1. What is the concept of human learning? Please give two examples.

Concept of humans learning by observation, experience, memorising, instructions etc., is called human learning.

* Child tries to identify the objects by continuous observation, memorisation and training.
* Riding bicycle. Initially child may struggle to balance the bicycle but by trail and error and by constant practice it will learn to balance.
* Learning a new language.

1. What different forms of human learning are there? Are there any machine learning equivalents?

Some forms of human learning are as follows:

* Learning by observation.
* Learning by insights.
* Learning by experience.

Reinforcement learning can be considered as equivalent to Machine Learning.

1. What is machine learning, and how does it work? What are the key responsibilities of machine learning?

Machine learning happens with the help of data. Models are built by observing different patterns in the data. Through the patterns different understandings related to the given problem can be found for taking better decisions.

* As machine learning operates with data, finding the suitable, appropriate, good quantity data is very crucial.
* Developing the model by selecting appropriate algorithms to get suitable accuracy and getting the reliable model.
* Tuning the model to improve its performance and addressing the issues such as Overfitting and Underfitting.
* Deployment of the model and maintaining it with continuous monitoring.

1. Define the terms "penalty" and "reward" in the context of reinforcement learning.

Reinforcement learning algorithms work on Reward-Penalty method. If the algorithm works or makes correct move it will be rewarded, if the algorithm makes any errors, it will be penalised.

1. Explain the term "learning as a search"?

Searching the best suitable model to solve the problem. Learning as a search means finding many possible methods for solution that need to be explored. To find the best parameters for the model to maximise its productivity or performance for a given problem is the basis for learning as a search.

1. What are the various goals of machine learning? What is the relationship between these and human learning?

The purpose of Machine Learning is to discover the patterns in the available data, which helps to make predictions and answering the questions related to problems. General goals are supervised learning, unsupervised learning and reinforcement learning.

Human learning is more general and flexible. Human can learn from vast experience through which one goes where as machine learning algos are designed to solve particular problems.

1. Illustrate the various elements of machine learning using a real-life illustration.

Key elements of Machine Learning are Representation of the model, evaluation of the model and optimisation of the model.

1. Provide an example of the abstraction method.

Abstraction means generalising the pattern in the data and to create abstract representations of the data which are helpful in problem solving. Creating a set of features which capture the most important information form the data is the main aim in abstraction method.

Example: Identifying the grammar, length of the message, punctuation, unique keywords in identifying the spam messages.

1. What is the concept of generalization? What function does it play in the machine learning process?

Generalisation refers to the trained model’s ability to adapt to new unseen data. It means how accurately a model is able to predict outcomes for previously unseen data.

1. What is classification, exactly? What are the main distinctions between classification and regression?

Classification means labelling or predicting a particular class. Classification predicts a discrete class label.

Regression means predicting the output variable which is continuous quantity like Temperature, House price etc.,

1. What is regression, and how does it work? Give an example of a real-world problem that was solved using regression.

Regression means building the relationship (Mathematical model) between dependent and independent variables. The output feature should be a continuous quantity. If only one independent and dependent feature is there, then it is called as Simple Linear Regression and if there are more than one independent features are used for prediction of dependent variable, then it is called as Multiple Linear Regression.

It works on the principle of Gradient Descent where the coefficients are continuously updated to get the global minima.

Practical Example:

* Effect of water and fertilizer on crop yields uses water and fertiliser as two independent features and crop yield as dependent feature.

1. Describe the clustering mechanism in detail.

Clustering is the process of grouping the datapoints into number of groups based on the similarity and dissimilarity between them. Similar nature of data points are grouped to the same cluster. Clustering is an unsupervised type of Machine Learning.

K-Means Clustering, DBSCAN, Hierarchical Clustering etc., are the different unsupervised algorithms used for clustering.

1. Make brief observations on two of the following topics:
   1. Machine learning algorithms are used
   2. Studying under supervision
   3. Studying without supervision
   4. Reinforcement learning is a form of learning based on positive reinforcement.
2. Machine learning algorithms are used: ML algorithms will find the hidden patterns inside the data to predict the output. Different types of ML algorithms are used to do different tasks. For Clustering, for Classification, for regression there are various algorithms like, K-Means, Logistic Regression, Linear Regression etc., There are broadly classified as:

* **Supervised ML Algorithms**: These are the one which require a labelled data set. Classification and Regression both tasks can be done using Supervised ML Algorithms. Linear Regression, Logistic Regression, Decision Tree, KNN are some examples of Supervised ML Algorithms.
* **Unsupervised ML Algorithms**: These are 2nd type of ML Algos which does not need labelled data set. In unsupervised algos the model will not have any predefined output but it tries to find the useful insights from the data. K-Means Clustering, DBSCAN etc are some examples of Uns upervised ML Algos.
* **Reinforcement Learning**: Reinforcement learning learns with the help of feedback given to the model in the form of rewards. If the feedback is positive rewards will be assigned or if the feedback is negative it is penalised. Supervision will not be there for the agent. Q-Learning algorithm is the example for Reinforcement Learning.

1. Reinforcement learning is a form of learning based on positive reinforcement:

* Reinforcement Learning takes feedback and assigning suitable action based on the feedback given to the agent. In a particular situation, the reward for the agent should be maximised.
* The agent in reinforcement learning learns from its experience unlike in Supervised, where the model is trained with the answers. In reinforcement learning algorithm gets feedback after each step and that helps to know whether the step taken is right or not.
* The output depends on the current input and the next input depends on the previous output. It is an autonomous, self-learning system which learns by trail and error. The main aim is to maximise the reward in case of reinforcement learning.