
E. Represent the relationship of n-place predicate using Semantic Net for the following:
   i. John ate ice cream with a spoon.
   ii. The tall man stole the red book from the girl.

Consider the following sentences: [10]

1. Jack owns a dog.
2. Every dog owner is an animal lover.
3. No animal lover kills an animal.
4. Either Jack or Bill killed the cat, who is named Kitty.
5. Cat is an animal.

a) Translate these sentences into formulas in predicate logic.
b) Find "Did Bill kill the cat?" using Backward Chaining.

SECTION-II

Do as directed: (Any Two) [20]

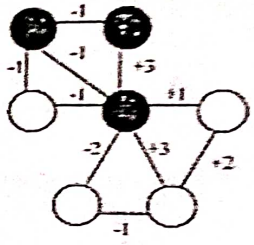
A. For a fully connected Multilayer Perceptron, do the following:
a) Show the architecture of a 3-layered MLP with the help of a labeled diagram and write its equation to obtain the output at last layer. [05]
b) Prove that XOR problem is non-linearly separable giving appropriate [05]

P. T. O.

E1577-2

justification.

B. For a Hopfield Network, do the following:
   a) List essential features of the network.
   b) Carry out parallel relaxation on the following network to obtain 2 stable states.



C. A box contains 2 red marble, 3 white marble, 4 green marbles and 1 blue marble. Two marbles are drawn at random without replacement. Find the probability of:
   a) Selecting a green marble in a second draw if the first marble is blue.
   b) Selecting a white marble in a first draw and red marble in a second draw.
   c) Selecting white marble in a first draw and white or blue in a second draw.
   d) Selecting red or white in a first draw and green or blue in second draw.
   e) Selecting red marbles in both draws.

5. **Answer the following with the help of appropriate examples: (Any Two)** [20]

A. Distinguish between: Supervised, Unsupervised and Reinforcement Learning. Write the equations for Perceptron Learning Rule.

B. Explain Natural Language as an application area of AI. Discuss in detail the steps of Natural Language Processing.

C. What are Probabilistic Graphical Models? Explain various categories of such models pointing out the differences and applications.

6. **Explain the following: (Any Two)** [10]

A. Monotonic Vs. Non-Monotonic Reasoning

B. Types of Inexact Reasoning

C. Monty-Hall Problem as an application of Bayesian Networks

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Candidate's Seat No :

M.Sc. (AI & ML) (Sem.-1) Examination

Object Oriented Concepts & Programming Using C++

December 2018

ne : 3 Hours] [Max. Marks : 100

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following [16]

(a) Explain the difference between Concrete class and Abstract class

(b) Describe the following terms with Example
i) this pointer ii) Dynamic binding

(c) Explain Scope resolution operator.

(d) Explain different data types in C++.

Q.2 Answer the following (Any four) [16]

(a) What are the basic characteristics of object oriented programming?

(b) What is constructor? Explain types of constructor.

(c) What is Member Initialization List (MIL)? Explain giving suitable example.

(d) What is the use of private member function?

(e) Explain the inline function with suitable example.

Q3 Answer the following(Any three) [18]

(a) Difference between : i) Aggregation and Generalization
ii) Manipulators and ios member function

(b) What are abstract classes? Give few examples of abstract classes.

(c) Explain static variable and static function with example.

(d) What are the advantages of using new and delete operators over malloc() and free() functions?

SECTION-II

Q4 Explain the following (Any Three) [18]

(a) What is Friend Function? What are the merits and demerits of using friend function?

(b) What is an operator function? Write a program to overload binary + operator as a member function for a class of your choice.

(c) What is stream? Describe various stream classes for console I/O operations.

(d) What is the purpose of using template in C++? Explain template function and template class.

P.T.O.

Q.5 Answer the following

(a) What do you mean by implicit and explicit conversion? Explain with suitable example. [16

(b) Explain copy constructor giving suitable C++ programming example.

OR

Q.5

(a) What is Virtual Function? What is its need? Explain with example. [16

(b) What is an Exception? Explain Exception Handling Mechanism. Give example with multiple catch blocks.

Q.6 Write short note on the following

(a) Polymorphism [16

(b) Pure Virtual Function

(c) tellg and seekp

(d) Inheritance types

1712E1559

Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem.-1) Examination

Mathematical Foundation

December 2018

: 3 Hours] **[Max. Marks : 100**

lote : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.I
(3) Make necessary assumptions wherever necessary.

SECTION-I

1 **Attempt any three:** [18]

(a) When is a system of linear equations said to be consistent? [6]
Determine if the following system is consistent.

(i) $x - 2y + z = 0$
$2y - 8z = 8$
$-4y + 5y + 9z = -9$

(b) What is an echelon form of a matrix? Row reduce the matrix [6]
$\begin{bmatrix} 1 & 2 & 3 & 4 \\ 4 & 5 & 6 & 7 \\ 6 & 7 & 8 & 9 \end{bmatrix}$ to echelon form.

(c) What are elementary row transformations? Explain each of them. How are they useful? [6]

(d) Apply Gauss Elimination method to solve the system of equations: [6]

$x + y + 2z = 8$
$-x - 2y + 3z = 1$
$3x - 7y + 4z = 10$

(a) Define eigen values and eigen vectors of a matrix A. Show that 7 is an eigenvalue of the $A = \begin{bmatrix} 1 & 6 \\ 5 & 2 \end{bmatrix}$ and find the corresponding eigenvector. [8]

(b) Diagonalize the following matrix, if possible [8]

$$A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$$

That is, find an invertible matrix P and a diagonal matrix D such that $A = PDP^{-1}$.

OR

P. T. O.

E1559-2

Q.2 What is Singular Value decomposition of a matrix? Find the singular value decomposition of $\begin{bmatrix} 2 & 3 \\ 0 & 2 \end{bmatrix}$. [16]

Q.3 **Attempt the following (Any Two):**

(a) In a population of workers, suppose that 40% are grade-school graduates, 50% are high-school graduates and 10% are college graduates. Among the grade-school graduates, 10% are unemployed, among the high-school graduates , 5% are unemployed, and among the college graduates, 2% are unemployed. [8]

If a worker is chosen at random and found to be unemployed, what is the probability that he or she is a college graduate?

(b) Explain (i) Mutually Exclusive events [8]

(ii) Independent Events

Suppose that the probability of a boy to be born is 60% and of a girl to be born is 40%. For a couple having three children , what are the probabilities of

(a) All 3 boys or all 3 girls?

(b) 2 girls and 1 boy ?

(c) Four defective light bulbs inadvertently got mixed with 6 good ones. [8]

(i) If 2 bulbs are chosen at random for a ceiling lamp (picked one after another), what is the probability that both are good?

(ii) If the first 2 are good, what is the chance that next 3 are good?

(iii) If we started all over again and chose 5 bulbs, what is the chance they all would be good?

SECTION-II

Q.4 **Attempt any three from the following:** [18]

(a) Show that the set W = { [x, y, z] | y = x + z } is a subspace of R^3 under usual addition and scalar multiplication.

(b) Define linear combination of vectors { $v_1, v_2, \dots, v_n$ }. Is $U = \begin{bmatrix} -6 & 0 \\ 3 & 8 \end{bmatrix}$ a linear combination of $A = \begin{bmatrix} 4 & 0 \\ -2 & -2 \end{bmatrix}$, $B = \begin{bmatrix} 1 & -1 \\ 2 & 3 \end{bmatrix}$ and $C = \begin{bmatrix} -12 & 2 \\ 1 & 4 \end{bmatrix}$?

(c) Show that the set S = { [1,2,3], [3,2,1], [3, 3, 3] } is linearly dependent set.

(d) Define basis of a Vector Space. Is the set S = {[1,1], [-1,1]} a basis of R^2 space?

(e) Define span of a Vector Space. Which of the following sets of vectors span R^3 ?

(i) S_1 = { [1, 0, 0] , [0, 1, 0], [0, 0, 1] }

(ii) S_2 = { [1, 1, 1] , [0, 1, 1], [0, 0, 1], [1, 2, 3] }

Q.5 **Attempt any two from the following:** [16]

(a) Find the row space and column space of the matrix

$$A = \begin{bmatrix} 0 & 2 & 3 \\ -5 & 6 & 1 \\ 3 & 2 & -4 \end{bmatrix}$$

(b) Find the null space of matrix $A = \begin{bmatrix} -1 & 1 & 1 \\ 3 & -1 & 0 \\ 2 & -4 & -5 \end{bmatrix}$

(c) Find the rank and nullity of the matrix $A = \begin{bmatrix} 1 & -1 & 3 \\ 5 & -4 & -4 \\ 7 & -6 & 2 \end{bmatrix}$

OR

Q.5 (c) Check the linearity of the following operator T: $R^2 \rightarrow R^2$ that maps each vector into its orthogonal projection on the y-axis, that is $T(x, y) = (0, y)$ is the operator.

Q.6 **Attempt any two from the following :** [16]

(a) Find the associated matrix of the linear transformation T: $R^3 \rightarrow R^3$, $T(x_1, x_2, x_3) = (x_1 + x_2, x_2 + x_3, x_1 + x_3)$ with basis B = { [1, 0, 0], [1, 1, 0], [1, 1, 1] } and B' = { [1, 0, 1], [0, 1, 0], [1, 0, -1] } for the domain and codomain of T respectively.

(b) Verify the Cauchy-Schwarz inequality for the vectors $-4 + 2x + x^2$ and $8 - 4x - 2x^2$ in P_2 with respect to inner product $< p, q > = \int_{-1}^{1} p(x)q(x)dx$

OR

(b) Find the formulas of norm and distance in M_{22} with respect to an inner product $< A, B > = a_1 b_1 + a_2 b_2 + a_3 b_3 + a_4 b_4$ where $A = \begin{bmatrix} a_1 & a_2 \\ a_3 & a_4 \end{bmatrix}$ and $B = \begin{bmatrix} b_1 & b_2 \\ b_3 & b_4 \end{bmatrix}$.

(c) Find the orthonormal basis from a basis { [1, 1,1], [1,2,1], [-1,1,0] for a Euclidean inner product space R^3.

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1812E1569

Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem.-1) Examination
Introduction to Programming with Python
December 2018

[Max. Marks : 100

me : 3 Hours]

e: (1) Make necessary assumptions wherever necessary.

(2) Write precise and to the point answers.

SECTION – I

Do as directed (Any Seven) **[14]**

(a) What gets printed by the following expressions?
`(i) print(type(1/2)) (ii) print(2*(123, 'hello'))`

(b) What is the difference between == and `is` operator in Python?

(c) List mutable and immutable built-in datatypes of Python.

(d) What is purpose of `id()` function in Python.

(e) What is the difference between `pass` and `continue` in Python?

(f) Write the syntax for dictionary comprehension.

(g) What are the different methods to copy an object in Python?

(h) What is the difference between an `iterator` and `iterable`?

Answer the following (Any Two) **[16]**

(a) Consider a string `my_str = "GU is the best University"`. Give the output of the following commands.
`(i) my_str.rfind('t') (ii) my_str.replace('e', '*', 2)`
`(iii) my_str.capitalize()`
Also, write a command to extract the word '`University`' from `my_str`.

(b) Explain with example built-in function that used to iterate over number sequence.

(c) What is list in Python? Explain the List Accessing Methods and List Comprehension.

Answer the following (Any Two) **[20]**

(a) What is Python? What are the benefits of using Python?

P. T. O.

(b) What is the difference between `list.sort()` and `sorted(list)`? When they can be applied? Illustrate by an example at least two usage of `sorted(list)`.

(c) Differentiate between following:

1. `lambda` Vs. `def`
2. `d[key]` Vs. `d.get(key)`, where `d` is dictionary object.

SECTION – II

Q:4 Do as directed (Any Six)

(a) What is function call or callable object in Python?

(b) What is Pickling and how does it differ from Unpickling?

(c) What is class instantiation?

(d) What are the benefits of using exception handling?

(e) Differentiate between class variables and instance variables.

(f) Discuss the usage of following special methods in Python class.
(i) `__getitem__` (ii) `__iter__` (iii) `__ipow__`

(g) How to assign values for the class attributes at runtime?

Q:5 Answer the following (Any Two)

(a) What are the various file positions methods? Explain with example.

(b) What is Method Resolution Order (MRO)? Explain the principles followed by MRO with example.

(c) Discuss with an example exception with arguments in Python.

Q:6 Answer the following (Any Two)

(a) What is property decorator? Why it is used in Python class? Discuss with an example.

(b) Write a function called `oops` that explicitly raises an `IndexError` exception when called. Then write another function that calls `oops` inside a try/except statement to catch the error. What happens if you change `oops` to raise `KeyError` instead of `IndexError`? Where do the names `KeyError` and `IndexError` come from?

(c) How to implement method overriding in Python? Demonstrate with an example.

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1912E1577 Candidate

M.Sc. (AI & ML) (Sem.-1) Examination
Introduction to Artificial Intelligence
December 2018

[Max. Marks : 100

: 3 Hours]

structions:
1. Figures to the right indicate full marks
2. Each section should be written in a separate answer book
3. Be precise and to the point in your answer

SECTION-I

[20]

Answer the following: (Any Ten)

i. Define Artificial Intelligence. List any two application areas of AI.
ii. What are the advantages of Predicate Logic over Prepositional Logic?
iii. Write any four properties of games, which makes them ideal subject for AI research.
iv. What is Heuristic Search? In which situations Heuristics are required?
v. Give one example each for Universal and Existential quantifiers.
vi. Define: State Space Search. Draw an example State Space for tic-tac-toe.
vii. What makes Best First Search algorithm better than DFS and BFS?
viii. Draw Search Graph and Search Tree for 3-water jug problem to indicate the difference clearly.
ix. What do you mean by Local Maxima with respect to search technique?
x. Write the four properties of knowledge representation.
xi. Distinguish between: Declarative and Procedural Knowledge.

[20]

Answer the following: (Any Four)

A. Analyze the Seven problem characteristics for 8-Queen Problem.
B. Explain Simple Hill Climbing algorithm with the help of an example.
C. Discuss any 4 issues in Knowledge Representation faced by a good system.
D. Represent the following knowledge using Conceptual Dependency:
   i. John ate ice cream with a spoon.
   ii. The tall man stole the red book from the girl.
E. Represent the relationship of n-place predicate using Semantic Net for the following:
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Consider the following sentences: [10]

1. Jack owns a dog.
2. Every dog owner is an animal lover.
3. No animal lover kills an animal.
4. Either Jack or Bill killed the cat, who is named Kitty.
5. Cat is an animal.

a) Translate these sentences into formulas in predicate logic.
b) Find "Did Bill kill the cat?" using Backward Chaining.

SECTION-II

Do as directed: (Any Two)

A. For a fully connected Multilayer Perceptron, do the following: [20]
a) Show the architecture of a 3-layered MLP with the help of a labeled diagram and write its equation to obtain the output at last layer. [05]
b) Prove that XOR problem is non-linearly separable giving appropriate [05]

P. T. O.

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1212E597

Candidate's Seat No : _____

M.Sc. (Sem.-1) (AI & ML) (Old) Examination

Mathematical Foundation

December 2019

[Time : 3-00 Hours] [Max. Marks : 100

Instructions : (1) Figures to the right indicate Full Marks.
(2) All questions are compulsory.
(3) Write both sections in the separate answer books.
(4) Make necessary assumptions wherever necessary.

SECTION-I

Attempt any three : 18

(a) Define consist system of linear equations. Determine if the following system is consistent :

$$2x - 3y = -2$$
$$2x + y = 1$$
$$3x + 2y = 1$$

(b) What is an echelon form of a matrix? Row reduce the matrix :

$$\begin{bmatrix} 1 & -5 & 7 \\ 6 & 9 & 7 \\ -9 & 6 & 1 \end{bmatrix}.$$

(c) Find the inverse of the matrix : $A = \begin{bmatrix} 2 & 1 \\ 3 & 4 \end{bmatrix}$. Using elementary row transformation.

(d) Apply Gauss elimination method to solve the following system of equations :

$$x + y + z = 1$$
$$3x + 5y + 6z = 4$$
$$9x + 2y - 36z = 17$$

Attempt any two : 16

(a) Diagonalize a matrix $A = \begin{bmatrix} 0 & 1 \\ -3 & 4 \end{bmatrix}$ if possible.

(b) Define eigen values and eigen vectors of a square matrix. Determine eigen value of the matrix :

$$\begin{bmatrix} 2 & 2 & 1 \\ 1 & 3 & 1 \\ 1 & 2 & 2 \end{bmatrix}$$

(c) Define rank of a matrix. Find the rank of the matrix $A = \begin{bmatrix} 1 & 2 & 3 \\ 1 & 4 & 2 \\ 2 & 6 & 5 \end{bmatrix}$.

[P.T.O.

3 Attempt any two from the following :

(a) A, B and C toss a coin in sucassion on the undering that first one to throw a head
What are their respective chances of winning?

(b) Three cards are drawn from a pack of 52. Find the probability that they are of the same colour.

(c) Three light bulbs are chosen at random from fifteen bulbs of which five are defective
Find the probability that :

(i) none is defective

(ii) exactly oe is defective

(iii) at least one is defective.

SECTION II

4 Attempt any three from the following :

(a) Is the set V of all pairs of real numbers (x, y) with the operations.
Addition : $(x_1, y_1) + (x_2 + y_2) = (x_1 + y_2 + 5, y_1 + y + 5)$
Scalar mulfiplication : $k(x, y) = (kx, ky)$
a vector space ? If yes, them prove it, is no then
identify all axioms that fail to hold.

(b) Show that the set $w = \{[x, y, z] \backslash y = x + z\}$ is a subspace of R^3 under usual addition and multiplication.

(c) Define linear combination of vectors $\{v_1, v_2 \ldots\ldots v_n\}$. Is the vettor [0, 5, 4] liner combination of $v_1 = [0, -2, 2]$ and $v_2 = [1, 3, -1]$?

(d) Show that $M_1 = \begin{bmatrix} 1 & 0 \\ 0 & 0 \end{bmatrix}, M_2 = \begin{bmatrix} 0 & 1 \\ 0 & 0 \end{bmatrix}, M_3 = \begin{bmatrix} 0 & 0 \\ 1 & 0 \end{bmatrix}$ and $M_4 = \begin{bmatrix} 0 & 0 \\ 0 & 1 \end{bmatrix}$
is a basis for the vector space M_{22}

(e) Find the coordinat vector of $v = [2, -1, 1]$ relative to the basis
$s = \{[1, 1, 0], [1, 0, 1], [0, 1, 1]\}$

5 Attempt nay two from the following :

(a) Find the row space and column space of the matrix

$$A = \begin{bmatrix} 1 & 5 & -1 \\ 2 & -3 & -6 \\ -1 & 0 & 2 \\ 4 & 1 & 1 \end{bmatrix}$$

(b) Find a basis for the null space of the matris.

$$A = \begin{bmatrix} -1 & 1 & 1 \\ 3 & -1 & 0 \\ 2 & -4 & -5 \end{bmatrix}$$

(c) Show that the transformation T : $R^3 \to R^3$ as under T (x, y, z) = x, y, -z) is a linear operator on R^3.

OR

(c) Determine the linear transformation T of the following whoss imges of basis vectors are given below :

T : $R^2 \to R^2$, basis B = {[1, 0], [0, 1]}, T [1, 0] = [1, 1] & T [0, 1] = [2, -1]

Also computi T (5, -2)

Attempt any two from the following : 16

(a) Find the associated matrix of the following linear trans formation.

T : $R^3 \to R^2$, T $(x_1, x_2, x_3) = 2x_1 = x_2 + x_3, x_2 - 4x_3)$

with bases B = {[1, 0, 0], [1, 1, 0], [1, 1, 1]} and

B = {[1, 1] [1, -1]} for the domain and co-domain of T respectively.

(b) Compate <u, v> // u // and <v, v> for the given pair of vectors and inner product.

$u = x, v = x^2$ in c [0, 1] using inner product

$$<u,v> = \int_0^1 uvdx.$$

OR

(b) Verify the cauchy-schwarz inequality for the vectors.

$$A = \begin{bmatrix} 0 & -2 \\ 2 & 1 \end{bmatrix} \text{ and } B = \begin{bmatrix} -1 & -1 \\ 1 & 1 \end{bmatrix}$$

respect to inner product <A, B> = tr ($A^T B$)

(c) Determine which of the following pair of vector are orthogonal with respect to eudidean inner product.

(i) u = [2, 1], v = [-1, 2]

(ii) u = [1, 2, -2, 1], r = [4, 0, 4, 0]

Note: (1) Figures to the right indicates full marks of the respective question.

(2) Intermediate calculation steps and results are to be shown.

SECTION – I

Q:1 Answer the following (Any two)

(a) (i) Define power set. Find the power set of $\{\{a\},\{b,c\},\{a,d\}\}$.

(ii) Let $A=\{-3,\ -2,\ -1,\ 0,\ 1,\ 2\}$. Find the range of the function $f:A\to\mathbb{R}$ defined by $f(x)=x^2-5x+6$ for all $x\in A$.

(b) Find an equation of tangent lines to the hyperbola $x^2-y^2=16$ that passes through point $(2,-2)$.

(c) Find $\frac{dy}{dx}$ where

(i) $y=\frac{x}{\sqrt{x^2-1}}$ (ii) $y=\cos\left(\frac{e^{x^2}}{1-x^2}\right)$

Q:2 Answer the following (Any Two)

(a) Using Taylor series expansion, obtain the approximate value of $\sqrt{1.05}$. Assume $f(x)=\sqrt{1+x}$.

(b) Each set X_r contains 5 elements and each set Y_r contains 2 elements and $\bigcup_{r=1}^{20} X_r = S = \bigcup_{r=1}^{n} Y_r$. If each element of S belongs to exactly 10 of the X_r's and to exactly 4 of the Y_r's, then find n.

(c) Find local extreme values of $f(x,y)=3y^2-2y^3-3x^2+6xy$.

Q:3 Answer the following (Any Two)

(a) Given that $z=4e^x\ln(y)$, $x=\ln(u\cos v)$, $y=u\sin v$. Find $\partial z/\partial u$ and $\partial z/\partial v$ using the chain rule. Also, evaluate them at $(u,v)=(2,\pi/4)$.

(b) If $Y=\{1,2,...,10\}$, $L=\{a\in Y | a^2\notin Y\}$, $M=\{a\in Y | a+1=6\}$, and $N=\{a\in Y | a \text{ is not more than } 6\}$. Draw Venn diagram showing the relation of Y, L, M and N. Is the statement $L-(M-N)=(L-M)-N$ is true? Justify your answer.

(c) Find the directional derivative of $f(x,y)=e^x\cos(y)$ at $(1,\pi/4)$ in the direction of the unit vector that makes an angle of $\pi/3$ with the positive x-axis.

SECTION – II

Q:4 Answer the following (Any Two) **[16]**

(a) Consider the two sets of vectors $S_1=\{(1,2,-1,3),(2,4,1,-2),(3,6,3,-7)\}$ and $S_2=\{(1,2,-4,11),(2,4,-5,14)\}$ in $\mathbb{R}^4$. Let $U=Span\{S_1\}$, and $W=Span\{S_2\}$. Show that $U=W$.

(b) (i) Find the matrix for 45° counterclockwise rotation of the plane about the origin.
(ii) Obtain the projection of $u=(1,-2,3,-4)$ on $v=(1,2,1,2)$.

(c) Let $u=(1,3,-4,2)$, $v=(4,-2,2,1)$, $w=(5,-1,-2,6)$ in $\mathbb{R}^4$. (i) Show that $\langle 3u-2v,w\rangle=3\langle u,w\rangle-2\langle v,w\rangle$, (ii) normalize u and v.

:5 Answer the following (Any Two) **[14]**

(a) Express M as a linear combination of matrices A,B,C where $M=\begin{bmatrix}4 & 7\\ 7 & 9\end{bmatrix}$, and $A=\begin{bmatrix}1 & 1\\ 1 & 1\end{bmatrix}$, $B=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$, $C=\begin{bmatrix}1 & 1\\ 4 & 5\end{bmatrix}$

(b) Check whether (3, 7, 4) in Span{(1, 2, 3), (2, 3, 7), (3, 5, 6)}.

(c) Obtain orthonormal basis from the given basis $\{(1,1,-1),(0,3,5),(1,2,1)\}$.

6 Answer the following (Any Two) **[20]**

(a) Define linearly independent vectors and linearly dependent sets. Are the vectors $u_1=(1,1,2)$, $u_2=(1,2,5)$, $u_3=(5,3,4)$. If so, find the relation between them. Also, extend it as a basis of the vector space $\mathbb{R}^3$.

(b) Contrast between *Nul A* and *Col A* for $m\times n$ matrix A.

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

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M.Sc. (AI & ML) (Sem.-1) (New) Examination

MSCAI 114

Object Oriented Concepts & Programming Using C++

December 2019

ıe : 3-00 Hours] [Max. Mark

ote: (1) Write both the sections in different answer books.
(2) Figure to the right indicates full marks.
(3) Make necessary assumptions wherever necessary.

SECTION - I

1. **Answer the Following.** **(18)**

) What is polymorphism? What is the difference between compile time and runtime polymorphism? How C++ compiler does achieve run time polymorphism?

) What do you mean by object oriented programming? Explain in detail.

) Explain Friend function with its merits and demerits.

2. **Answer the Following.** **(16)**

) What is constructor? Explain different types of constructor.

) Why we need friend function to overload operator? Explain it using example.

OR

) Explain rules to overload the operator in C++.

) Explain copy constructor with example.

3. **Answer the Following. (Any Two)** **(16)**

Explain following terms :

i) pure virtual function

ii) this pointer

What is stream? Explain advantages of using C++ I/O over C I/O.

Write a C++ program to implement template class STACK with all operations.

SECTION - II

Answer the Following. **(18)**

Explain difference between Manipulators and IOS member functions.

What are the issues one must consider while dealing with multiple inheritance? How to avoid it. Explain it using example.

Explain four different cases where user defined conversation are needed.

[P.T.O]

EG24 - 4

Q-5. Answer the Following.

(1) Explain derivation using different access modifier.

(2) Define a class **student** with appropriate data members and store five subject marks and make mark sheet like total, percentage, grade, etc. using appropriate member function. Write a C++ program to test a class that can store more than one student information.

OR.

(1) Explain MIL with example

(2) Define a class **employee** with appropriate data members and store salary detail like basic salary, HRA, DA, Gross, etc. using appropriate member function. Write a C++ program to test a class that can store more than one employee information.

Q-6. Write a short note on the following. (Any Two)

(1) IO modes

(2) Standard Template Library (STL)

(3) Namespaces

12

1712E624

Candidate's Seat No : _____

M.Sc. (AI & ML) (Sem.-1) (Old) Examination

MSCAI 114

Object Oriented Concepts & Programming Using C++

me : 3-00 Hours] **December 2019** [Max. Marks : 100

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following [16]

(a) Compare and Contrast Inline function and normal function

(b) Describe the following terms with Example
i) this pointer ii) Dynamic binding

(c) Explain Scope resolution operator.

(d) Explain different data types in C++.

Q.2 Answer the following (Any four) [16]

(a) Explain function template and class template with examples.

(b) What do you mean by object oriented programming? Explain in detail.

(c) What is Member Initialization List (MIL)? Explain giving suitable example.

(d) What is the use of private member function?

(e) Explain importance of destructor?

Q.3 Answer the following(Any three) [18]

(a) Difference between : i) Aggregation and Generalization
ii) Manipulators and ios member function

(b) What are abstract classes? Give few examples of abstract classes.

(c) Explain static variable and static function with example.

(d) Explain namespace in detail.

SECTION-II

Q.4 Explain the following: [16]

(a) What is Friend Function? What are the merits and demerits of using friend function?

(b) What is an operator function? Write a program to overload binary + operator as a member function for a class of your choice.

(c) What is stream? Describe various stream classes for console I/O operations.

(d) What is polymorphism? What is the difference between compile time and runtime polymorphism?

P.T.O.

EG24-2

Q.5 Answer the following:

(a) What do you mean by implicit and explicit conversion? Explain with suitable example.

(b) Explain copy constructor giving suitable C++ programming example.

OR

Q.5 Answer the following:

(a) What is Virtual Function? What is its need? Explain with example.

(b) What is an Exception? Explain Exception Handling Mechanism. Give example with multiple catch blocks.

Q.6 Write short note on the following (Any Three)

(a) tellg and seekp

(b) Inheritance types

(c) IO modes

(d) Standard Template Library (STL)

1312E605

Candidate's Seat No :_____

/42

M.Sc. (AI & ML) (Sem.-1) (Old/New) Examination

Problem Solving With Python

December 2019

[Max. Marks : 100

Time : 3-00 Hours]

ote: (1) Make necessary assumptions wherever necessary.

(2) Write precise and to the point answers.

old

SECTION – I

:1 Do as directed (Any Seven) [14]

(a) What gets printed by the following expressions?

(i) `print(map(len,['ab', 'cd']))`

(ii) `print(divmod(10, 3))`

(b) What is purpose of `type()` function in Python.

(c) List with example Boolean operators in Python.

(d) What is the difference between == and `is` operator in Python?

(e) What are the different methods to format string in Python?

(f) Write the syntax for list comprehension.

(g) What is the difference between a `for loop` and `while loop`?

(h) What is the difference between `pass` and `continue` in Python?

2 Answer the following (Any Two) [16]

(a) Consider a string `my_str = "GU is the best University"`. Give the output of the following commands.

(i) `my_str.rfind('i')` (ii) `my_str.replace('t', '*', 2)`

(iii) `my_str.casefold()` (iv) `my_str.split('the')`

(b) Explain with example built-in function `range()` and `enumerate()`.

(c) Explain any four built-in list methods with example.

3 Answer the following (Any Two) [20]

(a) What is Python? What are the key features of Python?

P. T. O.

(b) What is "any" and "all" in python? How they can be used in python? Explain with example.

(c) Write in brief about Dictionary in python. Explain properties of dictionary keys with example.

SECTION – II

Q:4 Do as directed (Any Six)

(a) What is class instantiation?

(b) Differentiate between class variables and instance variables.

(c) What does single-level inheritance mean?

(d) Let `a` and `b` be objects of class `Foo`. Which functions or methods are called when `print(a + b)` is executed?

(e) What is Pickling and how does it differ from Unpickling?

(f) Differentiate between `TypeError` and `ValueError`.

(g) Discuss about `assert` statement with example.

Q:5 Answer the following (Any Two)

(a) How to open a file in Python? What are the different techniques for reading text file?

(b) What is Method Resolution Order (MRO)? Explain the principles followed by MRO with example.

(c) What are the benefits of using exception handling? Discuss with an example exception with arguments in Python.

Q:6 Answer the following (Any Two)

(a) Explain Class methods, Instance methods and Static methods used in Python class. Also, state with an example when they can be applied.

(b) How to implement method overriding in Python? Demonstrate with an example

(c) What is property decorator? Why it is used in Python class? Discuss with an example.

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E605-3 New

M.SC. (AI & ML) Semester I

Problem Solving with Python

Time: 3 Hours [Max. Marks : 100]

SECTION I

Q:1 Answer the following (Any Two): [20]

1. Explain built-in data types of python.
2. What is List in python? Explain list bounds and list slicing with example.
3. Explain Recursive functions in python with example of Fibonacci series and also explain anonymous function lambda.

Q:2 Answer the following (Any Two): [16]

1. Write a difference between function and method and write how to define a function in Python.
2. Explain list assignment and its equivalence with example. Also explain list methods.
3. Write a python program that takes a number from user and calculate factorial, check whether it is prime or not and print its multiplication table.

Q:3 Answer the following (Any Two): [14]

1. Explain set in python. Also explain set Quantification with all and any.
2. Explain Prime number generation with Python.
3. Write a python program to arrange the characters of a given string "mountain" in an alphabetical order and counts number of vowels.

P. T. O.

E605 - 4

SECTION II

Q:4 Answer the following(Any THREE): [18]

1. What are various file positions methods? Explain with example
2. What is class and Object?? Explain Encapsulation and Information hiding in Python.
3. How to implement method overriding in Python? Demonstrate with an example.
4. Demonstrate any six operation on strings

Q:5 Answer the following(Any TWO): [20]

1. What is dictionary in Python? What are the advantages of Python dictionary type? How do you get a list of all the keys in a dictionary? Explain with example.
2. Write a python program to read contents of the text file and write into another.
3. Discuss with an example, exception with arguments in Python.

Q:6 Answer the following(Any SIX): [12]

1. What is class instantiation?
2. What is Pickling and how does it differ from Unpickling?
3. Explain Inheritance in Python in brief.
4. Explain seek() and tell() Methods in file operations of Python
5. Explain if-elif condition with example
6. Write a python code to generate two 4X4 matrices and add and subtract them in Python.(Take any elements in array)
7. "With" statement in Python.

1812E631 Candidate's Seat No.

/42

M.Sc. (AI & ML) (Sem.-1) Examination

MSCAI 115

Linear Algebra and Numerical Methods

December 2019

[Max. Marks : 100

ime : 3-00 Hours]

SECTION - I [18]

Q. 1 Attempt the following: [6]

a) Explain the followings terms with the help of an example of each :

i. Diagonal Matrix

ii. Transpose of a Matrix

iii. Orthogonal matrix

b) When are two matrices said to be similar? Show that similar matrices have the same eigen values [6]

c) What are the properties of Determinants of Matrices? [6]

Q. 2 Attempt any two: [16]

a) Compute the Characteristic equation and the eigen values of the following matrix: [8]

$$\begin{bmatrix} 3 & 6 & 5 \\ 6 & -5 & 3 \\ -24 & 38 & 2 \end{bmatrix}$$

b) Diagonalize the following matrix: [8]

$$\begin{bmatrix} 1 & 4 \\ 2 & 3 \end{bmatrix}$$

c) Let $A = \begin{bmatrix} 7 & 2 \\ -4 & 1 \end{bmatrix}$. Find a formula for A^k, given that $A = PDP^{-1}$ where $P = \begin{bmatrix} 1 & 1 \\ -1 & -2 \end{bmatrix}$ and $D = \begin{bmatrix} 5 & 0 \\ 0 & 3 \end{bmatrix}$ [8]

Q. 3 Attempt the following : [16]

a) Explain the followings terms with the help of an example of each [6]

i. Square Matrix

ii. Inverse of a Matrix

iii. Symmetric matrix

b) What is singular value decomposition? Perform Singular Value decomposition for the matrix $\begin{bmatrix} -2 & 0 \\ 0 & -1 \end{bmatrix}$ [10]

OR

Q. 3 Attempt the following : [16]

a) Prove that eigen vectors corresponding to distinct eigen values are orthogonal. [8]

b) Explain Principal Component Analysis , its method and its two applications. [8]

EG31-2

SECTION - II

[18]

Attempt Any Three:

Q. 4

a) Give advantage of using Gauss elimination with partial pivoting method over Gauss elimination method. [6]

b) Explain graphically Bisection method to find a root of equation f(x) = 0. [6]

c) Explain the difference between the Secant method and Regular False Position method. [6]

d) Explain the situations, when Newton Raphson method may fail to converge? [6]

[16]

Q. 5 Attempt any two:

a) Solve the following system with Gauss Elimination with partial pivoting. [8]

$$2x + y + z = 5$$
$$4x - 6y = -2$$
$$-2x + 7y + 2z = 9$$

b) Using Gauss Seidel iteration, solve the following system of equations [perform four iterations] starting from [1, 1, 1]. [8]

$$10x + y + z = 6$$
$$x + 10y + z = 6$$
$$x + y + 10z = 6$$

c) Solve the following system using the inverse of a matrix [8]

$$5x + 15y + 56z = 35$$
$$-4x - 11y - 41z = -26$$
$$-x - 3y - 11z = -7$$

[16]

Q. 6 Attempt the following :

a) Find a root of equation $x^3 - x - \sin x = 1$ by using the Regula Falsi method. [8]

b) Solve $x^4 - x - 10 = 0$ correct up to four decimal places by Secant method. [8]

OR

[16]

Q. 6 Attempt the following :

a) Solve $x^3 - 2x^2 + 3x - 1 = 0$ correct up to four decimal places by Newton Raphson method. (Take initial $x_0 = 4$). [8]

b) Explain inherent errors, truncation errors and errors due to rounding. Illustrate by an example of each. [8]

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M.Sc. (AI & ML) (Sem.-1) (Old) Examination

MSCAI 113

Introduction to Artificial Intelligence

December 2019

[Max. Marks : 100

me : 3-00 Hours]

Instructions:

1. Figures to the right indicate full marks
2. Each section should be written in a separate answer book
3. Be precise and to the point in your answer

SECTION-I

1. **All the statements given below are false. Correct the statements with proper justification. (Any Ten)** [20]

a) The characteristics of the computer system capable of thinking, reasoning and learning is known as Machine Intelligence.

b) Depth First Search method takes more memory than Breadth First Search.

c) The production rule comprises of a single rule.

d) A knowledge representation scheme in which knowledge is represented using objects, their attributes and corresponding value of the attributes is called Relational knowledge.

e) A heuristic function guarantees to reach to best solution.

f) Semantic Nets are better in representing facts than Conceptual Dependency.

g) Commutative production system always gives different results.

h) Game Playing is not an application area of AI.

i) Neural Networks can solve only linear problems.

j) Syntactic Analysis identifies every token in the sentence.

k) Fuzzy Logic cannot deal with Uncertainty.

Answer the following: (Any Four) [20]

A. What are the problems of Hill Climbing methods? What are their solutions?

B. What role does State Space Representation play in searching? What is the importance of Generator and Tester functions in State Space Search?

C. Heuristic functions improve the search process. Give an example of Heuristic function for blocks world problem.

D. Analyze the Seven problem characteristics for 3-Water Jug Problem.

E. Differentiate Declarative Knowledge from Procedural Knowledge.

Consider the following sentences: [10]

1. Ram is an employee and he works for a company.
2. All employees are people.
3. Sudhir is Ram's boss.
4. All employees either consider the boss a friend or dislike him.
5. A person only criticizes someone who is not his friend.
6. Ram criticizes Sudhir.

a) Translate these sentences into formulas in predicate logic.

b) Find "Does Ram like Sudhir?" using Backward Chaining.

E615 - 2

SECTION-II

4. **Do as Directed: (Any Two)**

A. What do you understand by Reasoning? What role does it play in Knowledge Representation? Distinguish between:
   a) Forward Vs. Backward Reasoning
   b) Monotonic Vs. Non-monotonic Reasoning

B. What are Hopfield Networks? Explain the Network Architecture. Explain the steps to reach to stable state in a Hopfield Network with the help of appropriate diagrams.

C. Attempt the following:
   a) Three candidates standing in an election to be mayor in a city have 0.25, 0.35 und 0.40 chance of winning according to a public opinion poll. The chances that they will build a bridge after they have been elected are 0.60, 0.90 und 0.80. What is the probability that the bridge will be build in city after the elections?
   b) Explain the Certainty Factor Theory.

5. **Answer the following with the help of appropriate examples: (Any Two)**

A. Take an example of your choice to discuss Natural Language Processing as a prominent application area of AI.

B. Explain any one Probabilistic Graphical Model.

C. What is Multilayer Perceptron? Which type of problems can it solve? Draw a labeled diagram to show a 3 layered fully connected Multilayer Perceptron. Consider input vector X and show the calculations performed at each layer to obtain the output y.

6. **Explain the following:**

A. Truth Maintenance System

B. Fuzzy Logic

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1612E615 - 3

Candidate's Exam No.

M.Sc. (AI & ML) (Sem.-1) (New) Examination

MSCAI 113

Introduction to Artificial Intelligence

December 2019

[Max. Marks : 100

Time : 3-00 Hours]

Instructions:

1. Figures to the right indicate full marks
2. Each section should be written in a separate answer book
3. Be precise and to the point in your answer

SECTION-I

Answer the following: (Any Two) [20]

A. a) Write any 2 definitions of Artificial Intelligence. [03]

b) Discuss an AI technique for solving tic-tac-toe problem for a non-magic square board. [03]

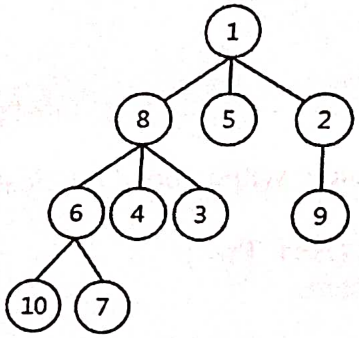
c) Describe all environment types by which Intelligent Agents get affected. [04]

B. Analyze 7-problem characteristics of Tower of Hanoi Problem. Give proper justification for each characteristic. [10]

C. a) What is State Space Search? Draw an example State Space for tic-tac-toe. [03]

b) What role does Heuristics play in searching? [03]

c) Show both, a BFS and a DFS traversal for the following tree considering node 1 as initial state and node 7 as goal state. [04]



Answer the following: (Any Four) [20]

A. Explain Steepest Ascent Hill Climbing technique with appropriate diagram of search trees.

B. What are Partitioned Semantic Networks? What are their advantages? Give any 2 examples to show the behavior of Semantic Networks.

C. Represent the following knowledge using Conceptual Dependency:

a) Jack punched Tim with a broken nose.

b) The bank manager ate pasta with a fork.

D. Represent the following using Semantic Nets:

a) Jack punched Tim with a broken nose.

b) The bank manager ate pasta with a fork.

E. Write PEAS description for an Automated Taxi Driver.

Consider the following sentences: [10]

1. Lucy is an employee and he works for a company.
2. All employees are people.
3. Fred is the boss.
4. Bosses give instructions to employees.
5. All employees do consider the boss a friend or dislike him.
6. Everyone is a friend of someone.
7. People only criticize people that are not their friends.

P. T. O.

E 615-4

8. Lucy criticized Fred.

a) Translate these sentences into formulas in predicate logic.

b) Find "Does Lucy like Fred?" using Backward Chaining.

SECTION-II

4. **Answer the following: (Any Two)**

A. How are Expert Systems build? Explain the steps involved in the development process.

B. Discuss the additional refinements of Game Playing.

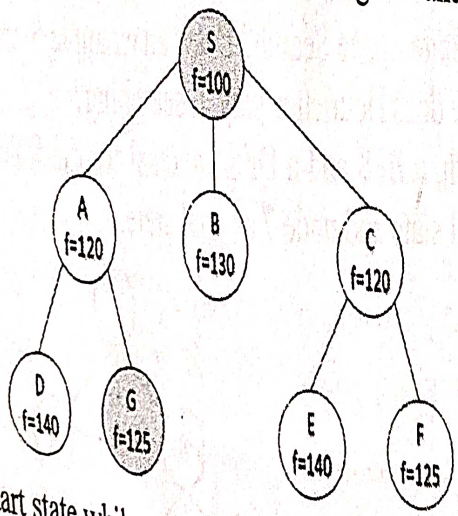
C. Which are the various issues encountered in Knowledge Representation?

5. **Answer the following with the help of appropriate examples: (Any Two)**

A. Explain Mini-Max Procedure of Game playing.

B. Who is a Knowledge Engineer? What are the stages involved in designing a Knowledge Base?

C. What do you understand by Iterative Deepening? Why is it said to be Admissible and Complete? Apply IDA* algorithm on the following tree and explain each step.



Node S indicates start state while node G indicates the goal state.

6. **Explain the following (Any Two):**

A. Truth Maintenance System

B. Decision Theory

C. Types of Uncertainties

****

M.Sc. Sem-I

Candidate's Seat No : sem-I

/43

0401E962

Jun. 2018

M.Sc. (A.I. & M.L.) (Sem.-I) Examination

50

Object Oriented Concepts Programming Using

January-2018

[Max. Marks : 70

ime : 3 Hours]

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following [8]

(a) What is object oriented programming? What are its main characteristics?

(b) Define a class of employees. It should contain employee number, name, address, and number of dependents for the employees. Define an array of 20 employees. Now write a simple **for** loop to read information about the employees. At the end, display all employees with more than two dependents.

Q.2 Answer the following (Any four) [8]

(a) What do you understand by constructor and destructor? Explain. When it becomes essential for programmer to write destructor in a class for the sake of efficiency? Explain with example.

(b) Distinguish between private, protected and public visibility specifiers.

(c) How is **cout** able to display various types of data without any special instruction?

(d) Explain the advantages and disadvantages of constructing an object dynamically

(e) What is is-a and has-a relationships between classes? How are they implemented in C++?

Q3 Compare & Contrast the following [9]

(a) Static members & Non static members of the class

(b) Inline function & normal function

(c) Function overloading and function templates

SECTION-II

Q4 Explain the following (Any Three) [9]

(a) const objects

(b) **this** pointer

(c) typeid operator

(d) Reinterpret_cast

P. T. O.

E 962-2

Q.5 Answer the following

(a) Explain conversion from class to basic type.

(b) What is function template and class template? Explain giving suitable example.

OR

Q.5 Answer the following

(a) Explain the use of following functions :

(i) fseek()

(ii) feof()

(iii) fread()

(iv) fopen()

(b) What are the advantages of saving the data in binary form?

Q.6 Write short note on the following (Any Two)

(a) Run Time Polymorphism

(b) Exception Handling

(c) Operator Overloading

M.Sc. (A.I.M.L.) (Sem.-I) Examination

Introduction Artificial Intelligence

January-2018

100

[Max. Marks : 70

: 3 Hours]

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

Section I

Que 1 Answer the following: 18

a) Analyse travelling salesman problem with respect to the problem characteristics. (Explain any 5 characteristic)

b) Write and explain the Hill climbing algorithm. Which major problems arise from Hill climbing? Which are the solutions to these problems. How Steepest Ascent Hill Climbing method is different from Hill climbing method.

Que 2

a) Write an algorithm for Depth first search. Discuss advantages and disadvantages of Depth first search and Breadth first search. 8

b) Which properties should be possessed by a good system for the representation of knowledge? 8

OR

Que 2

a) You are given two jugs, a 4 – gallon one and a 3- gallon one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug? 10

i) Define starting and ending states.
ii) Define state space.
iii) Define rules

b) Explain procedural Versus declarative knowledge. Also explain forward versus backward reasoning. 6

Que 3

a) Explain AI technique. Explain different properties of AI techniques. 6

b) Translate the following sentences into predicate logic. (Any 5) 10

i) Shenu is a poodle.
ii) Smith is master of poodle.
iii) It is cold on Saturday.
iv) Many poodles are trained.
v) If a dog is a good dog and has a master then he will be with his master.
vi) If it is Sunday and warm, then Shenu is at the park.
vii) If it is Sunday and not worm, then Shenu is at the circus.

P.T.O.

E-943-2

SECTION II

Que 4	(Any 2)	
a)	Explain different approaches to use non monotonic reasoning to perform default reasoning. Also explain abduction and inheritance.	18
b)	What is monotonicity? What is the purpose of Non monotonic reasoning system? Which are the key issues, which must be handled by NMRS?	
c)	Explain different steps in the natural language processing	
Que 5		16
a)	Write a short note on Hopfield networks.	
b)	Compare and contrast human brain versus neural network.	
	OR	
Que 5		
a)	Explain perceptron network.	
b)	Explain different types of learning in Neural Networks.	
Que 6		
a)	State Bayes theorem. Explain the situation in which Bayes theorem can be used to calculate the probability.	4
b)	Define conditional probability	2
c)	Solve the following:, P = {(x1, 0.3), (x2, 0), (x3, 0.8),(x5,1)} Q = {(x1, 0.3), (x2, 0.2),(x3,0.7),(x5,0)} R = {(x2, 0.8), (x3, 0.6), (x5,0.4)} Find: 1) P intersection Q 2) Q - R 3) P union Q intersection R	6
d)	i) 4 unbiased coins are tossed simultaneously. Find the probability of getting atleast one tail.	2
	ii) A bag contains 3 white, 4 black and 2 red balls. If 2 balls are drawn at random from the bag one by one, what is the probability that the balls are black?	2

0201E930

M.Sc. (A.I.M.L.) (Sem.-I) Examination

Introduction to Programming with Python

January-2018

Time : 3 Hours]

[Max. Marks : 70

100

Instructions:

a) Write both the sections in the separate answer books
b) All Questions are compulsory, there are a total of 10 questions.
c) All questions carry equal marks.
d) Read questions carefully. Hints to solve questions are also given.

Section-I

Q.1. Given that 'a' and 'b' are two positive integers with `a>b`, when we divide 'a' by 'b' we get a quotient 'q' and remainder 'r' such that `a=qb+r`. Complete the following python code to return the quotient and remainder WITHOUT using the division ('/') or modulo operator ('%').

```
def  division(a,b):
     assert a>=0 and b>0

     # Write your code here
     # Do NOT use /or % operators

     # return quotient and remainder
     return (q, r)
```

Hint: Division is repetitive subtraction.

Q.2. Converting nested list to a single list.
Write a python function such that it takes a list of lists as input and returns a single list containing all the elements.

Example:
Input: [[1,2,3],[4,5,6],[7,8,9]]
Output: [1,2,3,4,5,6,7,8,9]

Input: [[a,b],[1,5]]
Output: [a,b,1,5]

P.T.O.

E930-2

Q.3. Complete the following code such that it returns the greatest common divisor (gcd) of two positive integers 'a' and 'b'. Note that gcd(a,b) is the largest integer that divides both 'a' and 'b'.

```
def gcd(a,b):
    assert a>0 and b>0
    #Write your code here. You are free to use any logic or operators

    #return the gcd 'd'
    return d
```

Example:
gcd(10,5) = 5
gcd(7,9) = 1
gcd(12,15) = 3

Hint: gcd(a,b) <= max(a,b) and it divides both 'a' and 'b'.

Q.4. Write a function in python to return the lowest common multiple of 'a' and 'b'. You can use the gcd() function which you completed in Question 3 if you need it. Note: LCM is the smallest number which both integers 'a' and 'b' divide.

Example:
lcm(10,5) = 10
lcm(3,5) = 15
lcm(12,8) = 24

Hint: Recall the relation between the numbers 'a' and 'b' and their 'gcd' and 'lcm'.

Q.5. Given that there are two boxes each having some white balls and back balls. Let box-1 have 'w1' white balls and 'b1' black balls, similarly let box-2 have 'w2' white balls and 'b2' black balls.
Now you choose a box at random and take out one ball. Complete the following code which returns the probability of the ball taken out being white.

```
def prob_white_ball( w1, b1, w2, b2):
    assert w1>=0 and b1>=0 and w2>=0 and b2>=0

    # write your code here

    # return the probability that the ball is white
    return probability
```

Example:
prob_white_ball(1, 1, 1, 1) = ½ = 0.5
prob_white_ball(1, 2, 1, 3) = 7/24 = 0.29167

Hint: Recall that probability of choosing a white ball from a box = (number of white balls in the box) / (Total balls in the box).

E930-3

Section-II

Q.6. Draw the graphs of the following functions

a) y = x*x + 2
b) y = 2*x + 1
c) y = sin(x) + 1
d) y = tan(x)
e) y = 1/(x-1)

Q.7. Given the following data of house prices vs. area of plot. Write a python function that returns the equation of the best fit line. Note, you have to return 'm' and 'c' where `y=mx+c` is the best fit line

Area	House prices
1.0	3
2.0	5.5
5.0	10.5
7.0	14

Hint: Recall that if Ax=b, then `x = inverse(A.T * A) * A.T * b` , where A.T is the transpose of A.
You can use the numpy library. If A is a numpy matrix, then A.transpose() gives the transpose of A and numpy.linalg.inv(A) gives the inverse of A.

Q.8. a) Write a python function that returns the factorial of an integer. Example: factorial(5) = 5*4*3*2*1 = 120

b) Complex numbers are numbers which have a real and an imaginary part. Let z = a + i*b, where a and b are real numbers and 'i' is the square root of -1, then z is a complex number. When we multiply two complex numbers `z1 = a1+ i*b1` and `z2 = a2 + i*b2`, we get the result

```
z1*z2 = (a1 + i*b1)*(a2 + i*b2) = (a1*a2 - b1*b2) + i* (b1*a2 + a1*b2)
```

Write a python function that takes as input two complex numbers given as lists [a1, b1] and [a2, b2] and returns their product as a list using expression given above, i.e., return [a1*a2 - b1*b2, b1*a2 + a1*b2].

Hint: If you don't understand complex numbers, just simply use the expression given above to return the desired result.

P.T.O.

E930-4

Q.9. Check if the following functions are linear or non-linear. Give detailed explanation.

a) y = Ax, where A is a constant matrix and x and y are vectors.

b) y = x*x

Q.10. Let Ax=b, where A is a Matrix and x and b are vectors (Assume dimensions are such, that matrix multiplication is valid).

Many times there is error while collecting data. Let 'e' be the error in 'b', such that

```
b = b_actual + e
```

The error in 'x' is then `inv(A)*e`.

Write a python function that takes as input 'A', 'b' and 'e' and returns the relative error defined as follows:

Relative_error = (|| inv(A)*e || / || inv(A) * b ||) / (|| e || / || b ||)

Where ||a|| is the norm of the vector a.

Hint: You can use numpy library. numpy.linalg.inv(A) gives the inverse of a matrix A and numpy.linalg.norm(b) gives the norm of the vector b.

0101E887 Candidate's Seat No :

M.Sc. (A.L.M.L.) (Sem.-I) Examination

Mathematical Foundation

January-2018

Time : 3 Hours] **[Max. Mark**

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 (a) Define homogeneous system of linear equations. When does it have nontrivial solution? Show that the equation $\mathbf{A X = b}$, with $\mathbf{A} = \begin{bmatrix} 2 & -1 \\ -6 & 3 \end{bmatrix}$ and $\mathbf{b} = \begin{bmatrix} b_1 \\ b_2 \end{bmatrix}$, $\mathbf{X} = \begin{bmatrix} x \\ y \end{bmatrix}$ does not have a solution for all possible values of **b** and describe the set of all b for which this $\mathbf{A X = b}$ has a solution. [6]

(b) Define inverse of a matrix. Show that if **A** is invertible n x n matrix, then for each **b** in R^n, the equation $\mathbf{A X = b}$ has a unique solution $\mathbf{X} = \mathbf{A^{-1}b}$. Verify $\begin{bmatrix} 3 & 4 \\ 5 & 6 \end{bmatrix}^{-1} = \begin{bmatrix} -3 & 2 \\ 5/2 & -3/2 \end{bmatrix}$ and thus find solution of system of equations : $3x + 4y = 3$
$5x + 6y = 7$.

(c) What are elementary row transformations? Explain each of them. How are they useful? [6]

Q.2 (a) Define eigen values and eigen vectors of a matrix A. Find eigen values and eigen vectors of $A = \begin{bmatrix} 3 & 2 \\ 3 & 8 \end{bmatrix}$ [8]

(b) Let $A = \begin{bmatrix} 1 & 3 & 3 \\ -3 & -5 & -3 \\ 3 & 3 & 1 \end{bmatrix}$. A has eigen values 1, -2, -2. Diagonalize A. [8]

.2 **OR**

What is Singular Value decomposition of a matrix? Find the singular value decomposition of $\begin{bmatrix} 2 & -1 \\ 2 & 2 \end{bmatrix}$. [16]

P.T.O.

E889 2

Q.3 **Attempt the following (Any Two):**

(a) Apply Gauss Elimination method to solve the system of equations: [8]

$$5x - y + 2z = 7$$
$$-2x + 6y + 9z = 0$$
$$-7x + 5y - 3z = -7$$

(b) Explain (i) Mutually Exclusive events [8]
(ii) Independent Events

Two ordinary six sided dice are tossed. What are the probabilities

(a) That one die only shows a six?
(b) That both die show the same number?
(c) That the sum of the two numbers shown is ten?

(c) Four defective light bulbs inadvertently got mixed with 6 good ones. [8]

(i) If 2 bulbs are chosen at random for a ceiling lamp (picked one after another), what is the probability that both are good?

(ii) If the first 2 are good, what is the chance that next 3 are good?

(iii) If we started all over again and chose 5 bulbs, what is the chance they all would be good?

SECTION-II

Q.4 **Attempt the following:**

(a) Define subspace of a Vector Space. Show that the set $= \{ [x, y, z] \mid y = x + z \}$ is a subspace of R^3 under usual addition and scalar multiplication.

(b) Check the linearity of the following transformation. T: $R^3 \rightarrow R^3$ defined by $T(x_1, x_2, x_3) = (x_1, x^2{}_2, x_3)$.

(c) What is Cauchy-Schwarz's inequality in inner product space? Verify the Cauchy-Schwarz's inequality for the vectors $1 - x^2$ and $1 - x + x^2$ in P_2 with an inner product $< p, q > = \int_{-1}^{1} p(x)q(x)dx$

Q.5 **Attempt any two from the following:**

(a) Define linear combination of vectors. Which of the vectors given below are linear combination of $v_1 = [0, -2, 2]$ and $v_2 = [1, 3, -1]$?

(i) $W_1 = [2, 2, 2]$
(ii) $W_2 = [0, 4, 3]$

(b) Define linearly independent set of vectors. Which of the following set of vectors in R^2 are linearly independent?

(i) $S1 = \{ [1,0], [0,1] \}$
(ii) $S2 = \{[1,3], [0,5], [1,5]\}$

E 887-3

(c) If $S = \left\{\begin{bmatrix} 3 & 6 \\ 3 & -6 \end{bmatrix}, \begin{bmatrix} 0 & -1 \\ -1 & 0 \end{bmatrix}, \begin{bmatrix} 0 & -8 \\ -12 & -4 \end{bmatrix}, \begin{bmatrix} 1 & 0 \\ -1 & 2 \end{bmatrix}\right\}$, then show that S is a basis for M_{22}.

Q.6 **Attempt any two from the following :** [16]

(a) Find the null space of matrix $A = \begin{bmatrix} -1 & 1 & 1 \\ 3 & -1 & 0 \\ 2 & -4 & -5 \end{bmatrix}$

(b) Find the associated matrix of the linear transformation T: $R^3 \rightarrow R^3$, $T(x_1, x_2, x_3) = (x_1 + x_2, x_2 + x_3, x_1 + x_3)$ with basis B = { [1, 0, 0], [1, 1, 0], [1, 1, 1] } and B' = { [1, 0, 1], [0, 1, 0], [1, 0, -1] } for the domain and codomain of T respectively.

(c) Construct an orthonormal basis of the subspace spanned by the vectors v_1 = [1, -4, 0,1] and v_2 = [7, -7, -4, 1] of Euclidean inner product space R^4.

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Sem. I.

2./43

0401E962

Candidate's Seat No :_____

M.Sc. (A.I. & M.L.) (Sem.-I) Examination

Object Oriented Concepts Programming Using

Jan. 2018

Time : 3 Hours] **January-2018** **[Max. Marks : 70** 50

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following [8]

(a) What is object oriented programming? What are its main characteristics?

(b) Define a class of employees. It should contain employee number, name, address, and number of dependents for the employees. Define an array of 20 employees. Now write a simple **for** loop to read information about the employees. At the end, display all employees with more than two dependents.

Q.2 Answer the following (Any four) [8]

(a) What do you understand by constructor and destructor? Explain. When it becomes essential for programmer to write destructor in a class for the sake of efficiency? Explain with example.

(b) Distinguish between private, protected and public visibility specifiers.

(c) How is **cout** able to display various types of data without any special instruction?

(d) Explain the advantages and disadvantages of constructing an object dynamically

(e) What is is-a and has-a relationships between classes? How are they implemented in C++?

Q3 Compare & Contrast the following [9]

(a) Static members & Non static members of the class

(b) Inline function & normal function

(c) Function overloading and function templates

SECTION-II

Q4 Explain the following (Any Three) [9]

(a) const objects

(b) **this** pointer

(c) typeid operator

(d) Reinterpret_cast

P. T. O.

E 962-2

Q.5 Answer the following

(a) Explain conversion from class to basic type.

(b) What is function template and class template? Explain giving suitable example.

OR

Q.5 Answer the following

(a) Explain the use of following functions :

(i) fseek()

(ii) feof()

(iii) fread()

(iv) fopen()

(b) What are the advantages of saving the data in binary form?

Q.6 Write short note on the following (Any Two)

(a) Run Time Polymorphism

(b) Exception Handling

(c) Operator Overloading

43

0301E943

Candidate's Seat No :_____

M.Sc. (A.I.M.L.) (Sem.-I) Examination

Introduction Artificial Intelligence

January-2018

me : 3 Hours]

[Max. Marks : 70 100

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

Section I

Que 1 Answer the following:

a) Analyse travelling salesman problem with respect to the problem characteristics. (Explain any 5 characteristic) 18

b) Write and explain the Hill climbing algorithm. Which major problems arise from Hill climbing? Which are the solutions to these problems. How Steepest Ascent Hill Climbing method is different from Hill climbing method.

Que 2

a) Write an algorithm for Depth first search. Discuss advantages and disadvantages of Depth first search and Breadth first search. 8

b) Which properties should be possessed by a good system for the representation of knowledge? 8

Que 2 **OR**

a) You are given two jugs, a 4 – gallon one and a 3- gallon one. Neither have any measuring markers on it. There is a pump that can be used to fill the jugs with water. How can you get exactly 2 gallons of water into the 4-gallon jug? 10

i) Define starting and ending states.
ii) Define state space.
iii) Define rules

b) Explain procedural Versus declarative knowledge. Also explain forward versus backward reasoning. 6

Que 3

a) Explain AI technique. Explain different properties of AI techniques. 6

b) Translate the following sentences into predicate logic. (Any 5) 10

i) Shenu is a poodle.
ii) Smith is master of poodle.
iii) It is cold on Saturday.
iv) Many poodles are trained.
v) If a dog is a good dog and has a master then he will be with his master.
vi) If it is Sunday and warm, then Shenu is at the park.
vii) If it is Sunday and not worm, then Shenu is at the circus.

E-943-2

SECTION II

Que 4 (Any 2)

a) Explain different approaches to use non monotonic reasoning to perform default reasoning. Also explain abduction and inheritance. 10

b) What is monotonicity? What is the purpose of Non monotonic reasoning system? Which are the key issues, which must be handled by NMRS?

c) Explain different steps in the natural language processing

Que 5 15

a) Write a short note on Hopfield networks.

b) Compare and contrast human brain versus neural network.

OR

Que 5

a) Explain perceptron network.

b) Explain different types of learning in Neural Networks.

Que 6

a) State Bayes theorem. Explain the situation in which Bayes theorem can be used to calculate the probability. 4

b) Define conditional probability 2

c) Solve the following:, 6

P = {(x1, 0.3), (x2, 0), (x3, 0.8),(x5,1)}

Q = {(x1, 0.3), (x2, 0.2),(x3,0.7),(x5,0)}

R = {(x2, 0.8), (x3, 0.6), (x5,0.4)}

Find:

1) P intersection Q

2) Q - R

3) P union Q intersection R 2

d) i) 4 unbiased coins are tossed simultaneously. Find the probability of getting atleast one tail. 2

ii) A bag contains 3 white, 4 black and 2 red balls. If 2 balls are drawn at random from the bag one by one, what is the probability that the balls are black?

M.Sc. (A.I. & M.L.)
Sem. I.

18

1907E1020

Candidate's Seat No :

M.Sc. (AI & ML) (Sem-I) Examination

Object Oriented Concepts & Programming Wing C++

July - 2018

Time : 3 Hours] **July-2018** **[Max. Marks : 100**

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following (Any three) [15]

(a) Highlight the strengths of object oriented programming in brief.

(b) Distinguish between private, protected and public visibility specifiers.

(c) What are the advantages of inline functions?

(d) When do we declare a member of a class static? Explain giving suitable example.

Q.2 Answer the following [20]

(a) What is a constructor? Can we have more than one constructor in a class? If yes why would we define more than one constructor in a class? Explain.

(b) What is dynamic constructor? Explain giving suitable example.

(c) Describe the importance of destructor.

(d) Describe the copy constructor and explain its use.

Q.3. (a) Distinguish between multiple and multilevel inheritance. What do you understand by virtual base class ? [7]

(b) Declare a class **vehicle.** Define derived classes two-wheeler, three-wheeler, and four-wheeler (Assume appropriate members for all classes). Display the properties of all the vehicle using member functions of the classes. Write a C++ program to test your classes. [8]

OR

Q.3 (a) How are friend functions used to carry out overloading of operators? In which situation are they helpful? Explain giving suitable example. [7]

(b) Define **money** class having ruppee and paisa as data members. Overload + and - operators to add and subtract two money objects. Write a C++ program to test your class. [8]

P. T. O.

E10-20-9

SECTION-II

Q4 Answer the following

(a) Explain the use of following functions :

(i) fseek()
(ii) feof()
(iii) fread()
(iv) fopen()

(b) What are the advantages of saving the data in binary form?

Q.5 Answer the following

(a) How do the I/ O facility in C++ differ from that in C ?

(b) Explain conversion from class to basic type giving suitable example.

OR

Q.5 Answer the following

(a) What is **this** pointer? Explain the use of **this** pointer giving suitable example.

(b) What is function template? Write a function template for searching an element in a given array.

Q.6 Write short notes on the following (Any Two)

(a) Run Time Polymorphism
(b) Namespace
(c) Exception Handling
(d) Manipulators

1807E1015 Candidate's Seat No : _____

M.Sc. (AI & ML) (Sem-I) Examination

Introduction to Artificiate Intelligence

July-2018

: 3 Hours] [Max. Marks : 100

Section I

ue 1 Answer the following:

Explain seven problem characteristics with suitable examples. 9

Define Artificial Intelligence. List various applications of Artificial Intelligence. 5

Write generate and test algorithm. 4

ie 2

Write an algorithm for best first search. 8

Explain different characteristics of knowledge. 8

OR

ie 2

What is state space search? Explain with water jug problem. 8

Write an algorithm for depth first search and compare that with breadth first search. 8

ie 3

Explain how facts and rules are written in logic programming. 8

Translate the following sentences into predicate logic. 8

i) Cow is an animal.
ii) Cow is white.
iii) Cow eats sweet green grass.
iv) Horse runs very fast.

SECTION II

ie 4 (Any 2) 18

Write a short note on Non monotonic reasoning system

Write a short note on natural language processing

e 5

Write a short note on artificial Neural Networks. 8

What does it mean by parallel relaxation? Explain with example. 8

e 5

OR

Explain back propagation networks 8

Explain supervised learning and reinforcement learning in Neural Networks. 8

What is the difference between both of them?

6

Define the following: (any 4) 8

i) Probability
ii) Independent event
iii) Mutually exclusive event
iv) Impossible event
v) Exhaustive events

P.T.O

E1015 -2

b) Solve the following:, 8

A = {(x1, 0.7), (x2, 1), (x4, 0.3),(x6,0)}

B = {(x1, 0.4), (x2, 0.5),(x3,0.8),(x5,1),(x6,0)}

Find:

1) A UNION B

2) B - A

3) A –B

4) A intersection B

1707E1010 Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem-I) Examination

Introduction to Programming with Python

July-2018

: 3 Hours] [Max. Marks : 100

Write both the sections in separate answer books.

Make necessary assumptions wherever necessary.

Write precise and to the point answers.

SECTION – I

Answer the following (Any Two) **[20]**

What are the reasons for python being the first programming language of learners?

Explain built-in datatypes of python.

Write a python program to arrange the characters of a given string 'welcome' in an alphabetical order and counts number of vowels.

Answer the following (Any Two) **[20]**

What is list in Python? Demonstrate use of any three methods of list. Establish comparison between list and tuple.

Demonstrate any five operations on strings.

Consider the list L = [1, 7, 9, 12, 16]. Give the output of the following commands.
(i) L[0:3] (ii) L[0:-1] (iii) L[::-1] (iv) L[-1:-4] (v) L[:] (vi) L[:4]

Answer the following (Any One) **[10]**

Write a Python program to multiply two matrices.

What is dictionary in Python? What are the advantages of the Python dictionary type? How do you get a list of all the keys in a dictionary? Explain with an example.

P.T.O.

1707E1010

Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem-I) Examination
Introduction to Programming with Python
July-2018

3 Hours] [Max. Marks : 100

Write both the sections in separate answer books.

Make necessary assumptions wherever necessary.

Write precise and to the point answers.

SECTION – I

Answer the following (Any Two) **[20]**

What are the reasons for python being the first programming language of learners?

Explain built-in datatypes of python.

Write a python program to arrange the characters of a given string 'welcome' in an alphabetical order and counts number of vowels.

Answer the following (Any Two) **[20]**

What is list in Python? Demonstrate use of any three methods of list. Establish comparison between list and tuple.

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Write a Python program to multiply two matrices.

What is dictionary in Python? What are the advantages of the Python dictionary type? How do you get a list of all the keys in a dictionary? Explain with an example.

P.T.O.

1010 - 2

SECTION – II

Q:4 Answer the following (Any Two)

1. What is dictionary in Python? What are the advantages of the Python dictionary type? How do you get a list of all the keys in a dictionary? Explain with an example.
2. Explain if-elif condition. When do we use it? Explain with example.
3. Write a python program using function to find the sum of first 'n' even numbers and print the result.

Q:5 Answer the following (Any Two)

1. Write a python program that generate a random number from 1 to 30 and prompt the user to enter (or guess) the number until it matches with random number. Also, print the number of attempts that the user made.
2. What are the different ways of importing module? Which one is more beneficial? Explain
3. Write a python program to read the contents of a text file and write into another.

Q:6 Answer the following (Any One)

1. Demonstrate with example to randomize the items of a list in python.
2. Store the following data in a list, in a set and in a dictionary.

India	USA	UK	Japan
91	1	41	81

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160/E1005

M.Sc. (AI & ML) (Sem-I) Examination

Mathematical Fundation

July-2018

[Max. Marks : 100

3 Hours]

te : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

(a) Define consistent system of linear equations. Test the consistency of following system of equations: [6]

$$\begin{aligned} x + y + z &= 3 \\ x + 2y + 3z &= 4 \\ x + 4y + 9z &= 6 \end{aligned}$$

(b) Define inverse of a matrix. Find the inverse of the matrix [6]

$$A = \begin{bmatrix} 1 & 0 & -1 \\ 3 & 4 & 5 \\ 0 & -6 & -7 \end{bmatrix}$$

(c) Find the reduced row echelon form of the matrix [6]

$$A = \begin{bmatrix} 1 & -5 & 7 \\ 6 & 9 & 7 \\ -9 & 6 & 1 \end{bmatrix}$$

2 **Attempt the following (Any Two):** [16]

(a) Define eigen values and eigen vectors of a matrix A. Find eigen values and eigen vectors of $A = \begin{bmatrix} 3 & 1 \\ 2 & 4 \end{bmatrix}$ [8]

(b) Diagonalize the following matrix, if possible: [8]

$$A = \begin{bmatrix} 0 & 3 \\ 2 & -1 \end{bmatrix}$$

(c) Find the QR decomposition of [8]

$$A = \begin{bmatrix} 1 & -5 & 7 \\ 6 & 9 & 7 \\ -9 & 6 & 1 \end{bmatrix}$$

Q.3 **Attempt the following (Any Two):**

(a) Apply Gauss Elimination method to solve the system of equations: [8]

$$x + y + 2z = 8$$
$$-x - 2y + 3z = 1$$
$$3x - 7y + 4z = 10$$

(b) Explain (i) Mutually Exclusive events
(ii) Independent Events
Two ordinary six sided dice are tossed. What are the probabilities [8]
(a) That one die only shows a five?
(b) That both die show the number 5 ?
(c) That the sum of the two numbers shown is six?

(c) The life spans of 5000 electrical components are measured to assess their reliability. The life span (L) is recorded in the table below: [8]

Life span of component (yrs)	Number
$L > 5$	500
$4 < L \leq 5$	2250
$3 < L \leq 4$	1850
$L \leq 3$	400

Find the probability that a randomly selected component will last
(i) More than 3 years
(ii) Between 3 and 5 years
(iii) Less than 4 years

Q.4 **SECTION-II**

Attempt the following:

(a) Define subspace of a Vector Space. Show that the set [18]
$W = \{ \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \mid a_{11} + a_{12} + a_{21} + a_{22} = 0 \}$ is a subspace of M_{2x2} under usual addition and scalar multiplication.

(b) Check the linearity of the following transformation. T: $R^3 \rightarrow R^3$ defined by $T(x_1, x_2, x_3) = (x_1 + 1, x_2 + 2, x_3 + 3)$.

(c) What is Cauchy-Schwarz's inequality in inner product space? Verify the Cauchy-Schwarz's inequality for the vectors $-4 + 2x + x^2$ and $8 - 4x - 2x^2$ in P_2 with an inner product $< p, q > = \int_{-1}^{1} p(x)q(x)dx$

5 **Attempt any two from the following:** [16]

(a) Define span of a set $S = \{ v_1, v_2, \ldots, v_n \}$. Which of the following sets of vectors span R^3 ?

(i) $S = \{ [1, 0, 0], [0, 1, 0], [0, 0, 1] \}$

(ii) $S_1 = \{ [1, 1, 1], [0, 1, 1], [0, 0, 1], [1, 2, 3] \}$

(b) Define linearly independent set of vectors. Which of the following set of vectors in R^3 are linearly independent?

(i) $S_1 = \{ [1, 0, 0], [0, 1, 0], [0, 0, 1] \}$

(ii) $S_2 = \{ [1, 2, 5], [3, 6, 15] \}$

(c) Define coordinates relative to a basis. Find the coordinate vector of $[1, 0]$ relative to the basis $S = \{ [1, -1], [1, 1] \}$.

6 **Attempt any two from the following :** [16]

(a) Define null space of a matrix. Find the null space of matrix

$$A = \begin{pmatrix} 1 & 4 & 5 & 6 & 9 \\ 3 & -2 & 1 & 4 & -1 \\ -1 & 0 & -1 & -2 & -1 \\ 2 & 3 & 5 & 7 & 8 \end{pmatrix}$$

(b) Find the associated matrix of the linear transformation T: $R^2 \to R^2$, $T(x_1, x_2) = (2x_1 + x_2, x_1 - x_2)$ with basis $B = \{ [1, 0], [0, 1] \}$ and for the domain and codomain of T.

(c) Construct an orthonormal basis from the basis $\{ [1, 1, 1], [1, 2, 1], [-1, 1, 0] \}$ for Euclidean inner product space R^3.

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M.Sc. (A.I. & M.L.) Sem. I

2/18

1907E1020

Candidate's Seat No :

M.Sc. (AI & ML) (Sem-I) Examination

Object Oriented Concepts & Programming Wing C++

July-2018

Time : 3 Hours] **July-2018** **[Max. Marks : 100**

Note : (1) Write both the sections in the separate answer books
(2) Figures to the right indicate full marks.
(3) Make necessary assumptions wherever necessary.

SECTION-I

Q.1 Answer the following (Any three) [15]

(a) Highlight the strengths of object oriented programming in brief.

(b) Distinguish between private, protected and public visibility specifiers.

(c) What are the advantages of inline functions?

(d) When do we declare a member of a class static? Explain giving suitable example.

Q.2 Answer the following [20]

(a) What is a constructor? Can we have more than one constructor in a class? If yes why would we define more than one constructor in a class? Explain.

(b) What is dynamic constructor? Explain giving suitable example.

(c) Describe the importance of destructor.

(d) Describe the copy constructor and explain its use.

Q.3. (a) Distinguish between multiple and multilevel inheritance. What do you understand by virtual base class ? [7]

(b) Declare a class **vehicle.** Define derived classes two-wheeler, three-wheeler, and four-wheeler (Assume appropriate members for all classes). Display the properties of all the vehicle using member functions of the classes. Write a C++ program to test your classes. [8]

OR

.3 (a) How are friend functions used to carry out overloading of operators? In which situation are they helpful? Explain giving suitable example. [7]

(b) Define **money** class having ruppee and paisa as data members. Overload + and - operators to add and subtract two money objects. Write a C++ program to test your class. [8]

P. T. O.

E10.20-9

SECTION-II

Q4 Answer the following

(a) Explain the use of following functions :

(i) fseek()
(ii) feof()
(iii) fread()
(iv) fopen()

(b) What are the advantages of saving the data in binary form?

Q.5 Answer the following

(a) How do the I/ O facility in C++ differ from that in C ?

(b) Explain conversion from class to basic type giving suitable example.

OR

Q.5 Answer the following

(a) What is **this** pointer? Explain the use of **this** pointer giving suitable example.

(b) What is function template? Write a function template for searching an element in a given array.

Q.6 Write short notes on the following (Any Two)

(a) Run Time Polymorphism
(b) Namespace
(c) Exception Handling
(d) Manipulators

1807E1015

Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem-I) Examination

Introduction to Artificiate Intelligence

July-2018

e : 3 Hours]

[Max. Marks : 100

Section I

e 1 Answer the following:

Explain seven problem characteristics with suitable examples. 9

Define Artificial Intelligence. List various applications of Artificial Intelligence. 5

Write generate and test algorithm. 4

e 2

Write an algorithm for best first search. 8

Explain different characteristics of knowledge. 8

OR

e 2

What is state space search? Explain with water jug problem. 8

Write an algorithm for depth first search and compare that with breadth first search. 8

e 3

Explain how facts and rules are written in logic programming. 8

Translate the following sentences into predicate logic. 8

i) Cow is an animal.

ii) Cow is white.

iii) Cow eats sweet green grass.

iv) Horse runs very fast.

SECTION II

4 (Any 2) 18

Write a short note on Non monotonic reasoning system

Write a short note on natural language processing

5

Write a short note on artificial Neural Networks. 8

What does it mean by parallel relaxation? Explain with example. 8

OR

5

Explain back propagation networks 8

Explain supervised learning and reinforcement learning in Neural Networks. 8

What is the difference between both of them?

6

Define the following: (any 4) 8

i) Probability

ii) Independent event

iii) Mutually exclusive event

iv) Impossible event

v) Exhaustive events

P.T.O.

E 1015 - 2

b) Solve the following:,

A = {(x1, 0.7), (x2, 1), (x4, 0.3),(x6,0)}

B = {(x1, 0.4), (x2, 0.5),(x3,0.8),(x5,1),(x6,0)}

Find:

1) A UNION B
2) B - A
3) A –B
4) A intersection B

1707E1010 Candidate's Seat No :_____

M.Sc. (AI & ML) (Sem-I) Examination
Introduction to Programming with Python
July-2018

[Max. Marks : 100

: 3 Hours]

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P.T.O.

1010 - 2

SECTION – II

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