CPSC 433: Artificial Intelligence

Questions to prepare yourself for the Final Exam

- Name the subareas of AI.
- What is the general structure of an AI system, what knowledge is used and why do we have abstraction levels?
- What is the difference between computation and search?
- What are the advantages of computation, what are the disadvantages?
- What is the definition of a search model?
- What is the definition of a search process?
- What is the definition of a search instance?
- What is the definition of a search derivation?
- For what do we need the components of a search model, process, instance, derivation?
- What are the problem specific components of
  - set-based search
  - and-tree-based search
  - or-tree-based search?
- Given a concrete search model, a concrete search process to the model and a search instance, write down the search derivation produced by the process for the search instance. (Note: describing model, process and instance cannot be done in a short fashion, therefore: do not panic!)
- Given a problem and a search paradigm, produce a search model and search process that solves instances of the problem and follows the paradigm.
- What are the differences between and-tree-based search and or-tree-based search?
- Given two terms, decide if they are unifiable and if yes, generate their mgu. Examples:
  - \( f(x,y,g(x,c,d)) \approx f(g(y,a,d),a,g(x,c,d)) \)
  - \( f(x,y,x)) \approx f(a,g(x,b,c),d) \)
  - \( f(x,c,d) \approx f(f(x,c,d),c,d) \)
- Given two terms, apply the set-based search process for generating their mgu and write down a possible search derivation. Examples: see above
- Given a solvable unification problem and our set-based search model for it. If we have two different search processes for the model, will the mgus produced by the processes be different?
- Given two clauses and the Resolution inference rule, produce all clauses that are the result of applying the rule to the clauses. Examples:
  - \( Q(a) \lor Q(b), \neg Q(x) \)
  - \( P(a,b) \lor P(x,d), \neg P(a,y) \)
  - \( P(a,b) \lor P(x,d), \neg P(b,y) \)
• Given a clause and the inference rule Factorization, produce all clauses resulting from the application of the rule.
Examples: Q(a) ∨ Q(x)
        P(a,b) ∨ P(x,d) ∨ P(a,y)
        ¬P(b,y) ∨ ¬P(x,y)
        P(a,x) ∨ P(b,y)

• Given some clauses and a state in a modelelimination search, produce all possible successor states.

• Given a state in modelelimination search that has only leafs with sol-entry yes, check if it really fulfills the end condition.

• Given an or-tree-based search state for a constraint satisfaction problem instance (and the instance) and a leaf in this state, list all possible successor states that extend the leaf.

• What is the difference between and-tree-based search and and-or-tree-based search?

• What is the difference between tree-based search and graph-based search?

• What are general things that can be measured by a search control?

• Which parts of states can be measured by search controls?

• For knowledge representation in general, what does syntax and semantics mean?

• What are the reasons/ways why the same knowledge can be represented very differently?

• Logics in general:
  • How are terms defined?
  • What are the different kinds of predicate symbols?
  • What is an atom?
  • What do we need in addition to terms and atoms to define formulas?
  • What is the definition of an interpretation?
  • What is a logic (formally)?
  • What are the components of a calculus?
  • What do we need in addition to a calculus to build a theorem prover?

• For propositional logic and first-order logic, how is the general definition of a logic instantiated?

• What are the advantages and disadvantages of propositional logic?

• What are the advantages and disadvantages of first-order logic?

• What calculi do you use for propositional logic and what calculi for first-order logic?

• Given a description and a goal, translate them into propositional logic (first-order logic) and use a given calculus to prove that the goal is a consequence of the description!

• What are concepts that cannot be easily expressed in propositional logic or first-order logic?

• Which modern logics are used instead to express the concepts from above?

• What is the general structure of a rule in a production system?

• What are the three key components in a rule-based system?
• What is the structure of a rule in PROLOG?
• What is the structure of a rule in MYCIN/EMYCIN?
• Given a PROLOG program and a query, produce the answer!
• Given a set of EMYCIN rules, the truth values of some initial statements and an additional statement, compute the interpretation of this additional statement!
• Given a description, produce a PROLOG program representing this description!
• Given a description, produce a set of EMYCIN rules representing this description!
• What is the logic behind MYCIN/EMYCIN?
• On what result of probability theory is EMYCIN based?
• What are the Measure of belief and the Measure of disbelief?
• What programming paradigm are frames related to?
• How can knowledge representation with frames be visualized?
• What does XML stand for?
• Given a DTD and a faulty tagged text, find the errors in the tags with respect to the DTD?
• Name other schemes than DTDs to represent semantics to validate XML expressions!
• What is an ontology used for with regard to XML?
• What are the components of an ontology?
• What connections can be there between concepts and ontologies?
• What are the advantages and disadvantages of XML?
• What was the goal in developing Semantic Nets?
• What are the basic data structures of Semantic Nets?
• What are nodes in Conceptual Dependency graphs used for?
• What are the actions in Conceptual Dependency graphs and what are their semantics?
• What are modifiers in Conceptual Dependency graphs and what are their semantics?
• How does knowledge processing with Conceptual Dependency graphs work?
• Given a statement, transform it into a Conceptual Dependency graph!
• What are the components of a neural network?
• What is the general structure of a neural network?
• What are the parameters of an activation function?
• What are the parameters of a learning function?
• Given a network structure, an activation function and a learning function, train the network on a given set of input-output behaviors!
• What are the problems neural networks have?
• How do constraints fit into knowledge representation?
• What are the advantages of using constraints together with another knowledge representation mechanism compared to just using the other mechanism?
• Given some piece of knowledge to represent, what knowledge representation mechanism should be looked at first, according to our rules of thumb?
• + Any kind of questions about the team assignment!