

BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, Pilani

Mid Semester Exam 2023-2024

Applications of Artificial Intelligence in Civil Engineering

CE F417

Max. Marks: 100

Dated: 12/10/2023

Duration: 90 minutes

Q.1 Compressive strength is the main measure of structural quality of concrete. Structural design depends mainly on the compressive strength for some purposes the tensile strength is of interest. In the design of highway and airfield slabs, shear strength, and resistance to cracking requires information about the tensile strength. The compressive and splitting tensile strength are closely related depending on the nature strength of concrete. Concrete is not normally designed to resist direct tension; the knowledge of tensile strength is used to estimate the load under which cracking will develop. This is due to its influence on the formation of cracks and their propagation to the tension side of reinforced concrete flexural member. There is no direct relation between the compressive and the splitting tensile strengths. It was noticed that with the increased compressive strength, the tensile splitting strength is also increased but at a decreasing rate. Investigation was intended to present a relationship between compressive strength and splitting tensile strength for Self Compacting Concrete (SCC) containing microsilica (mS) as a cement replacement by weight and cast using portland cement. All other parameters (fine aggregates, coarse aggregates, water quantity are 850 kg/m^3 , 850 kg/m^3 , and 152 L/m^3 respectively, kept constant). 28 days strength were obtained as shown in table below. Predict the strength for 6% replacement. Take 2 neurons in hidden layer; complete one epoch.

Mix	Cement (kg/m^3)	mS (kg/m^3)	Slump flow (mm)	28 days compressive strength (MPa)	28 days Tensile splitting strength (MPa)
SCC ref	400	0	740	41.84	4.12
SCC 3% mS	388	12	717	44.72	4.63
SCC 6% mS	382	24	705		

(50)

Q.2 Consider the following civil engineering projects with the respective costs and benefits indicated. The total budget is 60 crores. Determine the optimal portfolio of projects using GA.

1. Population size = 4
2. Cross-over probability = 0.5
3. Mutation probability = 0.05
4. Iteration = 2

Project Id	Cost (crore)	Benefit (Lacs)
1	10	94
2	20	95
3	12	65
4	13	64
5	19	69
6	15	65

(30)

68384 69452 66248 75861 47021 33540 47426 05769
57298 29268 60243 67316 72656 56634 04700 60503
19654 89083 80797 58771 98292 79729 61975 88678
08569 75456 74793 50226 23927 76265 19250 43412
70925 35272 68788 41681 49562 99360 76525 71588
59839 95087 89342 33136 75197 22454 33799 26322
48753 54903 83338 24590 27390 45549 64516 54498
11109 41276 77334 16045 53026 42085 21791 82674
00023 01092 97887 07500 78661 65180 79065 37408
62380 60907 91883 98955 04296 88274 36340 65584
51294 20722 85879 90410 29931 84810 93615 20318
40208 80538 06432 81865 55566 07905 50889 48494
02564 66911 00428 73320

Q.3 Write T(True) or F (False).

(i) Writing T or F without explanation will not fetch any mark. (ii) Correct answer (T/F) with correct explanation will fetch +3 for each question, (iii) Wrong answer (T/F) with explanation will fetch -1 for each question.

1. In an Unsupervised learning both inputs and outputs are given.
2. A 3-input neuron is trained to output a zero when the input is 110 and a one when the input is 111. After generalization, the output will be zero when the input is 010
3. A perceptron is a single layer feed-forward neural network with pre-processing
4. Genetic Algorithm is a randomized parallel search algorithm, based on the principles of natural selection, the process of evolution.
5. GAs are exhaustive, giving out all the optimal solutions to a given problem.
6. GAs are used for solving optimization problems and modeling evolutionary phenomena in the natural world.

(15)

Q.4. Match the following (1-1)

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|--------------------|--|
| 1. Backpropagation | 1. Fundamental unit of an ANN |
| 2. Mutation | 2. Randomly changing genes in GA |
| 3. Synapse | 3. Maintaining variety in a GA populatio5 |
| 4. Convergence | 4. Connection between two neurons in an ANN |
| 5. Bias | 5. Algorithm used for training ANNs |
| | 6. When a GA solution reaches an optimal or near-optimal state |
| | 7. Genetic operator in Genetic Algorithms |
| | 8. An additional parameter in ANNs that shifts the activation function |

(5)