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

* Learning is the process of acquiring new understanding, knowledge, behaviours, skills, values, attitudes, and preferences.
* The ability to learn is possessed by humans, animals, and some machines; there is also evidence for learning in certain plants.
* Humans acquire knowledge through experience either directly or shared by others.
* Examples: Learning to drive a motorcar, typewriting, singing, or memorizing a poem or a mathematical table.

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

* The behavioural psychology described three types of learning: Classical Conditioning,
* Observational Learning and Operant Conditioning.
* Classical Conditioning:
* In case of Classical Conditioning, the process of learning is described as a Stimulus-Response connection or association.
* Operant Conditioning:
* It was also analysed that the behavioural change strongly depends on the schedules of reinforcement with focus on timing and rate of reinforcement.
* Observational Learning:
* For observational learning to take place effectively, four important elements will be essential: Motivation, Attention, Memory, and Motor Skills.
* The key difference with human learning lies. As explained, human learning may be model based, but it is often computationally efficient.
* Humans use mental models that generally require very few examples but can make new predictions through extrapolation.

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

* Machine learning (ML) is a type of artificial intelligence (AI) that allows software applications to become more accurate at predicting outcomes without being explicitly programmed to do so.
* Machine learning algorithms use historical data as input to predict new output values.
* Machine Learning is an AI technique that teaches computers to learn from experience.
* Machine learning algorithms use computational methods to “learn” information directly from data without relying on a predetermined equation as a model.

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

* Penalty: Reinforcement learning is all about gamifying the learning process. This type of machine learning uses a reward-penalty method to teach an AI system.
* If it makes the right move, it gets rewarded. If it makes a mistake, it receives a penalty.
* Reward: The Reward Function is an incentive mechanism that tells the agent what is correct and what is wrong using reward and punishment.
* The goal of agents in RL is to maximize the total rewards. Sometimes we need to sacrifice immediate rewards to maximize the total rewards.

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

* Learning can be viewed as a search through the space of all sentences in a concept description language for a sentence that best describes the data.
* Alternatively, it can be viewed as a search through all hypotheses in a hypothesis space.
* The application of machine learning is best thought of as search problem for the best mapping of inputs to outputs given the knowledge and
* resources available to you for a given project.

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

* The goal of machine learning, closely coupled with the goal of AI, is to achieve a thorough understanding about the nature of learning process (both human learning and other forms of learning), about the computational aspects of learning behaviours, and to implant the learning capability in computer systems.
* The relationship between human-learning and machine learning:
* Humans acquire knowledge through experience either directly or shared by others.
* Machines acquire knowledge through experience shared in the form of past data.
* Humans have emotions & thus form different patterns on that basis, while a machine (say computer) is dumb & everything is just a data for him

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

* There are three main elements to every machine learning algorithm, and they include:
* Representation: what the model looks like; how knowledge is represented.
* Evaluation: how good models are differentiated; how programs are evaluated.
* Optimization: the process for finding good models; how programs are generated.
* Real-life examples:
* Image recognition. Image recognition is a well-known and widespread example of machine learning in the real world.
* Speech recognition. Machine learning can translate speech into text. Certain software applications can convert live voice and recorded speech into a text file.
* Medical diagnosis. Machine learning can help with the diagnosis of diseases.
* Many physicians use chatbots with speech recognition capabilities to discern patterns in symptoms.
* Extraction. Machine learning can extract structured information from unstructured data. Organisations amass huge volumes of data from customers.

1. Provide an example of the abstraction method.

* Abstraction has been mainly studied in problem solving, theorem proving, knowledge representation (for spatial and temporal reasoning) and machine learning.
* In such contexts, abstraction is defined as a mapping between formalisms that reduces the computational complexity of the task at stake.
* Abstraction means displaying only essential information and hiding the details. Data abstraction refers to providing only essential information about the data to the outside world, hiding the background details or implementation.
* Consider a real-life example of a man driving a car

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

* Generalization refers to your model's ability to adapt properly to new, previously unseen data, drawn from the same distribution as the one used to create the model.
* Develop intuition about overfitting. Determine whether a model is good or not.
* Divide a data set into a training set and a test set.
* It is important because it increases the likelihood that the learner will be successful at completing a task independently and not have to rely on the assistance of a certain teacher or materials only found in one teaching setting.
* The importance of the generalization of skills is often overlooked.
* L1 and L2 regularization are two widely used methods. But you may also encounter different forms, such as dropout regularization in neural networks. Regularization can help avoid high variance and overfitting.
* To sum it all up, learning is well and good, but generalization is what we really want.

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

* In machine learning, classification is a supervised learning concept which basically categorizes a set of data into classes.
* The most common classification problems are – speech recognition, face detection, handwriting recognition, document classification, etc
* The most significant difference between regression vs classification is that while regression helps predict a continuous quantity,
* classification predicts discrete class labels.
* Classification is the task of predicting a discrete class label. Regression is the task of predicting a continuous quantity.

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

* Regression is a technique for investigating the relationship between independent variables or features and a dependent variable or outcome.
* It's used as a method for predictive modelling in machine learning, in which an algorithm is used to predict continuous outcomes.
* Real-world examples of linear regression models
* Forecasting sales: Organizations often use linear regression models to forecast future sales.
* Cash forecasting: Many businesses use linear regression to forecast how much cash they'll have on hand in the future.

1. Describe the clustering mechanism in detail.

* Clustering is the task of dividing the population or data points into a number of groups such that data points in the same groups are more similar to other data points in the same group and dissimilar to the data points in other groups.
* It is basically a collection of objects based on similarity and dissimilarity between them.
* Clustering Methods:
* Density-Based Methods: These methods consider the clusters as the dense region having some similarities and differences from the lower dense region of the space.
* These methods have good accuracy and the ability to merge two clusters.
* Example DBSCAN (Density-Based Spatial Clustering of Applications with Noise), OPTICS (Ordering Points to Identify Clustering Structure), etc.
* Hierarchical Based Methods: The clusters formed in this method form a tree-type structure based on the hierarchy. New clusters are formed using the previously formed one. It is divided into two category
* Agglomerative (bottom-up approach)
* Divisive (top-down approach)
* Partitioning Methods: These methods partition the objects into k clusters and each partition forms one cluster.
* This method is used to optimize an objective criterion similarity function such as when the distance is a major parameter example K-means, CLARANS (Clustering Large Applications based upon Randomized Search), etc.
* Grid-based Methods: In this method, the data space is formulated into a finite number of cells that form a grid-like structure. All the clustering operations done on these grids are fast and independent of the number of data objects example STING (Statistical Information Grid), wave cluster, CLIQUE (Clustering In Quest), etc.

13. Make brief observations on two of the following topics:

i. Machine learning algorithms are used:

* At its most basic, machine learning uses programmed algorithms that receive and analyse input data to predict output values within an acceptable range.
* As new data is fed to these algorithms, they learn and optimise their operations to improve performance, developing 'intelligence' over time.
* Here are six real-life examples of how machine learning is being used.
* Image recognition.
* Speech recognition.
* Medical diagnosis.
* Statistical arbitrage.
* Predictive analytics.
* Extraction.

ii. Studying under supervision

* Supervised learning, also known as supervised machine learning, is a subcategory of machine learning and artificial intelligence.
* It is defined by its use of labeled datasets to train algorithms that to classify data or predict outcomes accurately.
* There are two types of Supervised Learning techniques: Regression and Classification

iii. Studying without supervision

* Unsupervised learning, also known as unsupervised machine learning, uses machine learning algorithms to analyse and cluster unlabelled datasets.
* These algorithms discover hidden patterns or data groupings without the need for human intervention.
* Unsupervised learning is when it can provide a set of unlabelled data, which it is required to analyse and find patterns inside.
* The examples are dimension reduction and clustering.

iv. Reinforcement learning is a form of learning based on positive reinforcement.

* Reinforcement learning is a machine learning training method based on rewarding desired behaviours and/or punishing undesired ones.
* In general, a reinforcement learning agent can perceive and interpret its environment, take actions and learn through trial and error.
* Reinforcement learning is a type of machine learning method where an intelligent agent (computer program) interacts with the environment and learns to act within that.
* How a Robotic dog learns the movement of his arms is an example of Reinforcement learning.