[Time: 3 hrs] **[Total Marks: 80]**

Note : 1. Question 1 is compulsory
2. Answer any three out of remaining question
3. assume suitable data where required

Q1	Attempt any **4**	**[20]**
[A]	Explain problems faced by Hill Climbing algorithm.	**[05]**
[B]	Write PEAS descriptor for Shopping for used AI books on the Internet.	**[05]**
[C]	Write a program in Prolog to create a family tree.	**[05]**
[D]	Draw and explain architecture of Expert System.	**[05]**
[E]	Discuss different types of environments for Intelligent Agents.	**[05]**
Q2		**[20]**
[A]	Explain A algorithm with an example. Also discuss its performance.	**[10]**
[B]	What are the different types of agents? Explain Goal based agent with a diagram.	**[10]**
Q3		**[20]**
[A]	What is formulation of a problem? Formulate 8-Puzzle problem in terms of following components: initial state, actions, successor function, goal test and path cost.	**[10]**
[B]	Define chromosome, selection, fitness function, cross over and mutation as used in genetic algorithm. Explain the working of genetic algorithm.	**[10]**
Q4		**[20]**
[A]	"As per the law, it is a crime for an American to sell weapons to hostile nations. Country A, an enemy of America, has some missiles, and all the missiles were sold to it by Robert, who is an American citizen." Prove that "Robert is criminal." Using forward and backward Chaining.	**[10]**
[B]	What is planning in AI? Explain partial order planning with an example.	**[10]**

Q5 **[20]**

[A] Write first order statements for following **[10]**

(i) Every dolphin is Mammal

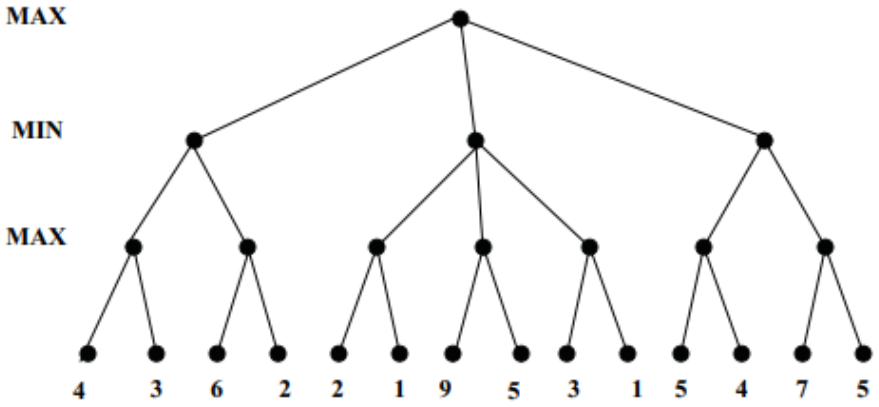
(ii) No purple mushroom is poisonous.

(iii) Every gardener loves sun.

(iv) You can fool someone all the time.

(v) All Romans were either loyal to ceaser or hated him.

[B] Explain Alpha-beta pruning algorithm. Apply alpha beta pruning on the following example considering the first node as MAX. **[10]**



Q6 **[20]**

[A] Explain Bayesian Belief Networks with an example. **[10]**

[B] Explain different types of learning in AI. **[10]**

****

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

Instructions:

1) **Question Number 1** is compulsory.
2) Solve any **three** questions out of remaining **five** questions.
3) Each Question carry 20 marks.
4) Illustrate your answers with neat sketches wherever necessary.
5) Figures to the right indicate full marks.
6) Assume suitable additional data, if necessary and clearly state it.
7) All sub-questions of the same question should be grouped together.

Q.1	**Answer any four.**		
	(a)	Give the any five applications of IoT.	**05**
	(b)	Give the advantages and disadvantages of NB-IoT.	**05**
	(c)	With suitable parameters compare CoAP with MQTT protocol.	**05**
	(d)	Explain similarities and differences of IoT and IIoT.	**05**
	(e)	Describe the data retention strategy in IoT.	**05**
Q.2	**(a)**	Compare with suitable parameters Fog computing with Edge computing.	**05**
	(b)	Give the IT and OT Responsibilities in the IoT Reference Model.	**05**
	(c)	Explain the role of Bluetooth Low Energy (BLE) in IoT and differentiate between Zigbee and Z-wave.	**10**
Q.3	**(a)**	Explain the complex flows between HTTP and MQTT in IoT applications.	**05**
	(b)	What is WebSocket and how it works?	**05**
	(c)	What is IoT data analytics? Explain different types of IoT Data Analytics.	**10**
Q.4	**(a)**	Explain various IoT Communication Models considering Logical Design of IoT.	**05**
	(b)	Explain the characteristics of Smart object.	**05**
	(c)	Explain how IoT can be used for smart parking in a city.	**10**
Q.5	**(a)**	Explain the Core IoT functional stack: Data Analytics versus Business Benefits.	**05**
	(b)	Considering the Core IoT Functional Stack Layer 3 - Applications and Analytics Layer, describe following terms i) Analytics application and ii) Network analytics.	**05**
	(c)	Describe the key features of 6LoWPAN. Give the comparison of an IoT Protocol Stack Utilizing 6LoWPAN and an IP Protocol Stack.	**10**
Q.6	**(a)**	Explain STOMP Architecture protocol in IoT.	**05**
	(b)	Give the benefits and drawbacks of AMQP protocol.	**05**
	(c)	Explain the key principles of Visualization and Dashboarding-Designing visual analysis for IoT data in applications.	**10**

———————

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

Instructions:

1) **Question Number 1** is compulsory.
2) Solve any **three** questions out of remaining **five** questions.
3) Each Question carry 20 marks.
4) Illustrate your answers with neat sketches wherever necessary.
5) Figures to the right indicate full marks.
6) Assume suitable additional data, if necessary and clearly state it.
7) All sub-questions of the same question should be grouped together.

Q.1	**Answer any four.**		
	(a)	Give the any five applications of IoT.	**05**
	(b)	Give the advantages and disadvantages of NB-IoT.	**05**
	(c)	With suitable parameters compare CoAP with MQTT protocol.	**05**
	(d)	Explain similarities and differences of IoT and IIoT.	**05**
	(e)	Describe the data retention strategy in IoT.	**05**
Q.2	**(a)**	Compare with suitable parameters Fog computing with Edge computing.	**05**
	(b)	Give the IT and OT Responsibilities in the IoT Reference Model.	**05**
	(c)	Explain the role of Bluetooth Low Energy (BLE) in IoT and differentiate between Zigbee and Z-wave.	**10**
Q.3	**(a)**	Explain the complex flows between HTTP and MQTT in IoT applications.	**05**
	(b)	What is WebSocket and how it works?	**05**
	(c)	What is IoT data analytics? Explain different types of IoT Data Analytics.	**10**
Q.4	**(a)**	Explain various IoT Communication Models considering Logical Design of IoT.	**05**
	(b)	Explain the characteristics of Smart object.	**05**
	(c)	Explain how IoT can be used for smart parking in a city.	**10**
Q.5	**(a)**	Explain the Core IoT functional stack: Data Analytics versus Business Benefits.	**05**
	(b)	Considering the Core IoT Functional Stack Layer 3 - Applications and Analytics Layer, describe following terms i) Analytics application and ii) Network analytics.	**05**
	(c)	Describe the key features of 6LoWPAN. Give the comparison of an IoT Protocol Stack Utilizing 6LoWPAN and an IP Protocol Stack.	**10**
Q.6	**(a)**	Explain STOMP Architecture protocol in IoT.	**05**
	(b)	Give the benefits and drawbacks of AMQP protocol.	**05**
	(c)	Explain the key principles of Visualization and Dashboarding-Designing visual analysis for IoT data in applications.	**10**

———————

Duration: 3hrs **[Max Marks:80]**

(1) Question No 1 is Compulsory.
(2) Attempt any three questions out of the remaining five.
(3) All questions carry equal marks.
(4) Assume suitable data, if required and state it clearly.

1 Attempt any **four** **[20]**

a) Write a short note on hypothesis testing.
b) What is Fisher's exact test?
c) Write a short note Simple Linear Regression
d) Write a short note on Random sampling
e) What is the empirical CDF function?

2 a) Construct a frequency distribution table for the following weights (in gm) of 30 oranges using the equal class intervals, one of them is 40-45 (45 not included). The weights are: 31, 41, 46, 33, 44, 51, 56, 63, 71, 71, 62, 63, 54, 53, 51, 43, 36, 38, 54, 56, 66, 71, 74, 75, 46, 47, 59, 60, 61, 63. **[10]**

(a) What is the class mark of the class intervals 50-55?
(b) What is the range of the above weights?
(c) How many class intervals are there?
(d) Which class interval has the lowest frequency?

b) What is the primary purpose of conducting a one-way ANOVA. Explain the key components of a one-way ANOVA, including the dependent variable, independent variable, and factors. **[10]**

3 a) Find the standard error of the estimate for the average number of children in a household in your city by using the data collected from a sample of households in your city. Then find a 95% confidence interval for the data. **[10]**

Household	No. of children
1	2
2	3
3	1
4	0
5	5
6	2
7	1
8	4

b) What is the concept of correlation in statistics, how is it different from regression? **[10]**

4 a) A radar unit is used to measure speeds of cars on a motorway. The speeds are normally distributed with a mean of 90 km/hr and a standard deviation of 10 km/hr. What is the probability that a car picked at random is travelling at more than 100 km/hr? **[10]**

b) Explain Numerical and Categorical data types with appropriate examples **[10]**

5 a) Duracell manufactures batteries that the CEO claims will last an average of 300 hours under normal use. A researcher randomly selected 20 batteries from the production line and tested these batteries. The tested batteries had a mean life span of 270 hours with a standard deviation of 50 hours. Do we have enough evidence to suggest that the claim of an average lifetime of 300 hours is false? **[10]**

b) Explain linear least square regression (LLSR) along with it's advantages and disadvantages. **[10]**

6 a) A farmer is trying out a planting technique that he hopes will increase the yield on his pea plants. The average number of pods on one of his pea plantsis 145 pods with a standard deviation of 100 pods. This year, after trying his new planting technique, he takes a random sample of his plants and finds theaverage number of pods to be 147. He wonders whether or not this is a statistically significant increase. What are his hypotheses and the test statistic? **[10]**

b) What is the Chi-Square Test in statistics, and in what kind of situations or research scenarios is it commonly used? **[10]**

****