**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?**

Machine Learning is a process of usage of statistical tools for analysing the data and do predictive modelling.

Machine learning works by undergoing some steps :-

* Collecting the Data
* Clean, prepare and manipulate Data
* Train Model
* Test Model
* Improve the Model

Machine Learning application in real world includes:

* Speech Recognition :- While using the web browser, Nowadays we must have often come across a feature “Search by Voice” which is an application made possible by machine learning algorithms. “Voice Texting” is another application of Machine Learning.
* Traffic Prediction :- Google Map with the help of real time data collected from users as well as the previous outcomes shows the traffic condition.

Some of the ethical concerns faced by machine learning are :-

* Privacy issues or misuse of personal data.
* Cost of innovation.

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

Various types of machine learning example include :-

1. Supervised Learning :- This is further categorised into Classification & Regression. The example of classification can be found in healthcare where a patient can be tested for diagnosing a disease. The example in regression is of predicting the price of a house based on many features.
2. Unsupervised Learning :- The unsupervised learning example can be thought of as in a class the teacher divides the section in accordance with marks obtained by the student. This leads to formation of a cluster.
3. Reinforcement Learning :- Netflix is an example of this. In Netflix, on our first visit, it shows the recommendations based on customer ratings, reviews and generes but once we start using it start suggesting in terms of our interest and likings.

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

1. Supervised Learning :- Supervised Learning is a type of machine learning in which we get an output in return. The input given are a number of features and based on this we get an output which is termed as labelled data. This is further categorised into Classification & Regression.
2. Unsupervised Learning :- The unsupervised learning also includes a number of features but we don’t get an output for this. Instead, the features are used for forming a cluster/group.
3. Reinforcement Learning :- Netflix is an example of this. In Netflix, on our first visit, it shows the recommendations based on customer ratings, reviews and generes but once we start using it start suggesting in terms of our interest and likings.

**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.**

Well posed learning problem is a computer program that learn from an experience (E) in context to some task (T) and some performance measure (P), if its performance on T, as measured by P, upgrades with experience E.

The main characteristics includes :-

* Learning Task
* Performance Measure
* Training Experience

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

No, Machine learning is not capable of solving each and every problem. It finds difficulty and gets confused while dealing with large datasets having many features. Apart from this, some of the areas where it feels difficulty are:-

Reasoning Power :- For example, ML can distinguish between apple and orange but it can’t be able to look tell quality of it.

Scalability :- ML models can’t be scaled on its own. Human intervention is required for possible upgradation.

Contextual Limitation :- It can detect a persons voice but can’t apprehend the context associated with it.

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

There are various algorithms mentioned below for solving machine learning problems.

Linear Regression – This algorithm is used to find out the relationship between input and output variables in linear way. The relationship is shown with the help of a straight line. This is further categorised into Simple and Multiple linear regression.The loss function is given by

½(log(y-y’)^2)

Logistic Regression – This algorithm is a classification based algorithm. The name regression is because of its following of Linear Regression as its underlying principal. It basically uses squashing through sigmoid function for removing the effects of outliers.The loss function is given by

-argmin ∑(log(1+exp(x’ \* w’y’))

Support Vector Machines(SVM)

KNN(K Nearest Neighbour)

Decision Trees

Bagging and Boosting Algorithms

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

Supervised learning is further classified into Classification and Regression.

In classification, the output is categorical.The example of classification can be found in healthcare where a patient can be tested for diagnosing a disease.

In Regression, the output is continuous.The example in regression is of predicting the price of a house based on many features.

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

1. Supervised Learning :- Supervised Learning is a type of machine learning in which we get an output in return. The input given are a number of features and based on this we get an output which is termed as labelled data. This is further categorised into Classification & Regression.
2. Unsupervised Learning :- The unsupervised learning also includes a number of features but we don’t get an output for this. Instead, the features are used for forming a cluster/group.

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

Machine learning works by undergoing some steps :-

* Collecting the Data – Firstly the data is collected from different sources.
* Clean, prepare and manipulate Data – Now after this, the process of feature selection and feature engineering part takes place. It involves taking care of null values,handling outliers, imbalanced datasets etc. Further, data is divided into Training and Test data.
* Train Model – Training is done for creating a model.
* Test Model – Model is tested on test data.
* Improve the Model – Results are noted and appropriate steps are taken for improving it. Hyperparameter tuning is done to increase the accuracy.
* Model Deployment

**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**

**iii. Study of the market basket** – It is a data mining technique used by retailers to increase sales by better understanding customer purchasing patterns. It involves analysing large datasets such as purchase history to reveal product grouping, customer interests, price ranges etc.

**iv. Linear regression (simple)** - This algorithm is used to find out the relationship between input and output variables in linear way. The relationship is shown with the help of a straight line. This is further categorised into Simple and Multiple linear regression.The regression equation is given by

y = mx + c

where, y is output variable, x is input variable, m is slope and c is constant.

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

**1. Generalization and abstraction** – Abstraction can reduce complexity by hiding irrelevant information and showing only the relevant ones.

Generalisation can reduce complexity by creating an umbrella term. In other words, umbrella term reduces redundancy and increase efficiency.

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

The unsupervised learning contains a number of features but we don’t get an output for this. Instead, the features are used for forming a cluster/group. These groups acts as a guidance for us.

**3. Regression and Classification**

In classification, the output is categorical.The example of classification can be found in healthcare where a patient can be tested for diagnosing a disease.

In Regression, the output is continuous.The example in regression is of predicting the price of a house based on many features.