# B3.2-R5 : ARTIFICIAL INTELLIGENCE AND MACHINE LEARNING

**DURATION : 03 Hours**                                            **MAXIMUM MARKS : 100**

**Roll No. :**

**Answer Sheet No. :**

**Name of Candidate :** _____ ; **Signature of Candidate :** _____

## INSTRUCTIONS FOR CANDIDATES :

- Carefully read the instructions given on Question Paper, Answer Sheet.

- Question Paper is in English language. Candidate has to answer in English Language only.

- **Question paper contains Seven questions. The Question No. 1 is compulsory. Attempt any FOUR Questions from Question No. 2 to 7.**

- **Parts of the same question should be answered together and in the same sequence.**

- **Questions are** to be answered in the **ANSWER SHEET** only, supplied with the Question Paper.

- **Candidate cannot leave the examination hall/ room without signing on the attendance sheet and handing over his/her Answer Sheet to the Invigilator. Failing in doing so, will amount to disqualification of Candidate in this Module/Paper.**

- After receiving the instruction to open the booklet and before answering the questions, the candidate should ensure that the Question Booklet is complete in all respects.

## DO NOT OPEN THE QUESTION BOOKLET UNTIL YOU ARE TOLD TO DO SO.

1. (a) Is Python Call by Value or Call by Reference ? How are arguments passed by value or by reference ?

   (b) What is hard margin and soft margin in support vector machines ?

   (c) What factors affect the performance of Face Recognition System ?

   (d) What is the difference between policy and value function in reinforcement learning ? Why do we prefer Q learning ?

   (e) What is sampling with replacement and without replacement ?

   (f) Draw a graph of state space vs objective function that indicates both global and local maxima. Explain Simple Hill Climbing Algorithm.

   (g) Explain the different types of ambiguity associated with Natural Language Processing. **(7x4)**

2. (a) Explain the difference between supervised and unsupervised Learning.

   (b) Discuss various types of intelligent agents in Artificial Intelligence.

   (c) What are the key differences between OLAP and OLTP ? **(5+9+4)**

3. (a) Given three Points $(x1, y1)$, $(x2, y2)$ and $(x3, y3)$, write a Python program to check if they are collinear.

   (b) Write a Python program to find the longest word in a file. Get the file name from user.

   (c) Write a Python program to color between the curve of the mathematical function $f(x)=\sin(x)$. **(5+5+8)**

4. Consider the following four faces shown in Figure 1. You are given two sets of 100 points that fall within the unit square. Again, darkness or number of dots represents density. Lines are used only to distinguish regions and do not represent points.



(a)          (b)          (c)          (d)
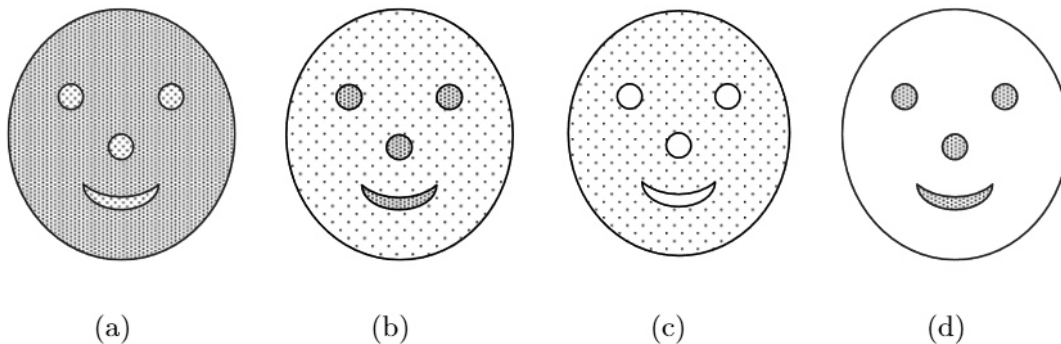
**Figure 1. Smiling Faces**

   (a) For each figure, could you use single linkage hierarchical clustering to find the patterns represented by the nose, eyes, and mouth ? Explain.

   (b) For each figure, could you use K-means to find the patterns represented by the nose, eyes, and mouth ? Explain.

   (c) What limitation does clustering have in detecting all the patterns formed by the points in Figure 1 ? **(7+7+4)**

**5.** Consider the following dataset for a binary class problem.

| A | B | Class Label |
|---|---|---|
| T | F | + |
| T | T | + |
| T | T | + |
| T | F | − |
| T | T | + |
| F | F | − |
| F | F | − |
| F | F | − |
| T | T | − |
| T | F | − |

(a) Calculate the information gain when splitting on A and B. Which attribute would the decision tree induction algorithm choose ?

(b) Calculate the gain in the Gini index when splitting on A and B. Which attribute would the decision tree induction algorithm choose ?

(c) Is it possible that information gain and the gain in the Gini index favor different attributes ?

**(7+7+4)**

**6.** (a) Explain the Softmax and ReLU functions in deep learning.

(b) What are the effects of using a learning rate that is too low or too high in deep learning ?

(c) What is transfer learning and its applications in Computer Vision ?

(d) What is overfitting and underfitting in deep learning, and how can they be addressed ?

**(4+4+4+6)**

**7.** (a) What is NLTK ? How does it differ from Spacy ?

(b) Explain the role of transformational rules in transformational grammar with the help of an example.

(c) List the problems associated with n-gram model. Explain how these problems are handled.

**(6+4+8)**

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**SPACE FOR ROUGH WORK**