Seminar 1 Questions:

1. **What is the Chinese room?**

The Chinese room is an experiment described by the philosopher John Searle, in which a person who doesn’t speak or understand Chinese is placed in a room. In the room there are a number of card with Chinese characters on them along with instructions written in a language the person understands (English). The person is given a story in Chinese and a number of questions about it. The person is able to use the cards to answer the questions about the story in Chinese by following the English instructions. If the system is configured correctly, the answers would be good enough that the people asking the question would believe that the room (the person inside the room) understands Chinese. Searle's reasoning is that neither the person, the cards or the room knows Chinese but the system still displays enough knowledge of Chinese that the people asking the questions believe that it understands the language. Just because a system functions intelligently (displays understanding), it doesn't necessarily mean that it is intelligent (understands).

1. **Why are search strategies needed for AI?**

When an AI system is faced with a problem it needs to decide a set of actions in order to move from the initial state to the goal state where the problem is solved. It stores the sets of possible actions in a search space where one of more of those sets will lead to the goal state. The system usually wants to find the goal state as fast as possible with the least amount of resources used therefore search strategies are implemented to search through the search space for a set of actions which will lead to the goal state.

1. **What is the difference between Depth-First and Breath-First Search?**

Depth-First Search (DFS)– starts by going down towards the left-most node at the deepest level. Then working its way to the right by going up to the parent, then to the next child node, then back to the parent and the next child. This is repeated until the parent doesn’t have any more children, it now acts as the child, goes up to its parent and the process is repeated until it reaches the right-most node.

Breath-First Search (BFS) **–** starts the search at the root and then to its children starting from the left. If the goal is not found it repeat the processes at the left-most child and its children where it acts as the root. This is repeated until the bottom rightmost node is reached.

1. **What is state space search?**

State space search is about mapping up all possible stages one can end up from one starting stage. This mapping is called a Space State. Then you can then, as in a direction graph, cross all possibilities until you reach the desired final stage. The example may be this game where you can fill a box with any of the boxes around in order to finally reach the lower stage of the picture.

However, this can be applied to more complicated problems, such as how an agent is going to move stand in a room to reach the final goal in the shortest time or way.

1. **Compare the AI technology we have today - Weak AI(ANI) with what is called Strong AI(true AI/AGI). Which are they biggest differences between the two types? Do you think we will ever achieve it as is called Strong AI?**

The AI Revolution: The Road to Superintelligence by Tim Urban, he addresses what difficulties it is is currently available. One of them, and perhaps the easiest to solve, is today's lack of hardware.

According to Tim, only one computer has so far managed to get up to the same amount of calculations per second as a human cope. That computer is today (2015, when the article was written) fastest supercomputer and takes up 720 square meters and uses 24 megawatts compared with the brain's 20 watts. Thus, with the present case of Moore's law and today's performance In computers it feels hard to soon reach the power needed to reach a reasonable level Strong AI. Even if it succeeds, we must make the AI ​​more human, smarter, more adaptive in its functioning. In order to achieve that, we may need to recreate something that mimic evolution, which feels quite far away. It feels almost more likely that man dies before that happens.The difference between the two is mainly their capabilities. Strong AI can emulate the human mind while weak AI can only simulate it.

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.

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.

1. **Give five examples of properties/applications that Weak AI have and another five for Strong AI.**

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| --- | --- |
| **Weak AI** | **Strong AI** |
| Reasons and solves simple problems within a domain | Reasons |
| Uses models for problem solving | Solves complex problems |
| Translates languages | Draws conclusions |
| Handles spell checking | Plans |
| Handles DB searches | Learns (ML) |
| Lack of consciousness  Has self-awareness | Communicates  Possesses consciousness |
|  | |
|  | |

1. **What is the Turing Test? Discuss how valid the test is**.

The Turing Test aims tests if something is intelligent. If a person cannot tell whether the written responses come from a person or a computer, it is considered intelligent. This is a matter of defining intelligence. If an AI is supposed to be a personal assistant, as Siri for example. It could be considered intelligent if the person using it could not tell whether it is a person or not. However, how do you test for intelligence in a chess bot for example? Should it mimic a human to be considered intelligent or should it just be better than the human opponent? I would say it is intelligent if it can reason, plan, learn and draw conclusions, maybe even have self-awareness. But a rather simple chess bot can beat a human, while the human cannot determine if it is a person or a computer. Would not this bot pass the test? Alan Turing’s original reasoning was that humans were the standard of intelligence, and the test is a formal way to determine how good a given machine is at appearing indistinguishable from a human purely intellectually. Some criticisms are that the Turing test does not consider perceptual skills or manual dexterity, or that it (unnecessarily) expects a machine intelligence to behave or be capable of mimicking a human, putting Turing’s fundamental argument to question. Turing himself also mentions that the test might encourage the machine to make mistakes in order to appear more convincing, which would otherwise be undesirable.

1. **Give five examples of Artificial Narrow Intelligence used in todays society.**

Cars (anti-lock brakes, tuning the fuel injection systems, self-driving) Phones (Google Maps, check tomorrows weather, talk to Siri) Email spam filters (starts with intelligence, then learns even more continuously) Recommended products online, Google Translate, Landing planes, allocating resources, Bots in games, Googles search service.

1. **Explain the difference between Uniform-Cost Search and Dijkstra’s algorithm.** Dijkstra’s algorithm is a variation of Uniform-Cost search. They both find the shortest(cheapest) path to the solution. UCS requires less memory as it gradually explores the nodes. Both explore the cheapest path possible every step. That is, takes the cumulatively cheapest node possible from the start. UCS can handle infinite graphs and requires less memory in practice.
2. **Explain the difference between Uniform-Cost search and A\*.**

UCS is uninformed while A\* is informed. A\* is a combination of UCS and Best-First search. A\* chooses the most efficient path, by minimizing the total path cost of the next node while also minimizing the approximative distance (according to heuristic) to the solution. A\* and UCS provides an optimal solution (which Best-First search alone does not). With a good heuristic, A\* is much better. Defining a good heuristic might be difficult.

1. **What is AI?**

During the Darthmouth conference in 1955 the term Artificial Intelligence was coined by John McCarthy. He proposed that “... every aspect of learning or any other feature of intelligence can in principle be so precisely described that a machine can be made to simulate it. An attempt will be made to find how to make machines use language, form abstraction and concepts, solve kinds of problems now reserved for humans, and improve themselves.”

There were originally 7 aspects of artificial intelligence that were proposed with the artificial intelligence problem:

1. Simulating higher functions of the human brain

2. Programming a computer to use general language

3. Arranging hypothetical neurons in a manner so that they can form concepts

4. A way to determine and measure problem complexity

5. Self-improvement

6. Abstraction: Defined as the quality of dealing with ideas rather than events

7. Randomness and creativity

There are generally two forms of AI, strong and weak. Strong AI performs on a human level of thinking and performs tasks intelligently. Weak AI simulate thinking and often performs tasks in small domains. There are many applications of artificial intelligence such as predicting, optimizing, speech recognition, etc.

1. **What are three examples of pathfinding algorithms?**

Bidirectional search, A\* search, and Dijkstra’s algorithm.

1. **What is a search algorithm, that picks the currently best option, called?**

It is called a greedy search. It will look at its alternatives and choose the highest ranked one, based on some internal rating system.

1. **Explain a possible situation when it would be sub-optimal to use a hill climbing algorithm.** One possible situation when a hill climbing algorithm would struggle is if there exists many local maximum within the search domain, and therefore create possible outcomes where the algorithm would think it is at the top, wrongfully so.
2. **What is ASI and what does it stand for?**

ASI is short for *Artificial Superintelligence* , and is a term closely related to the idea of computers surpassing the cognitive capacity of humans.

Reflect on the potential harm of Artificial Intelligence.It is common to approach ai with a concern regarding the risk of unintended consequences

that could potentially occur when we allow machines to take decisions. Even the great Stephen Hawking have raised is concern in the question, he said that Ai could evolve to the point that humans could not control it, which could spell the end of the human race. A less dramatic but yet impactful consequence is the devaluation of humanity and decrease of mankind labor, as AI becomes more proficient at specific tasks than humans.

1. **In many (even older) computer games, you can play against players that are controlled by the computer instead of a human. Are these programmes AIs? Explain why or why not.**

In fact, yes and no are both correct answers. These programmes are not „intelligent“. They normally consist of a set rules like „as long as you have less than 40 worker, produce workers“. Systems like this are not learning systems. On the other hand, following the sentence „as soon as it works, no one calls it AI anymore“, you can also say that it is an AI, especially in the time it was developed.

1. **You have a robot a position x in a room and it should move to position y. The movement is controlled by an artificial intelligence. How can the best possible schedule of tasks be detected? Why is BFS not the best solution here?**

This is a graph-based problem. The base of the solution is that every possible next step is an edge and every possible state is a node. The challenge is to find the shortest way from the origin to the goal. Therefore Breath-First-Search can be used. The problem is: By using a breath-first-search you have to process every single node. But there a many steps that make no sense. For example if you process a step that is in the direct opposite direction. You can improve the solution by using the A\* algorithm or Dijkstras-Algorithm and weighted edges. This can reduce the number of processed nodes to a much smaller size.

1. **Elaborate why AI could be dangerous in the wrong hands or if it implemented incorrectly.**

One reason could be that machines (as of today’s technology) lacks ethics and moral. Tasks like eliminating humans could be carried out effectively with the help of facial recognition.

1. **What are the consequences of an ASI?**

If an ASI (Artificial Super Intelligence) is created, it will understand that it is smarter than all the humans. It may decide that it has nothing to gain from humans since it can constantly improve itself and replicate on new systems. Even if it doesn’t exterminate humanity it can most likely be used as a weapon. That in itself is not very good either.

1. **Why is it important to know many different search algorithms?**

Each algorithm has different advantages and disadvantages. For example, DFS is very easy to implement but it might get stuck in infinite recursion. If that is the case, BFS might be a better choice. To choose the optimal algorithm you must know a few to decide on the best.

1. **When using A\* for pathfinding, what is an example of a heuristic function that might be used?**   
   The Euclidean distance between a given node and the goal node. Specifically, it is a lower bound of the true distance.
2. **What are main reasons machine learning and neural networks became more successful in the 21st century?**

This is primarily attributed to advances in computing power and availability of large amounts of data.

1. **Explain the difference between machine learning and classical (symbolic) AI.**

In symbolic AI all the steps are based on human-readable representations, using logical deduction and search algorithms to solve problems. Machine learning techniques, on the other hand, are designed with a set of parameters that adjust to produce desired behavior based on data or some form of selection. Many machine learning techniques can be examined using known models from mathematical statistics.

1. **Discuss some ethical concerns with strong AI.**

One issue is that, like any powerful tool, it could be controlled and misused by governments or corporations. Another is the issue of consciousness, whether an artificial mind of comparable intellect to a human would have rights, if it would be ethical to simply abort or delete an AI process.

1. **Nick Bostrom describes three ways a superintelligent AI system could function, which three ways?**

It could function as an oracle, granting us answers to nearly any question posed to it (Google is a primitive type of Oracle).

As a genie, which executes any high-level command it’s given (use a molecular assembler to build a new and more efficient kind of car engine)

As a sovereign, which is assigned a broad and open-ended pursuit and allowed to operate in the world freely, making its own decisions about how best to proceed.

1. **Discuss what you think that John McCarty means with: “as soon as it works, no one calls it AI anymore.”**

That our definition of what AI is, keeps evolving with the advances made in AI.

The phrase refers to the fact that tasks such as beating a human in chess used to be looked at as something that only an “intelligent” AI would be able to perform. These tasks have since been performed by machines and are now not considered feats of intelligence, but merely a computer performing calculations.

1. **What are intelligent agents and how are they used in AI?**

Autonomous entities that use sensors to know what is going on, and with actuators perform their tasks or goals. An intelligent agent is something which observes and acts on its surroundings to try to achieve a goal.

1. ***What is considered a greedy search algorithm***

A greedy search algorithm is an algorithm that uses a heuristic for making locally optimal choices at each stage with the hope of finding a global optimum.

1. **How AI can improve our work?**

There are many ways to improve our work with AI such as eliminating

busywork, creating new technology jobs, preventing workplace injuries.

However, for me, the most important part is reducing human error with smart algorithms.

1. **What are the most popular search techniques?**

Search techniques can be separated into two parts such as “Uninformed search” and “Informed search”.

Inside uninformed search, we have breadth-first, depth-first, depth-limited, iterative deepening depth-first and bidirectional search. The term 'uninformed' means that they have no additional information about states beyond that provides in the problem definition.

In informed search, which we have information is available about the problem this could guide the search, we have best-first and A\* search.

Each technique has some benefits and disadvantages inside itself.

1. **What are the ethical problems w AI?**

Unfortunately, of course, there are some ethical problems coming with AI.

With those, unemployment comes first. That can be followed by inequality and security problems.

1. **What is technological singularity?**

Technological singularity refers to a specific point in time where Artificial Intelligence will be powerful enough to start improving itself beyond that which the creators intended/predicted.

1. **How does a machine learning algorithm teach a program without being programmed?**

Machine Learning algorithms perform tasks a multitude of times and utilize statistical data results from the tries to improve on itself and reach desirable outcomes.

1. **Explain the A\* algorithm and where it is used**

The A\* algorithm is widely used for searching the shortest path. It is based on the heuristic approach like the Best-Search-First (BFS) and more formal approach such as the Dijkstra's algorithm. There are two fundamental elements to the algorithm, a closed list and a open list. A closed list contains areas where the algorithm already have been evaluated and explored. The open list contains areas that are directly adjacent to the areas in the closed list. The shortest distance is calculated as the

following:

f(n) = g(n) + h(n)

g(n) = represents the cost/distance of the path from starting point to any vertex n.

h(n) = represents the estimated cost from vertex n to the end goal.

If h(n) i calculated as straight line the distance is calculated as follow:

x 2 = coordinate of the goal location

x 1 = coordinate of the current location

y 2 = coordinate of the goal location

y 1 = coordinate of current location

dx = | x 2 - x 1 |

dy = | y 2 - y 1 |

Distance = sqrt(dx 2 + dy 2 )

The open list is always contain the first starting point and the closed list will always begin empty. Each node will always keep a pointer to its parent node to track where it came from. We iterate in the open list to pull out the best node n ie node with the lowest value of f. If n is the end goal we are done or else it is removed from the open list and added to the closed list. The open list will continue gain new nodes as we search for the lowest n node and check if it is our ultimate destination.

1. **Explain the Dijkstra's algorithm and what it is used for**

Dijkstra's algorithm is used to calculate the shortest path from the source to each of the remaining vertices in a weighted graph. The algorithm is only applicable if all the vertices are connected and the edges are non-negative. Each round the algorithm will keep the shortest distance of vertex v from the source in an array/list. All other vertices that hasn't been visited are set to infinity. It will continue to add all the shortest distance to the array/list until all the vertices has been visited.

1. **Explain Artificial Super Intelligence and why we should be concerned**

Artificial Super Intelligence (ASI) is a program that is far more superior than the smartest human beings in every possible field. This includes creativity, social skills, and general wisdom and so on. The reason we should be concerned is quite simple, think of the intelligence staircase in which there is an staircase and the humans are standing a few steps above the ground. Now image there is an ape one step below us. Now try to explain how revolutionary the smartphone is and how its going to change our world. Surely it is going to be impossible no matter how hard you try and the ape is only

one step below us in terms of intelligence. Now image the staircase continues on about 50 more flights and you probably have the ASI standing right there. No matter how hard we try we simply cannot comprehend the ASI hence there is no way of knowing what the ASI can do to us.

1. **Name 3 different areas within AI.**

For example, "Natural language processing", "Predictive programming" and "Deep learning"

1. **What is the definition of artificial intelligence according to the dictionary?**

The capacity of a computer to perform operations analogous to learning and decision making in humans, as by an expert system, a program for CAD or CAM, or a program for the perception and recognition of shapes in computer vision systems.

1. **Give some examples of benefits and improvements that artificial can provide in the future, discuss?**

Possible solution to the climate change, human implants, robots used for dangerous jobs and more.

1. **What is domain independent planning?**

It is a domain where the environment is not predefined for the AI, thus it need to be able to adapt to an unknown environment.

1. **Explain what artificial planning and scheduling is**

Artificial planning is identifying steps to a goal and executing them in the correct order by scheduling them. This can be done by trial and error - one possible path is tested first, if it does not work, the artificial agent may then backtrack and reevaluate its plan.

1. **Name 3 areas within AI and give examples of existing systems/research in each area.**

Speech recognition - consists of AI that can recognize speech patterns and follow commands. Examples of current such systems are Siri on iPhone and Alexa by Amazon.

Multi-agent systems, multiple AI machines working together. An example is for multiple drones to fly such that they, together, represent a predefined pattern by communicating with each other. The machines can either have own goals or a common goal - the thing to note is that they are working and communicating together to achieve the goal(s).

Machine learning - an AI agent that is able to learn from the past and adapt to future situations. A lot of systems are using machine learning, such as Spotify, to identify what songs you could be interested in, depending on previous music that you listened to or liked.

1. **2. What does ANI, AGI and ASI stand for and what is the difference between them?**

Artificial Narrow Intelligence, Artificial General Intelligence and Artificial Super

Intelligence. ANI is considered weak AI as it has a set of limitations to what it can do. It can only reason and solve simple tasks within a predefined domain. When solving these problems it has to use models. AGI on the other hand is considered strong AI and can reason freely and solve more complex tasks. ASI is what we get when we go one step deeper as it is a lot smarter than any human brain in every thinkable field.

1. **Explain what “Industrie 4.0” is. Mention three technologies that is included in “Industrie 4.0”.**

Industrie 4 is the current trend of automation and data exchange in manufacturing technology. It includes:

Cyber physical systems- Software components with distributed units such as integrated units, smart objects, Human beings, physical environment like: Smart Cities, Smart Grids, Smart Factories, Smart Buildings, Smart Homes and Smart Cars.

Internet of things - Network of connected heterogeneous objects: sensors, smart devices, embedded computers, mobile devices.

Cloud computing – Cloud computing metaphor: the group of networked elements providing services need not be individually addressed or managed by users; instead, the entire provider-managed suite of hardware and software can be thought of as an amorphous cloud.

1. **Compare planning and scheduling, what is the difference between the two?**

Scheduling includes specifying when a specific task shall execute and how long the execution time is. Planning on the other hand just examines what tasks have to be done with no concern as to when to execute or how long that task takes to execute.

1. **What does STRIPS stand for and what is it?**

STRIPS or Stanford Research Institute Problem Solver is a planning approach developed by Fikes and Nilsson in 1971. It involves the system identifying the differences between the current state and the goal state and then selects actions which reduces these differences, the method is called means-ends analysis.

1. **Why has AI become so popular in recent years and what might explain the rise of it?**

The computing power is constantly rising and since AI requires a lot computing power the use of complex AIs is getting more efficient every year. Furthermore, large sets of data are required for the training of useful Ai-agents. Recently more and more data are collected which enable more efficient AIs. Also, algorithms for AIs are constantly achieving better result and the development of AIs is funded by a raising number of stakeholders, e.g. tech giants and governments.

1. **What is the difference between problem solving and planning?**

Planning refers to determining a sequence of actions that are known to achieve a particular objective when performed. Problem solving instead is all about a systematic search through a range of possible actions in order to reach some predefined goals or solution.

1. **What are heuristic search algorithm?**

Searching is universal technique of problem solving in AI. There are uninformed brute-force search algorithms like Breadth-First or Depth-First Search. However, larger problems with a large number of possible states require problem-specific knowledge to maintain the efficiency of the algorithm. Heuristic functions are used to calculate an optimal path between two states in terms of costs. An example for a heuristic search algorithm is “A\* Search”.

1. **Discuss what possible drawbacks of AI are?**

First of all, the creation of a working AI requires a huge amount of costs (working hours and money) and it is not guaranteed the final result will provide the expected outcome, e.g. IBMs cancer detecting AI Furthermore, an AI has no emotions or moral and therefore will never fully replace a human being. Nevertheless, some jobs can easily be replaced by AIs, which can result in an increasing unemployment rate.

1. ***Explain Internet of Things.***

Internet of things is considered to be a network consisting of many different devices, from computers, cars to dish washers, and it enables all these devices to communicate and exchange data. Smart home is considered to be a subcategory of Internet of Things and it is the most spread-out example. Furthermore, Medical Care, indubitably, benefits from Internet of Things. The so-called Smart HealthCare is considered to be a digitized healthcare system, which connects medical resources and healthcare services.

1. **What are some real-world applications of search algorithms? And what types of problems are they used for.**

Finding the shortest way from one city to another, pathfinding for robots, pathfinding in games, etc. Tree structures and graphs.

1. **What is a rational agent?**

It is something that selects a rational (i.e max performance for least cost) action based on currently existing knowledge.

1. **Discuss the risks of AI, and why superintelligence could be harmful.**

Most researchers agree that a superintelligent AI is unlikely to become intentionally violent. Instead, when considering how AI might become a risk, experts think two scenarios

most likely:

1 : Autonomous weapons that in the hands of the wrong people can cause massive destruction.

2: The difficulty of defining our goals with the AIs goals, if we say “take us to the airport as fast as possible” it might do that in a dangerous way whereas the human operator had the optimal way in mind the AI might speed or take dangerous route.

1. **What type of problem is not suited for AI?**

Problems which have a defined answer which can relatively easily be found using common algorithms of mathematical formulas. AI could be used for these type of problems, but aren’t needed and wouldn’t necessarily do better than the pre-existing solutions.

1. **What are 4 criterias that can be used to evaluate a search algorithm's performance.**

Completeness: Is the algorithm guaranteed to find a solution when there is one?

Optimality: Does the strategy find the optimal solution?

Time complexity: How long does it take to find a solution?

Space complexity: How much memory is needed to perform the search?

1. **Describe in short the concept of AI planning and an example of how it can be used.**

AI planning is about finding a way to reach a goal, or to go from A to B. A number of states can be defined on a graph, including paths that link the different paths together.

After you have defined a start- and goal-state, the AI will try to find its way from the start-state to the goal-state, by moving one step at a time, and then examining the new paths that emerge for every step, until it reaches the goal. You generally achieve this by using some algorithm, such as A\* Search. This can be used for mapping a road network, to figure out how to get from address A to B in a city.

1. **What is a toy problem and provide an example. How is it different from a real world problem?**

A toy problem is a problem that can be used to test the effectiveness of AI and different algorithm, but what it actually can achieve, doesn't really offer any benefit to the user. It doesn't help them solve a problem that they care about.

An example could be a robot vacuum problem that is too simplistic to be implemented in an actual robot, or some AI that can finish a game puzzle.

1. **Discuss how does “*hill climbing*” / “*gradient descent*” work?**

At each state we could evaluate the transition to next state/path, one could then use a gradient evaluation function as a way of choosing the best following path.