**Time: 3 Hours** **Max. Marks: 80**

INSTRUCTIONS:
(1) Question 1 is compulsory.
(2) Attempt any **three** from the remaining questions.
(3) Draw neat diagrams wherever necessary.

**Q.1** **5 marks each**

(a) From above given probability distribution find **P (**Cavity | Toothache**)**

| | Toothache | | ¬ Toothache | |
|---|---|---|---|---|
| | Catch | ¬ Catch | Catch | ¬ Catch |
| Cavity | 0.108 | 0.012 | 0.072 | 0.008 |
| ¬ Cavity | 0.016 | 0.064 | 0.144 | 0.576 |

(b) Explain the Centroid method of Defuzzification with a suitable diagram?
(c) Describe Deep Learning concept with an example.
(d) Describe in detail Holdout method and Random subsampling?

**Q.2** **10 marks each**

(a) How to improve the classification accuracy of class-Imbalanced data. Explain with suitable examples.
(b) Define Cognitive Computing. Draw a neat diagram of elements of the cognitive system and explain the elements.

**Q.3** **10 marks each**

(a) Explain the components of CNN architecture.
(b) What is Multi modal application? Explain the Data Science for Multi modal applications.

**Q.4** **10 marks each**

(a) Consider two fuzzy sets.

$$\underset{\sim}{A}=\left\{\frac{0.2}{1}+\frac{0.3}{2}+\frac{0.4}{3}+\frac{0.5}{4}\right\}$$

$$\underset{\sim}{B}=\left\{\frac{0.1}{1}+\frac{0.2}{2}+\frac{0.2}{3}+\frac{0.1}{4}\right\}$$

Find the algebraic sum, algebraic product, bounded sum, and bounded difference of the given fuzzy sets and also describe properties of fuzzy sets.
(b) Illustrate inferencing in Bayesian Belief Network with an example.

**Q.5** **10 marks each**

(a) List steps in building a typical cognitive application. Explain the same for Healthcare application.
(b) Illustrate the autoencoder with architecture diagram.

**Q.6** **10 marks each**

(a) Calculate Accuracy, Precision, Recall, Sensitivity and Specificity for the following example.

| Actual Class / Predicted Class | Cancer=yes | Cancer=no |
|---|---|---|
| Cancer=yes | 90 | 210 |
| Cancer=no | 140 | 9560 |

(b) Write a short note on- Trends in Data Science.

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