Seminar 4 questions

1. **Why is the term “mobile agent” problematic compared to the other terms describing types of agents?**Mobile agents are agents who move around in a specific environment. The problem here is that in this case the term describes an agent in a physical environment (most times a robot). All the other terms describe software, and so in fact virtual, agents.
2. **Why does an agent needs to be developed for a specific environment?**The type, appearance and properties of an environment can differ a lot. For example for a vacuum cleaner the environment is a room or a building. For a web crawler the web is the environment. These two environments got in fact nothing in common. So the agents needs to be developed to interact with a specific environment.
3. **Explain what a meta agent is and give an example what it can be used for?**  
   A meta agent is an agent that does not directly fulfill a task but has an observing or supervising role. A meta bot can be for example a bot that observes the acting of the remaining agents and delivers some statistics about the acting.
4. **Think about a bot playing poker. Explain if and why the state is observable, partially observable or not observable. Give an example how to change the environment to change the current status of observability**A poker game is partially observable. The agents knows its cards and it knows the cards in middle. Via abductive reasoning it can also guess some of the cards of the other players. But it does not know these cards. It also does not know the cards in the stack. To make the environment observable the agent needs to look through the cards of the other players and the cards in the stack.
5. **Explain what an appropriate performance measure for a chatbot can be?**An appropriate performance measure for a chat bot can be how it is accepted by humans. The more humans like to interact with the bot the better the bots does its job. A key indicator to calculate this could be how many users use the chatbot instead of a human partner. Another could be in how many cases the user asks the chatbot to forward him or her to a human partner.
6. **What is software agents?**A software agent is a computer program that acts for a user or other program in a relationship of agency. Agents are known as bots . They may be embodied, as when execution is paired with a robot body, or as software such as a chatbot executing on a phone (e.g. Siri) or other computing device.
7. **Explain BDI**Beliefs - Desires - Intentions

B – the beliefs about the world (informational state of the agent) –> can use inference rules to lead to new beliefs

D – the agent would like to accomplish goals (desire/motivational state of the agent)  
I – intentions the agent has chosen to do.

1. **What is the type of Environment where an action always leads to exactly one guaranteed outcome (from the same state)?**Deterministic Environment.
2. **Explain the differences between static and dynamic environment**Static AI environments rely on data-knowledge sources that don’t change frequently over time. Speech analysis is a problem that operates on static AI environments. Contrasting with that model, dynamic AI environments such as the vision AI systems in drones deal with data sources that change quite frequently
3. **What is a Decision Agents?**A decision agent is used for decision making.
4. **Name three different kind of agents that exist in a an agent system**Software agent, Meta-agents, Mobile agents.
5. **Explain the concept “Stochastic environment”.**It is an environment that includes elements of uncertainty. An action made in this kind of environment may have different outcomes.
6. **Discuss the difference between “Fully observable environment” and “Partially observable environment”.**In a “Fully observable environment”, the agent is informed about the current state, the agent has complete access to the information. In a “Partially observable environment”, there can be information that is currently not available to the agent.
7. **Give an example of a Complete AI environment.**Complete AI environments are those on which, at any given time, we have enough information to complete a branch of the problem. Chess is a classic example of a complete AI environment.
8. **What is a multi-agent system (MAS) and its advantage?**Agents are computer systems that autonomously act on behalf of a human to carry out specific tasks in order to achieve complex problems. Multi-agent systems are several agents in a loosely coupled network cooperating in a way to solve a much more complex problem.   
   The advantages of a multi-agent system over a single agent or centralized system are the following:

- Decentralisation means that the system will not suffer from a single point of failure.

- The system is flexible and can work with older system by building a system wrapper around older systems. This allows for integration and compatibility for older system.  
- Since each agents is programmed to do certain task it is a more natural way of representing task allocations.  
- The system is highly computational efficient, reliable, flexible, extensible, robust and reusable.

1. **What are the most common types of agents - describe them briefly***Software agents -* Computer programs that are capable of acting on behalf of a human in an environment autonomously. An example are bots derived from the word robots. They are capable of interacting with humans. They can also be request from other agents.

*Intelligent agents -* These agents are able to gather information ie from sensor to carry out certain task. It is an autonomous entity that is capable acting according to its environment (reactive). They are also capable of being proactive ie able to determine what it should do next and task initiatives. Last they are able to interact with other agents.

*Meta-agents -* These agents are capable of reasoning. They are usually used to monitor a multi-agent system because they have the ability to monitor the entire system and prescribe appropriate actions.

*Negotiation agents -* These are specialised system capable of negotiation on behalf of a human. It is commonly used in auctions. The basic requirements involved are negotiation sets which represent the space of possible proposal. It also needs an protocol that defined the legal proposal that the agent can take. It also needs a number of strategies in its arsenal and rules for determining a deal.

*Rational agents -* These agents are theoretical entity based on realistic models that have certain preferences and wants to maximize the positive outcome.

*BDI agents -* Stands for Beliefs, Desires and Intentions. Belief represent informational state of the agent ie its understanding about the world around it. Beliefs can also include inference rules which allows for new beliefs. These belief are stored in databases. The desire represent the motivational state of the agent. For example finding the best price. Intentions represents the deliberative state of the agent, this means what the agent has chosen to do to accomplish its goals.

*Mobile agents -* These agents are able to move from one computer to another autonomously and continue its executions.   
*Autonomous agents* - These agents are capable of making its own decision based on its environment. Typical autonomous agents are self-driving cars in which they can gather information from its environment and act accordingly

1. **Environment influences multi-agent systems. Discuss more about how they can affect these agents.**   
   There are two types of environment in multi-agent systems, the observable (accessable) and the non-observable (inaccessible) environment. The observable environment means that the agent is able to gather all information about the environment and is complete, accurate, up-to-date. The non-observable environments is the unknown that not predictable The hybrid is the partially observable environment where some parts of the environments is known. Furthermore, an action can influence the state, deterministic means that the outcome is due to the single action performed, stochastic means that the actions cannot determine the outcome. Environment can also be collaborative ie working together or non-collaborative ie working independently. An environment can be fixed ie static or ever changing ie dynamic. A fixed number of actions in an environments is known to be discrete whereas an infinite amount of actions that can be performed is known as continuous. Lastly when a task only considers the best action at hand it is known as episodic where as sequential (non-episodic) considers both previous actions and future actions in order to plan ahead of the best possible outcome in the long run.
2. **What is Swarm Intelligence (SI) ?**It's the collective behavior of a decentralised system. In an SI system they are simple agents called boid communicating and interacting with each other. These agents follow simple rules which isn't very intelligent, however when combined with other agents collectively, there is a global intelligent system. An example would be ants and ants colonies, individually the ants are very limited in its capabilities but when they work together collectively they build something very extraordinary and can be considered very intelligent.
3. **What are the limitation of multi-agent systems?**Since multi-agent systems involves many individual agent cooperating together to solve a complex task it can be difficult to manage and coordinate. Their individual goals isn't the same as the ultimate end goal and must be recognised and managed.
4. **What are three main characteristics for multi-agent systems (MAS)?***Autonomy:* The agents in the MAS are at least somewhat independent, self-aware or autonomous.   
   *No broad perspective:* No single agent in the MAS has full overview of the MAS. The systems tend to be to complex for a single agent to exploit such knowledge. *Decentralized:* allocates computational resources. No single agent is selected as supervisor. Since a result would be that single point failure could happen if the supervisor crashed.
5. **How does a utility-based agent work?**The term utility could be used to define how ‘happy’ the agent is with a state. By defining a measurable state, you can make comparison of different world states and rank them by how ‘happy’ the agent was with those states. With this utility function you can then get your agent to work towards a goal that maximizes its happiness.
6. **What are some problems that can happen between agents?**There can be inconsistencies between agents in how they handle a problem or how they work towards the goal. Managing interdependencies between different agents’ actions can be hard to coordinate.
7. **What is the difference between a rational agent and a reactive agent?**The difference is that a reactive agent is idle until an event occurs where it has to react and make a decision based on its rules, this could prove difficult if it encounters a situation it has not been in previously. A rational agent will continuously search for the action that it believes is correct given the current situation.
8. **Explain interface agents.**An interface agent is a kind of agent used to help the end user. An example is an agent that observed how the user is using a particular system and then gives tips on how to use the system for efficiently. Or an agent that helps the user schedule meetings and it might learn over time that the user does not like to schedule meetings on a particular day so it stops suggesting the user to schedule a meeting for that day.
9. **What is the main difference between a software agent and intelligent agent?**Software agents are entities capable of performing relatively simple tasks and are not

considered intelligent. Intelligent agents on the other hand are agents that can follow

instructions and has the capability of learning and using knowledge to achieve their goals.

1. **Explain the terminology “Percept sequence”, “Performance measure” and “Actuators”.**Percept sequence refers to all the things an agent has learned by moving around in the environment. Performance measure refers to how the system is designed to measure success, e.g. an algorithm such as A\* can determine success by giving different paths a higher score than others depending on how good they are. Actuators refers to what the agent use to do something, e.g. an robot that use its legs to move.
2. **Describe what an autonomous agent is and how they are used. Is there any risks with having autonomous agents?**Autonomous agents are agents who make their own choices about how to act in an

environment without any influence or interference by the user/owner. They process the information gathered from the environment and calculates an appropriate action. They can be both intelligent and software agents. They are used in for example self-driving cars. The whole concept of having an agent that cannot be influenced by the user comes with its risks. Any type of security breach or malfunction of these agents, e.g. when in a self-driving car can lead to serious damage and would be hard to take back control over.

1. **What is the difference between an environment that is discrete or continuous?**It means that there's a limited amount of states, like in Chess or solving a puzzle. A continuous environment have much less clear boundaries in the environment, and the amount of possible actions are infinite.
2. **List the division types of environments**There are different ways to look at an environment. Environments can be:

Observable/Non-observable, Deterministic/Stochastic, Collaborative/Non-collaborative, Static/Dynamic, Discrete/Continuous, Episodic/Sequential.

1. **Explain Goal-based agents and Utility-based agents**Goal-based agent is an agent that uses the goals it has, and combines them with the

set of available actions, in order to reach that goal. On the other hand, Utility-based

agent is an agent that also looks forward to reaching a goal but has a more complex

way of choosing the action to be taken: it namely chooses the action that maximizes

the expected utility of the action outcomes.

1. **Reflect on the differences between Goal-based agents and Utility-based agents** - Utility-based agents are more flexible than goal-based agents

* Utility-based agents are faster than goal-based agents
* Goal-based agents are not enough to generate high-quality behavior in many of the environments, while the utility-based are.
* Utility-based agents can put forth the tradeoff needed to carry out some action, while the goal-based agents cannot
* Utility-based agents are safer to use than Goal-based ones

1. **Where are Multi-Agent Systems applied in practice?**MAS are applied in the real world mainly for applications including transportation, logistics and graphics, like computer games. It is widely advocated for use in networking and mobile technologies, to achieve automatic and dynamic load balancing, high scalability and self-healing networks.
2. **Can a Multi-Agent-System be domain-independent?**The environment of an agent has a high impact on the respective agent. Dynamic environments can require a also dynamic agent, which reacts to changes in the environment and intelligent agents are learning from is environment. Hence, there is a strong interrelation between an agent and its specific environment, which has to be taken into account in the design process. Therefore, building a single MAS which can be used in different environments seems to be impossible.
3. **Give and describe an example of a software agent.**A spam filter is a type of software agent, the spam filter makes its own decisions

on what emails are likely to be spam/malicious and filters those in to the trash

can on behalf of the user.

1. **Discuss the impact of software agents on the day to day life of the average person.**Mainly since the rise of the smartphone, the number of software agents we encounter every day has been increasing rapidly, with spam filters helping us manage incoming mails, chatbots replacing human support and the recent addition of household assistants such as alexa or google home acting as a hub for our digital needs in the home. One risk that comes with the increased comfort these software agents provide is that the users over time may come to forget/never learn how to perform the tasks that the agents now perform which may turn out to be a negative thing.
2. **Give some examples of main categories of multi agents?**Passive agents - "agents without goals" that could be obstacles.

Active agents - with simple goals like birds flocking.

Cognitive agents - complex calculations.

1. **Could you name some agents for users and their differences?**User agents - act on the behalf of the user – commonly, refers to a web browser telling a website information about the browser and operating system

Interface agents – personal assistant who is collaborating with the user in the same work environment like Microsoft Office Assistant.

Information agents – have access to many different information sources collate and manipulate information obtained from these sources in order to answer queries

1. **What kind of agent is a self driving car? And why?**It's an autonomous agent. It makes its own choices about how to act in its environment without any influence. The car processes information from its environment and calculates an action.
2. **What is a simple agent program?**The simple agent program maps all the possible sequences of events that would result in a specific behaviour of an agent.
3. **Could humans be considered rational agents?**A rational agent is one that acts as to maximize expected performance. Humans do not have well-defined primary goals or utility functions, and rarely or never act optimally with respect to these. Humans are not rational agents, by the definition of a rational agent.
4. **Discuss the relation between meta-agents and multi-agent systems.**A meta-agent is one capable of reasoning about the behavior of other agents, which can be critical to perform rationally in a multi-agent system. For example, a rational game playing agent might learn that its opponent also acts rationally, enabling it to better predict outcomes.
5. **Does a rational agent have to be capable of learning?**This depends on the agent’s environment. For example, in a known static or fully observable environment, optimal performance may not require learning.
6. **Compare an agent function and an agent program. What is the difference?**An agent function is a purely abstract mathematical idea of a mapping from percept sequences to actions. This idea can be used, for example, to define or reason about rational agents, but what determines the agent’s actions is the software implementation, the agent program.
7. **Does an agent require an environment?**An agent is defined as an entity that acts on some environment, perceiving it with sensors and manipulating it with actuators. An agent without an environment is not an agent.
8. **What is the difference between multi agent systems and expert systems?**In expert systems there is a human present between the software and the environment. In agent systems the agent resides in the environment and interacts with it directly (no user interface).
9. **List arguments why to use an agent based approach.**

- Robustness: no single critical point of failure.

- Flexibility: support of complex interaction.

- Scalability: easy to add new agents to the system.

- Efficiency: less complexity.

1. **Name a few potential issues when designing a software agent.**

● How should tasks be scheduled and prioritized.

● How should the environment be probed and what should happen when the

environment changes.

● How will communication work between agents.

1. **Explain simple Reflex agents and Model-based agents.**

Simple Reflex Agents generally only react to their current input and do not not apply

any knowledge from earlier input. They are very basic but I imagine they are

similar to thermostats and the likes in buildings, where they gather data about

the current temperature and then either raise or lower the set temperature.

Model-based Reflex Agents rely on previously recorded information to make a

model of the world around it. The agent then has to make decisions and keep

track of what happens to the world independently from the agent and how the

agent itself affects the environment with actions. Combining this model with its sensory input

1. **Explain Simple reflex agents, Model-based reflex agents and Goal-based agents***Simple reflex agents:* Acts solely on the basis of the current percept, ignoring the history of percepts. Only successful in in fully observable environments. Rational if correct decision is based only on current percept.   
   *Model-based reflex agents:* Acts based on the model/structure describing how the world works. Percept history in combination with knowledge about how the world works gives information even about the unobservable part of the environment. Therefore, it can handle partially observable environments.   
   *Goal-based agents:* Extended version of model-based. Chooses actions in order to

achieve goals. Agents are able to recognize desirable states.

1. **Explain Utility-based agents and Learning agents.**   
   *Utility-based agents:* Uses a utility function which maps a state to a measure of the utility of the state. This allows the agent to evaluate states and compare them, thus being able to choose the best state out of several good ones. (Decide actions which takes you to the state).   
   *Learning agents:* Can initially operate in unknown environments and become more competent than it was with the initial knowledge.
2. **Agents for users: describe User agents, Interface agents and Information agents.***User agents:*   
   Acts on the behalf of the user, commonly a web browser. Telling the website information about users’ browser and OS.   
   *Interface agents:* Personal assistant which collaborates with user in same work environment. Assist the user, ex bring articles of the type that the user has shown interest in.   
   *Information agents:* With access to multiple sources of information, the agent compares and manipulates information obtained to be able to answer queries.
3. **Describe Collaborative, Non-collaborative and semi-collaborative environments.**A collaborative environment contains multiple agents which carries out tasks together. A non-collaborative environment means that the agent carries out the tasks individually. Semi-collaborative environment means collaborative but with some individual work as well.
4. **If the environment is a crossword-puzzle what are the attributes of the environment?**Fully observable, non-collaborative, deterministic, static, sequential, discrete.
5. **Give real world examples of agents that are being used in our society today.**● A digital assistant is an agent who can perform tasks or services for a person.

● Computer bots in games are also agents that responds to your actions ,e.g. enemies or opponents.

● Spam filters in mail services.

● Robot vacuum cleaners are agents that uses sensors and actuators to clean an environment.

1. **What are some modern Intelligent Agents?**

Siri by Apple, created as a voice command AI to perform tasks. Alexa, created by Amazon to receive commands similar to Siri.

1. **In modern AI, multiple types of agents exist. Two of these are meta- and intelligent agents. Explain how they are related.**A meta agent isn’t an intelligent agent itself, but it monitors multiple intelligent agents performing tasks. In addition, the meta agent controls the flow of the system, can solve conflicts and plan how to achieve a task in the system. Intelligent agents, however, only perform a set task in a simple domain, while meta agents are part of a undefined domain and may adapt to situations that can arise.
2. **Robocup is an AI competition where multiple robots play for a team and try to score against the other, as in a regular soccer game. What type of agents are used in these systems?**

Robocup, where teams of intelligent agents play soccer against each other. Here, each robot is an intelligent agent, while the system itself is a meta-agent system controlling the game. The type of agents used are intelligent agents that are apart of a meta-agent system.

1. **Explain if agents need to cooperate in a multi agent system?**No, agents do not need to cooperate in a multi agent system, but may intentionally do so.
2. **Describe a flexible agent?**

It’s an agent that is not pre-programmed and learn everything from experience.

1. **When is impossible to use a single agent to solve a problem which can be solved using MAS?**

One use case is the application of IoT-technology to monitor temperatures in different areas of your house. Using single agent system gives no possibility of differentiating the temperature in different areas.