

Name:

Birth Date:

Matriculation Number:

Mock Exam Künstliche Intelligenz-2

July 9., 2017

	To be used for grading, do not write here							
prob.	1.1	1.2	2.1	3.1	4.1	4.2	Sum	grade
total	8	14	20	6	20	12	80	
reached								

Exam Grade:

Bonus Points:

Final Grade:

Organizational Information

Please read the following directions carefully and acknowledge them with your signature.

1. Please place your student ID card and a photo ID on the table for checking
2. The grading information on the cover sheet holds with the proviso of further checking.
3. no resources or tools are allowed except for a pen.
4. You have unspecified(sharp) for the test
5. You can reach 80 points if you fully solve all problems. You will only need 0 points for a perfect score, i.e. 80 points are bonus points.
6. Write the solutions directly on the sheets.
7. If you have to abort the exam for health reasons, your inability to sit the exam must be certified by an examination at the University Hospital. Please notify the exam proctors and have them give you the respective form.
8. Please make sure that your copy of the exam is complete (8 pages including cover sheet and organizational information pages) and has a clear print. **Do not forget to add your personal information on the cover sheet and to sign this declaration (next page).**

Declaration: With my signature I certify having received the full exam document and having read the organizational information above.

Erlangen, July 9., 2017

.....
(signature)

Organisatorisches

Bitte lesen die folgenden Anweisungen genau und bestätigen Sie diese mit Ihrer Unterschrift.

1. Bitte legen Sie Ihren Studentenausweis und einen Lichtbildausweis zur Personenkontrolle bereit!
2. Die angegebene Punkteverteilung gilt unter Vorbehalt.
3. Es sind keine Hilfsmittel erlaubt außer eines Stifts.
4. Die Lösung einer Aufgabe muss auf den vorgesehenen freien Raum auf dem Aufgabenblatt geschrieben werden; die Rückseite des Blatts kann mitverwendet werden. Wenn der Platz nicht ausreicht, können bei der Aufsicht zusätzliche Blätter angefordert werden.
5. Wenn Sie die Prüfung aus gesundheitlichen Gründen abbrechen müssen, so muss Ihre Prüfungsunfähigkeit durch eine Untersuchung in der Universitätsklinik nachgewiesen werden. Melden Sie sich in jedem Fall bei der Aufsicht und lassen Sie sich das entsprechende Formular aushändigen.
6. Die Bearbeitungszeit beträgt unspecified.
7. Sie können 80 Punkte erreichen, wenn Sie alle Aufgaben vollständig lösen. Allerdings zählen 0 Punkte bereits als volle Punktzahl, d.h. 80 Punkte sind Bonuspunkte.
8. Überprüfen Sie Ihr Exemplar der Klausur auf Vollständigkeit (8 Seiten inklusive Deckblatt und Hinweise) und einwandfreies Druckbild! **Vergessen Sie nicht, auf dem Deckblatt die Angaben zur Person einzutragen und diese Erklärung zu unterschreiben!**

Erklärung: Durch meine Unterschrift bestätige ich den Empfang der vollständigen Klausurunterlagen und die Kenntnisnahme der obigen Informationen.

Erlangen, July 9., 2017

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(Unterschrift)

Please consider the following rules; otherwise you may lose points:

- If you continue an answer on another page, please indicate the problem number on the new page and give a page reference on the old page.
- Always justify your statements (we would like to give points for incorrect answers). Unless you are explicitly allowed to, do not just answer “yes”, “no”, or “42”.
- If you write program code, give comments!

1 Bayesian Reasoning

Problem 1.1 (enumeration)

Explain the Inference by Enumeration algorithm, query variables and hidden variables. 8 pt

Problem 1.2 (Earthquake Alarm)

Your house has an alarm A which is (very likely) set off by a burglar B , but can also (rarely) be set off by an earthquake E . Your two neighbours John and Mary are supposed to call you (J and M) when your alarm goes off and you are not at home. 14 pt

Use the algorithm from the lecture to construct a Bayesian network for these 5 variables. More precisely: 6 pt

1. State the exact formal condition for when the algorithm inserts an edge between two nodes. 8 pt
2. Execute the algorithm for the variable order $X_1 = B$, $X_2 = E$, $X_3 = A$, $X_4 = J$, $X_5 = M$.

Justify your decisions.

2 Decision Theory

Problem 2.1 (Decision Network)

You try to decide on whether to take an umbrella to Uni. Obviously, it's useful to do so if it rains when you go back home, but it's annoying to carry around if it doesn't even rain. You look at the weather forecast, which has three possible values: **sunny**, **cloudy** and **rainy**. 20 pt

1. Draw the decision network for bringing/leaving an umbrella depending on whether it does or doesn't rain later.
2. Explain *formally* how to compute whether or not to take an umbrella, assuming you know $P(\text{rain} = b | \text{forecast} = x)$ for all $b \in \text{Bool}, x \in \{\text{sunny}, \text{cloudy}, \text{rainy}\}$.

3 Markov Models

Problem 3.1 (Stationary)

Define what it means for a Markov model to be *stationary*, and why we are interested in stationarity. 6 pt

4 Learning

Problem 4.1 (Tennis Trees)

Consider the following decisions on whether or not to go play tennis. The target is 20 pt “PlayTennis”.

Outlook	Temperature	Humidity	Wind	PlayTennis
Sunny	Hot	High	Weak	No
Overcast	Hot	High	Weak	Yes
Rain	Mild	High	Weak	Yes
Rain	Cool	Normal	Strong	No
Rain	Mild	Normal	Weak	Yes

Apply decision tree learning to this table.

Problem 4.2 (Linear Regression)

Given a set of examples $E \subseteq \mathbb{R} \times \mathbb{R}$, explain how to do *linear regression by loss minimization* 12 pt

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