AML Assignment-2

Q1. Define Generalized Linear Model along with its 3 components?

Q2. Explain the following equation in terms of GLM models for Linear Regression, Logistic Regression and Poisson Regression: $u = b_0 + b_1 X$

Q3. Differentiate between General Linear Model and Generalised Linear Model.

Q4. Which shortcomings of Linear Regression led to the development of Generalised Linear Models. Elucidate with examples.

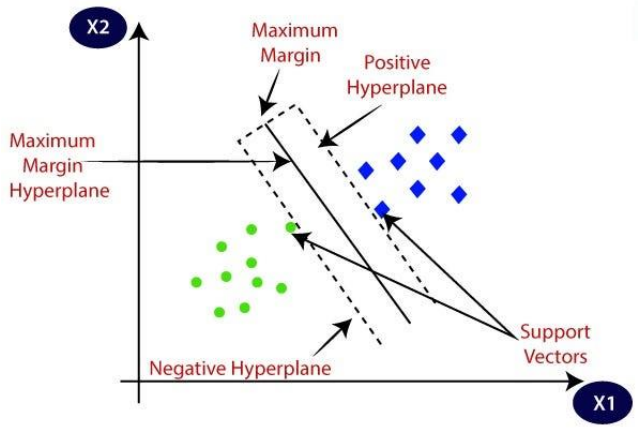
Q5. Define Link Function in Generalised Linear Model. Write Link functions for Linear Regression, Logistic Regression and Poisson Regression.

Q6. Draw a flowchart to explain the working of Expectation-Maximization Algorithm. Explain each step of E-M algorithm in detail.

Q7. Write 3 applications of EM algorithm. Also, give advantages and disadvantages of using EM.

Q8. Define Gaussian Mixture Model in brief. How EM is used in GMM?

Q9. What are Support Vector Machines (SVMs)? Explain each component of the following sample SVM graph:



Q10. What are Support Vectors in SVMs? What is the basic principle of a Support Vector Machine?

Q11. What is the "Kernel trick"? Explain the role of Kernel Trick in improving SVM model.

Q12. What is the role of the C hyper-parameter in SVM? Does it affect the bias/variance trade-off?

Q13. Explain different types of kernel functions with their graphs. You may consider the example of Iris dataset to explain these Kernel Functions.

Q14. Define the term Hyperparameter. Explain the role of C-hyperparameter and Gamma hyperparameter in SVM.

Q15. If you train an SVM classifier with an RBF kernel. It seems to underfit the training dataset: should you increase or decrease the hyper-parameter γ (gamma)? What about the C hyper-parameter?

Q16. Is SVM sensitive to the Feature Scaling?

Q17. Explain the following concepts and terms related to Genetic Algorithm:

- Population

- Chromosomes
- Gene
- Allele
- Fitness function
- Genetic operators

Q18. Draw a flowchart to show the working of Genetic Algorithms. Differentiate between Mutation and Crossover genetic operators.

Perform one iteration of the algorithm with the following four strings as the original population:

String 1 : 11011, String 2 : 01010, String 3 : 01000, String 4 : 10101.

Of course, we cannot use actual roulette wheel selection in the assignment, so make the following assumptions (where, as in the study guide, string positions are counted from the left):

(1) **Selection.**
Suppose that roulette wheel selection gave strings 1 and 2 as a breeding pair, and strings 2 and 4 as a breeding pair.

(2) **Crossover.**
For the breeding pair string 1, string 2 the crossover position 3 was randomly selected, and for the breeding pair string 2 and string 4 the crossover position 4 was randomly selected.

(3) **Mutation.**
All the children had mutation position 2.

Q19.

Write output of each step after 1 iteration.

Q20. Solve the following 0/1 Knapsack problem using Genetic Algorithm.

Suppose we have a knapsack that has a capacity of 13 cubic inches and several items of different sizes and different benefits. We want to include in the knapsack only these items that will have the greatest total benefit within the constraint of the knapsack's capacity. There are three potential items (labeled 'A,' 'B,' 'C'). Their volumes and benefits are as follows:

Item #	A	B	C
Benefit	4	3	5
Volume	6	7	8

We seek to maximize the total benefit:

Q21. Explain different types of Mutations and Crossover operations in Genetic Algorithm. Write outputs for the following: