**1. Explain the term machine learning, and how does it work? Explain two machine learning applications in the business world. What are some of the ethical concerns that machine learning applications could raise?**

A subset of AI that develops models and make computers to learn and make predictions withour being programmed. It works in few steps like collecting data and preprocess it for model and then making model by training and evaluation and at last deployment. Examples in real life use case of ml is fraud detection, algorithms that finds activities that are anomalous and flag it fraud. Customer churn predictions, by analyzing customer behavior, previous data, and other features, machine learning models can identify patterns that indicate potential churn.

**2. Describe the process of human learning:**

**i. Under the supervision of experts**

It is an expert guidance that guides you. These experts can be a teacher, mentor, instructor

**ii. With the assistance of experts in an indirect manner**

It is guidance which indirectly teaches, like reading books, youtube videos, reading etc…

**iii. Self-education**

Self-education is process of learning without any supervision or instructions. Self paced learning

**3. Provide a few examples of various types of machine learning.**

Supervised machine learning – Trained on a labeled dataset

Unsupervised machine learning – Trained on unlabelled datasets.

Reinforcement learning – Reinforcement is basically an agent learning to make decisions or predictions by trail and error method.

Deep Learning – In deep learning an artificial neural network tries to find the pattern in the data.

**4. Examine the various forms of machine learning.**

Supervised Machine learning – In this model is trained on labeled datasets with features and target variable. It learns the relationship between features and labels, after learning it can be used on unseen data or new data.

Unsupervised Machine learning – In this model is trained on unlabeled datasets, here no predefined target variable. It finds patterns or group of data points without guidance.

Reinforcement Learning – In this learning an agent learns or takes decisions/actions through trail and error. On correct decision its gets a reward and on wrong decision its get a penality.

Deep Learning – It is subset of Machine learning. It focus on neural network with multiple layers. It captures complex patterns and relationships. It has various domains such as NLP, speech recognition, recommendation systems

Online Learining – It is also known as steaming learning, it updates the model continuously as new data comes.

**5. Can you explain what a well-posed learning problem is? Explain the main characteristics that must be present to identify a learning problem properly.**

A well-posed learning problem means a well-defined and well-structured one. In order to identify a learning problem properly certain factors are to be satisfied. Well-defined task, Availability of data, Quality and constant data, scalability, evaluation matrices.

**6. Is machine learning capable of solving all problems? Give a detailed explanation of your answer.**

No, it is not capable of solving all the problems because of various reasons. Firstly lack of data or labelled data, supervised machine learning needs labelled data but there is a lack of labeled data. The complexity level has increased mostly deep learning models because of the large amount of parameters, features . Having domain expertise is one the problems as the problem complexity increases domain expertise is also required.

**7. What are the various methods and technologies for solving machine learning problems? Any two of them should be defined in detail.**

Various methods of machine learning methods are as follows

Supervised Machine learning: An algorithm learn from the labelled dataset to make predictions or gives answers on unseen data. In supervised machine learning there are features and with respect to it there are target vaiables, The goal is to learn or make a function that accurately predicts the target values. Process of supervised ml is Data collection, data preprocessing, model selection, model training, model evaluation, model deployment.

Unsupervised Machine learning: In this approach, the algorithm finds patterns and relationships without any target variable. In this dataset consist of only input features and goal is to find patterns, group similar data points. It has also the same process but at last knowledge extraction is added in it.

**8. Can you explain the various forms of supervised learning? Explain each one with an example application.**

Classification: In this goal is to predict the class or category based on input features. The target variable is in the category form. For example spam detection here goal is to classify mail are spam or not, target variable should be spam or not spam/yes or no/0 or 1.

Regression: In this goal is to predict a continuous value based on the input features. Example predicting the height of a person on the basis of age, weight etc..

**9. What is the difference between supervised and unsupervised learning? With a sample application in each region, explain the differences.**

Main difference is that supervised ml need labelled target dataset for finding relationships and pattern in the data, where as in unsupervised machine learning there is no target variable. In supervised ml approach is to find the pattern on labelled dataset (labelled target variable) and make predictions on unseen data where as in unsupervised ml approach input data without labelled target variable it find the hidden pattern and relationships and predicts on unseen data.

**10. Describe the machine learning process in depth.**

Machine learning process have various steps:

**Define the problem:** Define the problem clearly. Goal, availability of the data, task, etc.

**Data collection:** Collecting data from various sources like databases, local, api etc.

**Data preprocessing:** It is the crucial part where cleaning, transforming and preprocessing (handling missing values, outliars, normalization, scaling features, encoding) the data to make suitable for the training.

**Data splitting:** Splitting the data into the training set, testing set, validation/development set

**Model selection:** Based on data and problem best ml algorithm should be choosed.

**Model Training:** After choosing the algorithm model training starts where model learn pattern and relationships between the data.

**Model evaluation:** after training the model it should be evaluated on testing set. Common evaluation methods are precision-recall, accuracy score, mean squared error etc

**Model tuning and optimization:** If the model performance is not up to the mark it is hyper-tuned or adjusted the architecture of the model.

**Model Deployment:** Then the trained model is deployed in real-world application to make prediction on unseen data.

**Repeat the process:** If gaol is not achieved then start the whole process.

**a. Make brief notes on any two of the following:**

**i.MATLAB is one of the most widely used programming languages.**

**ii. Deep learning applications in healthcare**

Deep learning algorithms can be used to analysing images, where it finds abnormalities in x-ray scans, CT scans, MRIs etc. Predicting diseases from the reports. Deep learning can be used to assist doctors. In operation theatre, robots can be used as assistance for helping doctors.

**iii. Study of the market basket**

**iv. Linear regression (simple)**

The goal is to find the best-fit line that represents the relationships between the independent variable dependent variable. F(x) = wx + b where F(x) is the dependent variable x is the independent variable, b is the y-intercept and w is the slope

**11. Make a comparison between:-**

**1. Generalization and abstraction**

In Generalization objective is to predict accurately and in abstraction simplifying the complexity

Generalization focuses on performing well and abstraction focuses on transforming raw data into meaningful features.

**2. Learning that is guided and unsupervised**

**3. Regression and classification**

Regression predicts numerical values from the labelled data sets where as classification prediction the class or category of target variable