**1) What is strong AI and weak AI and what are the differences between strong and weak AI? Give examples of areas in strong AI, as well as weak AI, and motivate why the areas are strong AI versus weak AI. (5p)**

Artificial Narrow Intelligence (ANI) is sometimes referred as ”Weak AI”, is AI that specializes in one area. It can only do one task, play chess for example. Weak AI reasons within a single domain, uses models for problem solving and has no consciousness as it is just designed for one area this is all it does.

Artificial General Intelligence (AGI) is sometimes referred as ”Strong AI”, it demonstrates ”human-like” intelligence. It can perform any intellectual task that a human can. Professor Linda Gottfredson describes intelligence as “a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, learn quickly, and learn from experience.” That also describes what AGI should be able to do on the same level as a human. It should have human capabilities such as reasoning, planning, learning, being conscious and communicating.

**2) Explain the differences between supervised and unsupervised learning algorithms. When are supervised learning algorithms used and unsupervised learning algorithms used?**

In supervised machine learning we “teach” the program using already defined examples. Using these examples, the program can then draw accurate conclusions when it is given new data.  
In unsupervised machine learning we don’t “teach” the machine anything. We give it a bunch of data and then it must figure out patterns and relations by itself. This could potentially lead to patterns and conclusions no human could have thought of.

A supervised algorithm is an algorithm in which both the input and output can be perceived, while an unsupervised learning algorithm is used when the input is known but the output is not

**3) In Multi-Agent Systems: What factors dictate what actions an agent takes in a given situation. (Mention at least 6 different factors.)**

According to the book “Artificial Intelligence; Foundations of Computational Agents”how an agent behaves depends on the following six factors (Poole and Mackworth,  
2010):

* Prior knowledge about the agent and its environment
* History of interaction with the environment
* Observations of the current environment
* Past experiences of previous actions and observations or other data from which it can learn
* Goals that it must try to achieve
* Abilities, which are the actions it is capable of carrying out

**4) In Decision-support systems: What are the differences between procedural knowledge and declarative knowledge? Provide examples while explaining the differences.**

Procedural knowledge is knowledge that is about how to do something. Things like cycling or painting fall into this category.

Declarative knowledge on the other hand is knowledge that can prove that something is the case. The fact that it goes 60 min in an hour or that grass is green is such knowledge. More specifically, for the AI area one can identify a robot that possesses one of these skills by, for example, if it can. navigating around in a room that it has not been in before, this is a sign of procedural knowledge while a robot like to achieving a similar effect requires that a map of the room has been downloaded before probably using declarative knowledge.

* Procedural is knowledge about how to do something. It describes itself, procedural information describes how to execute a procedure. The procedural knowledge is therefore often related to rules, if x then do y else do z. It explains how the system should execute things.
* Declarative knowledge are concepts, objects and facts. This is a descriptive type of knowledge which describes what kind of facts about a field that is known.

**5) What are: Decision-support systems, Expert systems and Knowledgebased systems? Describe and give at least 6 different, distinct differences between the systems.**

Expert systems are very specific and have extensive “knowledge” in a certain domain. If you try to apply a medical expert system on facial recognition, chances are that it would fail. A knowledge system on the other hand uses a modular system of knowledge that can be replaced with knowledge in another area. If the application of the system is to be used in a specific domain an expert system would be better since it is custom made for just this task.

Decision-support system is a interactive computer based system that help humans to solve problems. The system typically uses raw data, documents, personal knowledge or business models to help solve ill-structured, unstructured or semi-structured problems. The general characteristic involves the following:

● Ability to process information and knowledge

● Tackle large-scale, time-consuming and complex problems

● Make decision process and outcome more reliable

● Encourage exploration and discovery

● Generate new evidence in decisions

These type of systems are usually used in businesses to help manage the company, monitor activities and help with planning. This allows the company to gain competitive advantage over other competing organisations.

"A properly designed DSS is an interactive software-based system intended to help decision makers compile useful information from a combination of raw data, documents, and personal knowledge, or business models to identify and solve problems and make decisions.”

A difference between an expert system and a knowledge-based system is that the expert system is designed to work within one domain whereas a knowledge based system has a knowledge base which can contain information from any domain.

Expert systems uses reliable data while knowledge based systems might also have inaccurate data.

A decision support system (DSS) require extended interaction with decision makers for the system to be effective whereas an expert system tries to mimic the knowledge of experts in their domain and require less involvement of end users.

**6) How does a training process on a feed-forward network including backpropagation work?**

When the neural network begins its training process it start by initializing random values as each neurons respective weights. The training process is essentially only a process of adjusting the weights, there is actually not much intelligence behind a neural network. There are different methods on how to adjust the weights but one method that is particularly interesting is called back propagation. Back propagation is a process where the network feeds a value called the error gradient from the output layer and backwards towards the input layer while adjusting weights as you traverse the network. The network continues to train like this until the error values are small enough such that the desired output is not compromised. It is however important to not train the neural network to much, because if the error gradient reaches zero because it is an indication that the training process is considered done, therefore the network would not be able to process new data.

**7) PostNord is a company that handles about 2 191 billion mails every year. To handle the mails more effective and efficiently, PostNord wants a computer system. The system will register the incoming and outgoing mails, handle the mail addresses, and the kinds of mails are sent to different receivers, i.e., postcards, mails, and light- and heavy weighted boxes. PostNord wants to be able to make an evaluation of certain mails and areas where many mails are sent to particular receivers. Also, predict the sort of mails that will be sent coming years. Your task is to suggest a solution that handles the requirements and present the solution to PostNord.   
a) Initial study with requirements   
b) Design showing the model and architecture of the content of the system and dependencies between the parts   
c) Suggestion technique to use and how to use it to handle the requirements   
d) Motivate all the choices made in a-c)**