# Guaranteed questions

1. **What is machine learning (ML)?**

   A set of methods that can automatically detect patterns in data, and then use the uncovered patterns to predict future data, or to perform other kinds of decision making under uncertainty (such as planning how to collect more data!)

2. **What are the main ML types?**

   The main types are:

   (a) Supervised Learning
   (b) Unsupervised Learning
   (c) Semi-Supervised Learning
   (d) Reinforcement Learning

3. **What ML algorithms you studied after the midterm exam?**

   (a) K-Means Clustering
   (b) Hierarchical Clustering
   (c) Recommender Systems
   (d) Large Scale and Online Learning
   (e) Ensemble Learning
   (f) k-Nearest Neighbors (kNNs)
   (g) Principle Components Analysis (PCA)
   (h) Recurrent Neural Networks
   (i) Reinforcement Learning
   (j) Autoencoders
   (k) Bayesian Networks

4. **Which is more important to you — model accuracy, or model performance, support your answer with an example? This is a partial answer, you need to provide a simple example and your opinion.**

   The model accuracy, or model performance is based on your opinion supported by a simple example (hint: all answers are correct such as either one or both together based on the example you provide).

5. **What are advantages and disadvantages of Hidden Markov Mode**

   (25 Bayesian Networks — Thu, Apr16

## L15 K-Means Clustering — Tue Mar3

1. **List, then define the common clustering algorithms.**
2. **What are the two main steps of K-means Algorithm?**
3. **Write the pseudocode of K-means Algorithm**
4. **How k-means algorithm works?**
5. **List advantages and disadvantages of k-Means.**

## L16 Hierarchical Clustering — Thu Mar 5

1. **What is cluster analysis?**
2. **What are the typical applications of cluster analysis?**
3. **List, then define the two approaches of hierarchical clustering.**
4. **List all steps of the hierarchical clustering of agglomerative (bottom-up) approach.**
5. **Define the dendrograms, then illustrate how do dendrograms work with a diagram.**
6. **List, then define all possible methods of merging the clusters that depend on the distance measures.**
7. **What are the advantages and disadvantages of hierarchical clustering?**

## L17 Recommender Systems — Tue Mar 10

1. **Define the recommendation systems, why using Recommender Systems?**
2. **What types of recommendation systems, list them, then draw diagrams show the working mechanism of each?**
3. **List advantages and disadvantages of both collaborative filtering and content-based recommenders.**
4. **How to fill rates of users who have not rated any movies?**

## L18 Large Scale and Online Learning —Thu Mar 12

1. **Supervised Learning, Semi-Supervised, and Unsupervised Learning for what kinds of applications can be used? What is the different between them in terms of input and output samples?**
2. **What are the differences between Gradient Descent types: Batch, Stochastic, and Mini batch? Which one is the faster to converge?**

3. **What are the hardware-based solutions can be used to machine learning for big data?**
4. **What are the platforms for online machine learning algorithms?**

## L19 Ensemble Learning — Thu Mar 19

1. **Define the ensemble learning, illustrate the key motivation of the ensemble learning, then draw the general idea diagram of the ensemble learning**
2. **List the ensemble methods that minimize variance and bias.**
3. **What are the different methods for changing training data? List them, then illustrate the working mechanism of each method, support your working mechanisms with illustration diagrams.**
4. **Can a set of weak learners create a single strong learner?**
5. **What are the main features of the Random Forest method?**

## L20 k-Nearest Neighbors (kNNs) — Tue Mar 24

1. **What are the Idea, algorithm, and types of the Instance-Based Learning?**
2. **List the k-Nearest Neighbors (k-NNs) Main Steps.**
3. **What are the three require things to implement the k-NNs?**
4. **How to classify an unknown instance (sample) using the k-NNs?**
5. **What are the two common distance metrics used for k-NNs?**
6. **List Advantages and Disadvantages of k-NNs.**

## L21 Principle Components Analysis (PCA) — Thu Mar 26

1. **Define the principle components analysis (PCA), then list the 3 main fields could be used to and 3 application examples.**
2. **What do we mean by the variance and covariance? List the differences between the variance and covariance.**
3. **Illustrate the main tasks of the PCA Process — step 1.**
4. **How we could derive new datasets through the PCA Process — step 5?**

## L22 Recurrent Neural Networks — Tue Apr 7

1. **Define RNNs, the show whether RNNs are Supervised or Unsupervised Learning?**
2. **What is the major difference between RNNs and FNNs? illustrate that.**
3. **List types AND architectures of RNNs, then draw the architecture of traditional RNNs.**
4. **List, then illustrate the three main training approaches of RNNs.**
5. **What are the pros and cons of the typical RNNs architecture?**

## L23 Reinforcement Learning — Thu Apr 9

1. **List the four main machine learning types.**
2. **Define the reinforcement learning with a diagram, then compare between the reinforcement learning and supervised learning.**
3. **Draw the generic learning model to learn from data. Then define the main operations of it through indicating each operation (i.e. Sensor Data, Feature Extraction, etc.) and related steps.**
4. **What are the key features and elements of the reinforcement learning?**
5. **List the 3 types of reinforcement learning.**
6. **What makes reinforcement learning different from other machine learning paradigms?**

## L24 Autoencoders — Tue Apr 14

1. **What are autoencoders? List the general types of autoencoders based on size of hidden layer?**
2. **What are the main differences between PCA and autoencoders?**
3. **List the key elements AND components of autoencoders? Then illustrate the components.**
4. **List, then explain the 3 main properties AND 4 hyperparameters of autoencoders.**
5. **List the 8 types AND 5 applications of autoencoders.**

# L25 Bayesian Networks — Thu Apr 16

1. **What are Bayesian networks (BNs)? List BN components and importance.**
2. **List types of probabilistic relationships, then provide 7 real-world Bayesian network applications.**
3. **Define hidden Markov model (HMM), then list and illustrate components of HMM.**
4. **List, with illustration, the 4 main inference algorithms of Hidden Markov Model.**
5. **What are advantages and disadvantages of Hidden Markov Model?**