1. **Name five types of Decision Support Systems (DSS) and explain them briefly.**

There are different Decision Support Systems that can be categorized into five types:  
  
●Communication-driven DSS is a type of DSS that emphasizes communications,  
collaboration and shared decision-making support. Its intention is to support and help  
organize a meeting or help users to collaborate. Examples: chats and instant messaging softwares, online collaboration and net-meeting systems.  
  
●Data-driven DSS​ is used to retrieve information from a database or data warehouse  
to find specific answers for specific purposes.Examples: computer-based databases that have a query system to check (including the incorporation of data to add value to existing databases.  
  
●Document-driven DSS is the most common support application targeted among a  
wide base of users. Its main function is to search web pages and look for documents  
based on precise set of keywords or terms.  
  
●Knowledge-driven DSS is a specific class of computerized information system that  
supports organizational decision-making activities and problem-solving expertise.  
The expertise consists of knowledge about a particular domain, understanding of  
problems within that domain, and skill at solving the problems.  
  
●Model-driven DSS uses a different models to solve problems or helps with decision  
making. These model can be statistical, financial, mathematical, analytical, simulation  
or optimization.

1. **What are the three fundamental components of a DSS architecture?**

The database (or knowledge base), the model and the user interface.

1. **What is the difference between deductive and inductive reasoning?**

In inductive reasoning you add up a number of facts that together build towards a  
hypothesis/conclusion. In deductive reasoning it’s quite the opposite, you start with a  
hypothesis and deduce a conclusion using facts.

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-Inductive reasoning is reasoning when the premises supports the conclusion (the  
conclusion is part of the reasoning).  
-Deductive reasoning is the opposite, is uses available facts/premises to arrive to a  
conclusion (the conclusion must be true if the premises are also true).

1. **What is Fuzzy logic?**

Fuzzy logic basically means that everything isn’t binary. The answer doesn’t have to be a strict “yes” or a strict “no”, it could be an “I don’t know” or “maybe”. Temperature doesn’t have to be “hot” or “cold”, it could be “just right”.

Fuzzy sets are useful when a sharp transition of membership is to be avoided. Ordinary sets have a binary membership states where you are either member or not. Fuzzy sets allow for the definition of

“middle aged man” where young man will gradually become a member from the young ages and later experience gradual loss of membership as the man grows older than a specified age.

1. **What are the main limitations with DSS?**

Lack of creativity, imagination and intuition. Often limited by the computer  
system, on which it is running. Interfaces are not sophisticated. Design narrowed to  
an application does not handle multiple decision.

A DSS does not have creativity, imagination or intuition to make reflective decisions.  
Another downside to implementing a DSS is the cost of developing one. If a DSS doesn’t have enough data, it will then make inaccurate decisions which also a downside.

1. **What is inference engine?**

Inference engine applies logical rules to a knowledge base to deduce new  
information.

1. **What is the difference between planning and scheduling?**

Planning is what to do, and when to do it. Scheduling is about how long an action  
takes and when it occurs.

Planning is considered to be about identifying how to proceed in executing a task, and we base this on our knowledge and/or experience. Scheduling, on the other side, is more about verifying that our approach we have planned is suitable and we can do that through different scheduling tools. Planning has a very important place in AI. Autonomous robots, driverless vehicles, routing, timetabling and investment are the most fundamental ones.

1. **What kind of reasoning is the following:**
   1. **All men are mortal.**
   2. **Socrates is a man.**
   3. **Therefore, Socrates is mortal.**

Deductive reasoning

1. **What is heuristics?**

Heuristics is a rule or data used for finding more efficient ways to solve a problem  
and can also be used to make search methods more effective. When not all facts are known but we can still draw a conclusion. Heuristics help us make decisions based on earlier or hardcoded information, that may or may not lead us to the right answer. This, I assume, can be used in AI to give some already existing information about certain situations the AI might find itself in.

*“Experience-based techniques for problem-solving, learning, and discovery that find a solution which is not guaranteed to be optimal, but sufficient for a given set of goals.” – Karolinska Institutet”*

1. **What are Reasoning systems, when should they be used and what are their benefits and drawbacks?**

**-What are they?**  
Reasoning systems is a computer system that makes conclusions of facts and/or  
hypotheses from the knowledge base. Reasoning systems can use different logical  
techniques such as inductive or deductive reasoning.  
  
**-When should they be used?**  
Deductive reasoning should be used when someone wants to apply theories/hypotheses to specific situations.  
Inductive reasoning should be used when you have gathered information and wants  
to draw a conclusion based on collected data.

1. **What are the three different forms of DSS based on the user interaction?**

Passive DSS: Only supports the decision-making process but does not deliver solutions.  
Active DSS: Gives suggestions and solution out of the decision-making process.  
Cooperative DSS: In an iterative way the user and the DSS creates out of the decision-making process a solution.

1. **What are the three components of which a DSS consists?**

Database management system (DBMS): Serves as a database, which stores data that is relevant to the problem for which the system was designed. Provides access on the data to the user.  
Model-base management system (MBMS): Provide a set of models or rules the system uses to generate useful information for the user, out of the data stored in the DBMS. Dialog generation management system (DGMS): The DGMS provides a user interface that is easy to use for those who are not familiar with complex computer systems.

1. **What is abductive reasoning? Give an example.**

Looks at a set of observations and proceeds to the conclusion that possible fits the observations. Is useful for forming hypothesis to be tested.  
For example, a person walks into their living room and finds torn up papers all over the floor. The person's dog has been alone in the room all day. The person concludes that the dog tore up the papers because it is the most likely scenario. Now, the person's sister may have brought by his niece and she may have torn up the papers, or it may have been done by the landlord, but the dog theory is the more likely conclusion.

Abductive reasoning is useful when you start with a set of observations and based  
on the observations tries to find the most likely solution.

One drawback with abductive reasoning is that it doesn’t guarantee a solution.

Another example:

The doctor hears her patients symptoms:

Regular shortness of breath on cold days

Regular shortness of breath when exercising

Therefore, the best explanation of these symptoms is that her patient is an asthma sufferer.

1. **What is business intelligence?**

Business intelligence means all the technologies, applications and methods a company uses to analyze and represent internal information to achieve a better and easier decision making process.

Business Intelligence, also called decision support, is a process or collection of methods for analyzing data and presenting information with which the owner, board, CEO, and other business developers within a company use to make smart decisions.

1. **List some fields where DSS is used.**

Clinical decision support for medical diagnoses. A DSS transforms the patient’s data into a set of appropriate diagnoses. Used from manager for business decisions: production process optimization, resource usage optimization, strategy decisions. Agriculture, where farmers use DSS to transform weather data and satellite date in useful information to increase the field produce.

SL travel planner, this DSS helps me decide when to leave for school and what  
route to take. Youtube video suggestions. Youtube will suggest videos for me to  
watch based on what i have watched previously and what others with similar  
preferences to me have watched, there by allowing me to find other videos i  
might like.

1. **What are the 3 parts of a STRIP instance?**

Initial state, goal state and a set of actions. The next question says there is also a current state.

1. **Explain how a means-end algorithm works. Also name a system that uses it.**

It has an initial, current and goal state which it moves towards. Each action chosen will reduce the difference between the current state and the goal state. For deciding what makes a good move or action the algorithm must have some kind of heuristic which it can apply to the states to measure them. An example of a system that uses this is STRIP.

1. **Compare an expert system with a knowledge system.**

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.

1. **What is Constraint programming?**

**Constraint programming** is a form of programming that place variables in relation to each other such as (A or B) or (y < 3) which are known as “constraints”. However, constraints don’t have to specify steps or actions that should be taken by the program. Instead the constraints can be used to find out properties that will guide to of a potential solution. This can be used as a scheduling technique in artificial intelligence. An example of this could be if a temperature in a system is over a certain point then perhaps this could mean that the system should prioritize a cooldown mechanism.

Constraint programming languages can follow either of two different approaches (2):

* Refinement Model, variables are initially unassigned but over time receive values that can either be within their range or not. If a variable receives a value that is outside of its range or domain, the value should be removed. This process goes on until all the variables have received values.
* Perturbation Model Variables are assigned to a single initial value, over time the system will receive changes to variables and then try to assign new values that are consistent with the previous changes to the other variables.

1. **How does a Knowledge based system make decisions?**

A knowledge-based system uses a large knowledge base concerning a specific

domain to form the basis of what decision should be taken next. This is action is then

taken automatically.

1. **Name three types of intelligent systems.**

Knowledge based systems, Expert Systems and DSS

1. **What is “means-end analysis” and briefly explain the idea behind it**

Means-end analysis is a planning method used in AI, the idea behind it is that actions that should be taken to a desirable goal are called means and the goal is referred to as the end.

1. **What are decision-support systems (DSS)?**

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.”

1. **What is monotonic and non monotonic reasoning?**

Non-monotonic reasoning from data in a knowledge base is that given a conclusion made from the existing data, adding new data may invalidate the previous conclusion if it contradicts it. In monotonic reasoning on the contrary, by adding new data to the knowledge base, previous conclusions cannot be changed due to the newly added data. So if is true for non-monotonic reasoning, adding B may invalidate A. If B is added using monotonic reasoning, A cannot be changed to be false.

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**Monotonic learning** is when an agent may not learn the knowledge that contradicts with what it already known or exists, it will not replace a statement with its negation. Thus, the knowledge base may only grow with new facts in a monotonic fashion. The advantages of monotonic learning are:  
  
1.greatly simplified truth-maintenance  
  
2.greater choice in learning strategies  
  
**Non-monotonic** learning is when an agent may learn the new knowledge that contradicts what it already known or existing. So it replaces the old knowledge with new if it believes there is sufficient reason to do so. The advantages of non-monotonic learning are:  
  
1.increased applicability to real domains,  
  
2.greater freedom in the order things are learned in

1. **What is a drawback when using Inductive reasoning?**

Using inductive reasoning may cause a fact to be concluded as true, even though it runs the risk of being false. If for example removing a dollar bill from a wallet turns out that the dollar is $5, inductive reasoning may determine all bills in the wallet to be $5. This may hold for the first bill, but does not mean that it is true for the whole wallet. In conclusion, inductive reasoning says that:

​if nothing contradicts A, let A be true. Adding new data may change A to be false, but it is assumed that A is true, as long as nothing contradicts it.

1. **What is the benefit of developing a DSS?**

When dealing with large sets of data, complex problems or time consuming calculations,conclusions done by hand may not be reasonable to do. By developing a DSS, decisions may be made much faster and sometimes new ways of thinking may be discovered by the system in the process

1. **What is a problem that inductive reasoning could give a solution to? And is the solution certain to be correct?**

You have a bag of candies, you have picked 5 candies which have all been Swedish fish using inductive reasoning you assume that they are all Swedish fish. This is not certain to be correct as there could be other candies in there but possibly very few of them are different.

1. **What is probabilistic reasoning? When could it be used?**

Probabilistic reasoning is a way of making a decision based on the probability of it. An application is for a diagnosis of a patient, if they have a high temperature and we want to check if a cold could be the cause and it turns out they only have a 0.8% chance of having a cold, then that is not very likely.

Probabilistic reasoning uses logic and probability to handle uncertain situations. There are three techniques used:

**Uncertainty factor -** The ability to look at truth or false in terms of integers. For example 0 is false and 1 is true and the truth proposition lies between 0 and 1. For example birds typically flies (0.9) and Tweety is a bird (1.0) Classical probability theory (Bayes Theorem) - Bayes Theorem is a formula that describes the probability of an event based on prior knowledge related to the event. For example if cancer is

related to age, we can assess the probability of getting cancer with higher confidence compared to assessing cancer diagnosis without the age factor.

Fuzzy set theory - Fuzzy logic is an approach to computing based on "degrees of truth" rather than true or false. Fuzzy logic includes 0 and 1 as extreme cases of truth (or "the state of matters" or "fact") but also includes the various states of truth in between so that, for example, the result of a comparison between two things could be not "tall" or "short" but ".11 of tallness."

1. **What is bayesian inference?**

It’s a description of how our prior knowledge affects our final probability conclusion. Using Bayes’s theorem we can update our probability and statistics when new knowledge becomes readily available.

1. **Explain the term big data and where can it be seen now?**

Big data is a term that describes the large volume of data – both structured and unstructured – that inundates a business on a day-to-day basis. (SAS) Banking industry is the one who already has usages of big data techniques. Banks today receive information from countless sources and it is crucial for them to process the information in a proper way.

1. **Describe Dempster Schaffer theory evidence**

Dempster Schaffer theory evidence allows one to combine evidence from multiple sources, and the conclusion it reaches has always a certain degree of disbelief. That degree of disbelief depends on both the number of answers and the subjective probability of each one. Dempster Schaffer theory is represented as a belief function.

1. **Describe Bayes theorem and what it could be used in?**

It describes the probability of an event, based on prior knowledge of conditions   
that might be related to the event. It could be used in spam filters**.**

1. **A version of a reasoning system is a interactive system, what is a interactive system?**

A interactive system ask clarifying questions to the system, to guide the reasoning.

1. **A robot is trying to navigate through a room, which reasoning method do you think it should use, discuss advantage/ disadvantage?**

Deductive reasoning:   
Deductive reasoning has a conclusion(s) and try´s to match the parameters to it/them. If a robot should be able to work with an unspecified domain then you need many prewritten conclusions and thus a large program. The program will probably be slow and my not solve the problem. This requires the program to go through every conclusion to find the correct one.   
Inductive reasoning:   
inductive reasoning uses the indata to draw a conclusion, it´s works in the opposite order as deductive reasoning. This makes the conclusion to a hypothesis which in this case is beneficial. By having a uncertainty we can calculate the probability that an event occurs and evaluate which conclusion should be used.

1. **Explain how can machine learning improve a DSS or expert system?**

Machine learning is used to reason better and better based on new facts learned when being trained. These systems may for example use inductive reasoning where better decisions can be given when the system is trained.

1. **Name 3 ways to represent data.**

• Heuristics representation (rules), if a then b else c.

• Frames: As an object in a object-oriented language.

• (OAV) object- attribute – value

1. **Discuss the benefits for a company to use a decision support system.**

It can help to analyze the situation the company is in and automate the process of gathering and analyzing the data of the company’s situation. This is of course relevant in the field of AI since the AI would need to gather data about its world and analyze and reason about the data.

1. **What does BDI stand for?**

BDI stands for Belief-desire-intention.

1. **Explain when a heuristic function is more desirable than an ordinary/exact function?**

A heuristic function is desirable when an accuracy is not as important as the time constraints imposed to solve problem. A heuristic function allow for faster but more imprecise solutions to be found.

1. **Explain when one should use the Bayesian model and when to use** **Dempster Schaffer model?**

When one has predefined measureable probabilities one should use the Bayesian model, if there are unknown probability values involved, one could use the Dempster Schaffer model.

1. **Describe how an AI can use search algorithms for planning a real world action such as the movement of a robot to a certain location.**

First the AI needs input about the environment which it can abstract in to a digital representation in which actions can be simulated. Then search algorithms can be used to attempt to traverse the abstraction. If a solution is found the AI now have a series of actions to perform in order to achieve the goal.

1. **What is the difference between data and information?**

Depending on the context (the rules) we can get different information from the same data. We need knowledge about the data. Without knowledge we won’t know what the data says. It is first when we have both data and knowledge that we can acquire information.

1. **What does it mean to reason?**

When we reason we take more than just the data into account. We look at our knowledge and data and from that derive new information. We do not solve something when we reason. You could say that we rearrange what we already do know into something more concrete( A conclusion).

1. **What are the advantages and disadvantages of DSS?**

The main advantages of DSS can be followed as increasing productivity,  
understanding, speed and the ability to analyze different type of information which will reduce the problem of complexity.

On the other hand, the main disadvantages of DSS are in the data mining phase because if you don’t have a proper database, then a manager will never have an accurate information. Also setting DSS can be require some investments but in the long period it will reduce the cost.

1. **What are the basic planning algorithms?**

Classical planning, reduction to other problems, temporal planning, probabilistic planning, preference-based planning and conditional planning.

1. **How DSS and planning relate?**

Since DSS systems are the systems that supporting us in our jobs and planning has a fundamental area of planning, we use planning too much in DSS systems. We can show strategic planning as an example of it. Strategic planning is a planned process in which an organization defines what it aims to achieve and how it is going to achieve it. Also decision making, which can be explained as referring to all organizational processes that makes the organization to make great choices between different options.

1. **What are the benefits of the idea to involve a decision support system and a human in decision making? Give an example of an advantage for both, systems and humans.**

The idea behind a DSS is to combine the advantages and disadvantages of a human and a machine and, in best case, to use the advantages and balance out the disadvantages of both. A dss for example can look through much more pieces of information and is more neutral. But it can only use the information it has. A human also has in most cases a better intuition.

1. **Take a look a the following conclusion: “Since the number of pirates in the  
   Caribbean decreases, the speed of the climate change increases”. Is this a  
   deductive conclusion, an abductive conclusion or none of these?**This is an example for an abductive conclusion. Both, the decreasing number of pirates in the Caribbean and the increasing speed of the climate change, are observations. For this reason, the conclusion is just a hypothesis which can be true or maybe not (in this case it is very likely that the hypothesis is wrong). The conclusion can not be verified. This would be the case for a deductive conclusion.
2. **Are the conclusions made by inductive, abductive or deductive reasoning verified? Explain why or why not and give examples.**

The only reasoning strategy that always gives verified conclusions is deduction. A deductive reasoning can be “Every bird lays eggs” and “Every chicken is a bird”. So the conclusion is “Every chicken lays eggs”.

Inductive reasoning looks a generalized special cases and tries to figure out the basic rule. An example for a wrong inductive conclusion can be: “This bird is a chicken” and “This bird is brown” that concludes in “Every chicken is brown” that is obviously not right.

An abductive conclusion can be: “the bird is on a farm” and “most birds on farms are chickens”. The conclusion here is “the animal is a bird”. This needs not to be wrong. But it also needs not to be true. For example if you are on a turkey farm the bird can also be a bird.

1. **Discuss what possible drawbacks of a DSS are:**

First of all, it is quite difficult to quantify all the available data, but the DSS can only handle quantified data. As a result, some data can not be taken into account by the DSS although they are available. Furthermore, DSS can be confused with a decision maker instead of being just a tool to provide additional information to enhance the decision-making process of the person in charge. Also, if the system is used not in the intended context, the decision-making based on the DSS can lead to failure, since DSS have to be tailored to a specific need/context.

1. **Explain Case Based Reasoning and it's 4 step process.**

This is an automated process which takes in data and tries to model solutions to specific problems.  
As you gather data and make predictions, the process becomes more precise. Unlike in Rule based systems, CBR enables the AI to learn to make informed decisions without the programmer having to define the rules or definitions. The AI will simply learn by experience to make accurate predictions. It's useful when making recommendations or predictions.  
By making a prediction of an action based on the current state, you can make informed decisions. And as the sample of cases grow, the more refined the decision-making process becomes. CBR is divided into 4 steps.

* Retrieval: Finding an old case that is similar to the current case.
* Re-use: Propose an action based on an old case.
* Revision: Evaluating how well the proposed action performs in the current case.
* Retention: Store the results and evaluate your prediction and see if you need to make changes.

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The idea of case-based reasoning is derived from the human way of learning from experience. We have the ability to apply information, which was gathered during an earlier trial, to a new, similar event. Since new problems often are similar to new problems we might run into, the past solution used might be valuable yet again. If a CBR system is used in a similar environment often, like a helpdesk, it is often met by the same complains and can therefore benefit a lot from earlier experience with similar issues.

The four steps are:

● Retrieve - Retrieve similar cases from the case base.

● Reuse - Adapt the retrieved cases to fit to the new case.

● Revise - Revise it based on how well it works.

● Retain - Retain this new case in the case base.

1. **Is reasoning under uncertainty possible?**

AI systems can deal with incomplete data, inconsistent data and changes (world knowledge can be updated over time). For this, logic and probabilities are used to describe decisions instead of true and false as to be more likely true/false to cope with uncertainty. Basic methods are Fuzzy logic-, statistical- or symbolic methods.