1. What is AI?
2. What are the fields of AI?
3. What is Machine Learning?
4. What is Supervised learning, semi-supervised learning and unsupervised learning?
5. What is Clustering? Describe different forms of clustering.
6. Describe reinforcement learning.

1. Artificial intelligence as a broad term refers to the use of machines to simulate human intelligence via computer systems. It involves creating algorithms / software to perform tasks that are typically too complex to be performed by anything other than human level intelligence. Something that separates AI from typical software is that it is able to learn from experience and update its own methods of achieving its specified goals. A typical algorithm or bot would simply follow a set of instructions over and over again, exactly as its code tells it to, while AI is capable of analyzing how well it is achieving its current goals and updating its methods to try and correct any imbalances.

2. The five fields of AI listed within the class slides are broken down into Machine Learning (a branch which focuses on the use of data and algorithms to imitate and optimize human tasks), Neural Networks (a method in artificial intelligence that teaches computers to process data in a way that is inspired by the human brain), Deep Learning (part of a broader family of machine learning methods, which is based on artificial neural networks with representation learning), Representation Learning (a process in machine learning where algorithms extract meaningful patterns from raw data to create representations that are easier to understand and process), and Reinforcement Learning (an area of machine learning concerned with how intelligent agents ought to take actions in an environment in order to maximize the notion of cumulative reward).

3. Machine learning is a field of Artificial Intelligence which focuses on the use of data and algorithms to imitate the way that humans learn, gradually improving its accuracy. Deep learning, neural networks, representation learning and reinforcement learning are all considered subfields of machine learning, so within the overall field of Artificial Intelligence, Machine Learning is a pretty broad

umbrella. Machine learning is essentially the more advanced parts of AI that are reliant on complex algorithms, where things like symbolic logic – rules engines, expert systems and knowledge graphs are some examples of things that would be considered AI but *not* Machine Learning.

4. Deep learning is a subset of machine learning which is based on artificial neural networks with representation learning. The adjective "deep" in deep learning refers to the use of multiple layers in the network. Deep learning methods can be supervised, semi-supervised, or unsupervised, and the choice between the three largely depends on the task at hand and the complexity of the neural networks being used. Deep learning has aided image classification, language translation, and speech recognition. It can be used to solve any pattern recognition problem and without human intervention.

5. Cluster analysis or clustering is the task of grouping a set of objects in such a way that objects in the same group are more similar to each other than to those in other groups. It is essentially the act of assigning values meant to measure similarity to objects within a set and then grouping the objects based on those criteria. Some examples of different forms of clustering include hierarchical clustering (a method of cluster analysis that seeks to build a hierarchy of clusters), fuzzy clustering (the assignment of the data points in any of the clusters is not decisive. Here, one data point can belong to more than one cluster.), and spectral clustering (these techniques make use of the spectrum of the similarity matrix of the data to perform dimensionality reduction before clustering in fewer dimensions).

6. As stated above, reinforcement learning is another method that falls under the large umbrella of 'machine learning' within AI. It is a machine learning process in which an agent learns to make a sequence of decisions in an environment to maximize a reward signal over time. The 'reward signal' refers to a method of measuring the agents success, in which the agent receives a certain number of 'points', based on a reward function, in proportion to how well the agent is currently performing its task. The agent's goal in reinforcement learning under these circumstances is to perform any actions possible to maximize 'points', which should ideally align to performing its given task as well as possible. To give a very simple example in binary form, if you were training an agent to play tic

tac toe via reinforcement learning you could set up the reward function to award +1 point to the agent for each game it wins, and -1 point for each game it loses, thus teaching it that each set of actions it performs which win games should be repeated, and sets off actions that result in losing games and points, are ones that should not be repeated.