

(7 pages)

Reg. No. : .....

Code No. : 5734

Sub. Code : ZCIM 15

M.Sc. (CBCS) DEGREE EXAMINATION,  
APRIL 2023.

First Semester

Computer Science with Artificial Intelligence – Core

MATHEMATICAL FOUNDATION FOR DATA  
ANALYTICS

(For those who joined in July 2022 onwards)

Time : Three hours

Maximum : 75 marks

PART A — (10 × 1 = 10 marks)

Answer ALL questions.

Choose the correct answer :

1. Identify the type of learning in which labelled training data is used  
(a) Semi unsupervised learning  
(b) Supervised learning  
(c) Reinforcement learning  
(d) Unsupervised learning

2. Analysis of ML Algorithm needs \_\_\_\_\_  
(a) Statistical learning theory  
(b) Computational learning theory  
(c) Both (a) and (b)  
(d) None of the above
3. Gradient descent is an optimisation algorithm used for \_\_\_\_\_  
(a) Certain changes on algorithm  
(b) Minimising cost function  
(c) Maximising the cost function  
(d) Remaining same cost function
4. If the cost function is convex, then it converges to a \_\_\_\_\_  
(a) Global minimum (b) Global maximum  
(c) Local minimum (d) Local maximum
5. Given the equations are  $4x + 2y + z = 8$ ,  $x + y + z = 3$ ,  $3x + y + 3z = 9$  find the values of  $x$ ,  $y$  and  $z$  \_\_\_\_\_  
(a)  $\frac{5}{3}, 0, \frac{2}{3}$  (b) 1, 2, 3  
(c)  $\frac{4}{3}, \frac{1}{3}, \frac{5}{3}$  (d) 2, 3, 4

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6. The rank of the matrix ( $m \times n$ ) where  $m < n$  cannot be more than \_\_\_\_\_  
(a)  $m + n$  (b)  $m - n$   
(c)  $n$  (d)  $m$
7. Execute the following octave commands  
 $A = \{1, 2; 3, 4; 5, 6\}$ ;  $B = \{1, 2, 3; 4, 5, 6\}$ ;  
Which of the following are then valid commands?  
(a)  $C = A * B$  (b)  $C = B + A$   
(c)  $C = A * B$  (d) Both (a) and (b)
8. Let  $A$  be a  $10 \times 10$  matrix and  $X$  be a 10 element vector. Compute product  $A_X$  and write the following code  

```
V = zeros (10, 1); For i = 1; 10 for j = i : 10  
V = (i) = V (i) + A (i, j) * X (j);  
end  
end
```

How would you vectorise this code to run with out any for Loops \_\_\_\_\_  
(a)  $V = A * X$  (b)  $V = X * A$   
(c)  $V = A * X$  (d)  $V = \text{Sum} (A * X)$
9. Data can be visualised using \_\_\_\_\_  
(a) graphs (b) charts  
(c) maps (d) all of the above

10. Identify the clustering method which takes care of variance in data \_\_\_\_\_  
(a) Decision tree  
(b) Gaussian mixture model  
(c) K means  
(d) All of the above

PART B — (5 × 5 = 25 marks)

Answer ALL questions, choosing either (a) or (b).

11. (a) What are the advantages of supervised learning?  
Or  
(b) Discuss the most common unsupervised learning approaches.
12. (a) Write a short note on Stochastic Gradient Descent.  
Or  
(b) Explain the rules followed in gradient descent.

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[P.T.O.]

13. (a) If  $A = \begin{pmatrix} 2 & 5 \\ 1 & 3 \end{pmatrix}$  and  $B = \begin{pmatrix} 1 & -1 \\ -3 & 2 \end{pmatrix}$  find  $AB$  and  $BA$ . Is  $AB = BA$ .

Or

- (b) If  $A = \begin{pmatrix} 0 & 2 & 3 \\ 2 & 1 & 4 \end{pmatrix}$  and  $B = \begin{pmatrix} 7 & 6 & 3 \\ 1 & 4 & 5 \end{pmatrix}$  find the value of  $2A + 3B$ .

14. (a) How do you plot histogram?

Or

- (b) The position vectors of four points P, Q, R, S are  $a$ ,  $b$ ,  $2a + 3b$ ,  $2a - 3b$  respectively. Express the vectors  $\overline{PR}$ ,  $\overline{RS}$  and  $\overline{PQ}$  in terms of  $a$  and  $b$ .

15. (a) What are the advantages of vector victimisation representation?

Or

- (b) How do you find maximum value of matrices?

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PART C — (5 × 8 = 40 marks)

Answer ALL questions, choosing either (a) or (b).

16. (a) What is the cost function? Explain its types.

Or

- (b) Explain in detail the supervised and unsupervised learning with example.

17. (a) Explain the procedure for fitting a model to data.

Or

- (b) Consider the two functions

$$f_1(x, y) = (x - 5)^2 + (y + 2)^2 - 2xy$$

$$F_2(x, y) = [1 - (y - 4)^2 + 20(x + 6) - (y - 4)^2]^2$$

Starting with  $(x, y) = (0, 2)$  run the gradient descent algorithm for each function. Run for T iterations and report the function value at the end of each step.

18. (a) If  $a = 2i + 3j - 4k$ ,  $b = 3i + j - 2k$ ;  $c = -2i - j + k$  find (i)  $a \cdot b$  (ii)  $a \times b$  (iii)  $a \cdot (b \times c)$ .

Or

- (b) Compute the inverse of the matrix

$$\begin{pmatrix} 1 & 0 & -4 \\ -2 & 2 & 5 \\ 3 & -1 & 2 \end{pmatrix}$$

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19. (a) What is Digital matrix? How to create Digital matrix?

Or

- (b) Write a note on :  
(i) Assignment of variable  
(ii) Logical operations in octave.

20. (a) How to find transpose of a matrix in octave?

Or

- (b) List out and explain the control statements available in octave.

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