Midterm Test 2018

Beginn: 05.12.2018, 10:00
Ende: 11.12.2018, 12:00

Kurs: Methods of AI (Lecture + Practice)
Nummer: 8.3018
Semester: WS 2018/19
Dozenten: Prof. Dr. phil. Kai-Uwe Kühnberger, Dr. rer. nat. Nico Potyka

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1. Classical vs Local Search

(2 Punkte)

For which problem is classical search more natural than local search?

- ○ Finding a shortest sequence of actions to solve a problem.
- ○ Finding a variable assignment that minimizes an objective function.

2. Simulated Annealing

(2 Punkte)

Simulated annealing is likely to make non-optimal choices if

- ○ the temperature is high.
- ○ the temperature is low.
- ○ the neighborhood is large.
- ○ the neighborhood is small.

3. Hill Climbing vs Simulated Annealing

(4 Punkte)

Which of the following statements are true (assume a maximization problem)?

- ○ Hill Climbing can make choices that decrease the objective function.

- ○ Simulated Annealing can make choices that decrease the objective function.

Vorsicht: Falsche Antworten geben Punktabzug!

4. Single-point Crossover

(4 Punkte)

Suppose you are given the parent chromosomes

ABABBA
BABBAA

Perform the standard crossover operation that we discussed in the course. Assume that the crossover point is after the third gene. Put the result in the text box below. If the resulting chromosomes are 1111 and 0000, write

1111
0000

5. Uniform-order Crossover

(4 Punkte)

Suppose you are given the parent chromosomes

CAFBDEG
GCABFED

Perform uniform-order crossover for the template

1110000

Put the result in the text box below. If the resulting chromosomes are 1111 and 0000, write

1111
0000

6. Consistency Concepts

(4 Punkte)

Which statements about local consistency concepts are true?

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If the domain of a variable becomes empty while establishing local consistency, we know that the CSP is inconsistent.	○ Yes	○ No	○ keine Antwort
If the domain of all variables remains unchanged while establishing local consistency, we know that the CSP is consistent.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

7. Local vs Global Consistency

(6 Punkte)

Which of the following statements are true?

- ○ Every node consistent CSP is consistent.
- ○ Every node consistent CSP is arc consistent.
- ○ Every arc consistent CSP is node consistent.
- ○ Every strong (k-1)-consistent CSP is strong k-consistent.
- ○ Every strong k-consistent CSP is strong (k-1)-consistent.

Vorsicht: Falsche Antworten geben Punktabzug!

8. Classical vs Probabilistic Planning

(4 Punkte)

Select all building blocks that we have in probabilistic planning, but not in classical planning.

States	○ Yes	○ No	○ keine Antwort
Actions	○ Yes	○ No	○ keine Antwort
State transition probabilities	○ Yes	○ No	○ keine Antwort
Policies	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

9. Modified Policy Iteration

(5 Punkte)

Which of the following statements are related to setting $\gamma = 1$?

- ○ We count future rewards with 100%.
- ○ The probability that an action yields the desired state is 100%.
- ○ Values for a policy may be unbounded.
- ○ The policy evaluation phase may not terminate.
- ○ The policy improvement phase may not terminate.

Vorsicht: Falsche Antworten geben Punktabzug!

Which claims about logic are true

Terms of predicate logic are recursively defined.	○ Yes	○ No	○ keine Antwort
Propositional formulas are recursively defined.	○ Yes	○ No	○ keine Antwort
In general there are only finitely many terms.	○ Yes	○ No	○ keine Antwort
In general, there are only finitely many predicate logic formulas.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

11. Unification 2

(1 Punkt)

Assume the following set of expressions is given:

{P(g(x,y), f(y), z), P(g(A,y), f(B), B)}.

What is the most general unifier?
Hint: x,y,z,... are variables; A,B,... are constants

Remember: A most general unifier (mgu) of a set of terms or atomic formulas is a substitution making all elements of this set syntactically equal.

- ○ {z <- B}
- ○ {y <- B}{y <- B, z <- B}
- ○ {x <- A, y <- B, z <- B}
- ○ {y <- B}
- ○ There is no most general unifier.

12. Proofs 1

(5 Punkte)

According to the lecture, which claims about proof techniques are true?

Mathematical induction is an example of an indirect proof.	○ Yes	○ No	○ keine Antwort
With proof by contradiction we can prove that there is no largest prime number.	○ Yes	○ No	○ keine Antwort
A direct proof is based on the transitivity of the logical implication and Modus Ponens.	○ Yes	○ No	○ keine Antwort
Only a direct proof is a valid proof technique in classical logic.	○ Yes	○ No	○ keine Antwort
A direct proof is based on inductive sets.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

13. Models

(5 Punkte)

Which claims about a model M of a set of Axioms A in first-order predicate logic are true?

M is a pair consisting of a universe U and an interpretation function I.	○ Yes	○ No	○ keine Antwort
The interpretation function of M maps terms to elements of the universe of M.	○ Yes	○ No	○ keine Antwort
The interpretation function of M maps formulas to truth-values.	○ Yes	○ No	○ keine Antwort
The interpretation function of M maps all elements of A to true.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

14. Planning

(8 Punkte)

Which statements are true?

In STRIPS, goals are partial decriptions of states.	O Yes	O No	O keine Antwort
STRIPS defines goals as states where no operator can be applied further.	O Yes	O No	O keine Antwort
STRIPS proves a goal state by applying resolution.	O Yes	O No	O keine Antwort
STRIPS assumes the closed world assumption (CWA).	O Yes	O No	O keine Antwort
STRIPS describes states as a conjunction of positive ground literals, with domain objects (constants).	O Yes	O No	O keine Antwort
Frame axioms are added to STRIPS in order to ensure that a true description of actions can be given.	O Yes	O No	O keine Antwort
Frame axioms are added in the situation calculus to represent facts that do not change by performing actions.	O Yes	O No	O keine Antwort
The ramification problem is the problem to model non-change of actions.	O Yes	O No	O keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

15. Planning 2

(3 Punkte)

Assume the following specification of a goal state in the blocks world domain:

C on A on B

For which of the following initial states we get a Sussman anomaly

(A on B on C is short for A on B, B on C which is short for on(A,B), on(B,C))

A on Table, B on Table, C on Table	O Yes	O No	O keine Antwort
B on A on Table, C on Table	O Yes	O No	O keine Antwort
B on C on Table, A on Table	O Yes	O No	O keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

16. Decision Trees

(5 Punkte)

Which of the following statements are true?

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Decision Trees are usually constructed by choosing recursively locally best attributes on which examples are split until an acceptable tree is found.	O Yes	O No	O keine Antwort
The ID3 algorithm is a standard algorithm that works by selecting from all possible decision trees the one that maximizes information gain.	O Yes	O No	O keine Antwort
The ID3 algorithm is a standard algorithm that works by selecting attributes that maximize information gain.	O Yes	O No	O keine Antwort
The information gain for attribute A is the expected reduction of entropy caused by knowing the value of attribute A.	O Yes	O No	O keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

17. Random Forests

(5 Punkte)

Which claims are true?

Random forests are a generalization of k-means clustering.	○ Yes	○ No	○ keine Antwort
Random forests first, compute randomly decision trees and second, compute the mean of the classification of all those trees.	○ Yes	○ No	○ keine Antwort
Tree bagging for random forests means that decision trees are not trained on the original training set, but on different subsets of the training set.	○ Yes	○ No	○ keine Antwort
Feature subset selection for random forest means that no information gain is used to decide which feature should be used for a split, but the features are randomly chosen.	○ Yes	○ No	○ keine Antwort
Feature subset selection for random forests means that only a subset of all available features is used for an individual decision tree.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!

18. Support Vector Machines

(8 Punkte)

Which of the following claims are true?

A support vector machine computes the optimal hyperplane separating examples from two classes.	○ Yes	○ No	○ keine Antwort
A support vector machine is learning method for unsupervised learning.	○ Yes	○ No	○ keine Antwort
A kernel of a support vector machine specifies a similarity measure between given examples.	○ Yes	○ No	○ keine Antwort
Maximizing the distance between the separating hyperplane and the closest points of the data set (margin) is equivalent to minimizing the dot product between the hyperplane and the given examples.	○ Yes	○ No	○ keine Antwort
The kernel trick can be described as a compression of a high dimensional vector space to a low dimensional vector space, in order to simplify computation.	○ Yes	○ No	○ keine Antwort
In order to use SVMs for multi-class classification, one can use the one-against-all method, where k binary SVMs are trained for k classes, the ith SVM is trained using the examples of the ith class as positive examples and all other examples as negative examples.	○ Yes	○ No	○ keine Antwort
The parse tree kernel (Collins & Duffy) specifies the similarity between two trees by counting the minimal editing distance between the trees.	○ Yes	○ No	○ keine Antwort
The parse tree kernel (Collins & Duffy) specifies the similarity between two trees by counting the number of isomorphic mappings of partial parse trees between two trees.	○ Yes	○ No	○ keine Antwort

Vorsicht: Falsche Antworten geben Punktabzug!