## END SEMESTER EXAMINATION - MARCH 2025
### SEMESTER 4 : INTEGRATED M.Sc. PROGRAMME COMPUTER SCIENCE- DATA SCIENCE
COURSE : **21UP4CRMCP13 : BASICS OF ARTIFICIAL INTELLIGENCE**
*(For Regular 2023 Admission and Improvement/Supplementary 2022/ 2021 Admissions)*

Time : Three Hours                                                      Max. Weightage: 30

### PART A
### Answer any 8 Questions

1.  Let *N (x)* be the statement "*x* has visited North Dakota," where the domain consists of the students in your school. Express the quantification $\exists x \neg N(x)$ in English.

2.  List any four heuristic search techniques commonly used in AI-based problem solving.

3.  Write the recurrence relation of the sequence: 1, 3, 6, 10, 15, 21, .....

4.  List any two examples of variables that would be strongly correlated.

5.  Define the term regression in statistics.

6.  The derivative of a constant-valued function is _____.

7.  Find the generating function of the sequence: 0, 1, -2, 3, -4, 5, .......

8.  Define the term partial derivative of a function.

9.  If the proposition *p* states "I bought a lottery ticket this week.", and *q* states "I won the million dollar jackpot.", express the proposition ¬*p* ∨ (*p* ∧ *q*) in English sentences.

10. Write the formula to calculate the sum of an infinite geometric series.

**(1 x 8 = 8 Weight)**

### PART B
### Answer any 6 Questions

11. Discuss briefly about scaling of generating functions.

12. Show that the premises "A student in this class has not read the book," and "Everyone in this class passed the first exam" imply the conclusion "Someone who passed the first exam has not read the book."

13. A box contains 6 red, 4 white and 5 black balls. A person draws 4 balls from the box at random. Find the.probability that among the balls drawn, there is at least one ball of each colour.

14. Write short notes on agents in the context of Artificial Intelligence.

15. Three groups of children contain respectively 3 girls and 1 boy, 2 girls and 2 boys, and 1 girl and 3 boys. One child is selected at random from each group. Show that the chance that the three selected consist of 1 girl and 2 boys is 13 / 32.

16. Find $\frac{\partial z}{\partial x}$ and $\frac{\partial z}{\partial y}$ for the following function:
$$x^2 \sin y^3 + xe^{3z} - \cos z^2 = 3y - 6z + 8$$

17. Find the derivative of $\sqrt{\sin \sqrt{x}}$.

18. Explain the various types of constraints in a constraint satisfaction problem.

**(2 x 6 = 12 Weight)**

### PART C
### Answer any 2 Questions

19. Explain the Karl Pearson's correlation coefficient, along with the underlying assumptions.

20. Discuss how graphs / trees can be used in problem solving in AI.

21. Solve the recurrence relation $3a_{n+1} - 4a_n = 0, \; n \geq 0, \; a_1 = 5$

22. Find $\frac{dy}{dx}$ of the following functions:

(a). $y = \cos^{-1}\left(\frac{1-x^2}{1+x^2}\right), \; 0 < x < 1$

(b). $y = \sin^{-1}\left(\frac{2x}{1+x^2}\right)$

**(5 x 2 = 10 Weight)**