Knowledge representation exam 2022

Knowledge Representation (Vrije Universiteit Amsterdam)

Test KR2021 exam

Test ID: 110356
Folder: /Top/SIS/XM_0059
Folder description: Knowledge Representation
Version: 6.3
Randomised: No
Last modified: Wednesday, 29 december 2021 12:34:00
Number of questons: 29
Blocks: Fixed
Display questions once: No
Tools: Spell checker browser, Calculator extended
Test time: 165 minutes
Maximum score: 72 pt.
Chance score: 12.25 pt. / 17%
In test set with: -

Test instruction

Welcome to the exam of the course Knowledge Representation (XM_0059).

Officially, you will have 2 hour 45 minutes to finish the exam

The following tools are permitted:
- Calculator
- Scrap paper (nothing written or printed on it)
- Check here for the cheat sheet

There are 29 questions, including open questions for which you can gain 16 points. In total you can earn 72 points.

For questions about the content of the test you can contact us **after the exam.** In case you believe a question is incorrect or vague, please answer according to your interpretation, and make a note of the question number and your assumption.
We can then later discuss these cases. Information about the review of the exam is provided via Canvas.

If you have **not** signed up for this exam, you will not receive a result. Through VUnet you can object to the fact that you can no longer sign up after the expiry of the registration deadline (and the fact that you will not receive a result for this exam). Submit your appeal online within one week after the exam. More information can be found at www.vu.nl/intekenen.

Logic general

Question order: Fixed
Three short questions about Knowledge Represtation and Logics in general for 6 points in total.

Question 1 − KR − 289946.2.1

Question type: Multiple response
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: Yes
Maximum score: 1
Chance score: 0.34 pt. / 34%
Status:
Last modified: 13/12/2021 23:58
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which about the following statements about Knowledge Representation (KR) are true (multiple answers might be correct)?

A KR is a field of AI dedicated to representing information about the world in a form so that computers can use it to solve it to solve complex problems.

B KR is the field of AI dedicated to representing all human knowledge in formalisms, such as ontologies or knowledge bases, so that they can best archived for future generations.

C KR is a field of AI dedicated to representing adaptivity of artificial agents in the presence of new, and formalised, knowledge

D Knowledge Representation incorporates findings from other fields, such as psychology, about how humans solve problems and represent knowledge.

E Knowledge representation and reasoning incorporates findings from logics and formal systems to automate various kinds of *reasoning*

Question 2 − Proof by contradiction − 289903.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.25 pt. / 25%
Status:
Last modified: 11/12/2021 11:26
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

In a proof by contradiction, such as DPLL or tableau, I can prove that a formula F is entailed by a knowledge base KB by showing that

A the knowledge base KB and the formula F are together unsatisfiable.

B the knowledge base is unsatisfiable, which implies that the formula F must be entailed.

C the knowledge base KB and the negation of the formula are unsatisfiable.

D the formula F is unsatisfiable, which implies that it must be entailed by the KB.

Question 3 − Logic Engineering − 289915.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 4
Chance score: 1.00 pt. / 25%
Status:
Last modified: 11/12/2021 23:41
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider a language L defined as follows

•Syntax
- {+,-} ∈ L
- If F1, F2 ∈ L then "F1%F2" ∈ L

where % is an operator of L.

•Semantics: let I be an interpretation function:
- I(+)=2, I(-)=3
- I(F1%F2) = I(F1) * I(F2)

where * stands for standard multiplication.

What is I(+%(+%(-%+)))?

A 2+2+3+2

B 24

C 2232

D 2-2-3-2

Propositional Logic

Question order: Fixed
7 questions on Propositional Logic, with 18 points in total. The 6s question of this block is a bit more complex and might take a bit more time.

Question 4 − PL semantics example − 289904.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 11/12/2021 23:58
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following is true?

The propositional statement (-P & Q) -> (P -> -Q)

A is satisfiable, but not valid

B is valid

C is a contradiction

D neither valid, satisfiable nor a contradiction

Question 5 − CNF practical 1 − 289939.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.67 pt. / 33%
Status:
Last modified: 12/12/2021 00:10
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which is the correct CNF for the following formula ¬((P ∨ Q) ∧ R) ?

A {(P ∨ ¬R), (¬Q ∨ ¬R)}

B {(¬P ∨ ¬R), (¬Q ∨ ¬R)}

C {(¬P ∨ ¬R), (¬Q ∧ ¬R)}

Question 6 – DPLL soundness – 289911.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 11/12/2021 23:31
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

DPLL is sound and complete w.r.t. Description Logic satisfiability

A True

B False

Question 7 – DPLL properties – 289909.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 11/12/2021 23:07
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

As DPLL is a depth-first search method for an interpretation that satisfies all the axioms of a knowledge base, it can end op in a local minimum, and not find the best model.

Is this statement true or false?

A True

B False

Question 8 − DPLL Algorithm − 289938.1.1

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 4
Chance score: 0.00 pt. / 0%
Status:
Last modified: 29/12/2021 12:35
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Complete the DPLL algorithm steps in the empty place, where ~ denotes negation.

In order to prove satisfiability of a formula F

```
dpll(F, literal){
  remove clauses containing literal
  shorten clauses containing ~literal
  if (F contains no clauses) return [True] ;
 if (F contains empty clause)
      return [false] ;
  if (F contains a unit or pure L)
      return [dpll(F, L)] ;
  choose P in F;
  if (dpll(F, ~P)) return true;
  else return [dpll(F, P)] ;
}
```

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
True	**false**	**dpll(F, L)**	**dpll(F, P)**
SAT	F		
1	0		

Question 9 – DPLL calculation – 289940.1.2

Question type: Open-ended
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 6
Chance score: 0.00 pt. / 0%
Status:
Last modified: 28/06/2022 17:00
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*
Word count: 500
Word count: No

Let KB be the following knowledge base: {(P v Q) ^ (Q -> R) ^ (R -> -P)}. Prove or disprove whether (P ^ -Q ^ R) v (-Q ^ R) v (P ^ -R) is entailed by KB using DPLL. Please describe the individual steps you have for the proof, as well as the result of each of the steps.

You can use ^ or & for conjunction, and v for disjuction, - for negation, so that you do not need to include any additional symbols in your answer.

Please use the empty spaces at the end of the exam if necessary.

Grading instruction

Proof by refutation (Number of points: 2)

Correct CNF (Number of points: 2)

Correct DPLL (Number of points: 2)

Question 10 – GSAT – 289908.1.1

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 11/12/2021 23:33
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

In GSAT, it can happen that one has to check multiple times that the same truth assignment satisfies the axioms of a knowledge base or not.

True or false?

A True

B False

Question 11 – GSAT soundness – 289910.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 11/12/2021 23:33
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

GSAT is sound w.r.t Propositional Logic satisfiability.

True or false?

A True

B False

Description Logics

Question order: Fixed
7 questions on Description Logics worth 23 points. The last question is an open question and is worth 8 points.

Question 12 – Model ENglish in DL – 289912.1.2

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 14/12/2021 22:34
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following ALC statements corresponds to the English statement
A Mule is an animal that has a horse as a parent and a donkey.

A Mule = Animal ⊓ ∃.hasParent. Horse ⊓ ∃. hasParent.Donkey

B Mule = Animal ⊓ ∃.hasParent. (Horse ⊓ Donkey)

C Mule = Animal ⊓ ∃.hasParent. (Horse ⊔ Donkey)

D Mule = Animal ⊓ (∃.hasParent. Horse ⊔ ∃. hasParent.Donkey)

Question 13 – Modelling DL in English – 289906.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 11/12/2021 23:56
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following English sentences is a faithful paraphrase of the following Concept

$$\text{Speaker} \sqcap \exists \text{gives}.(\text{Talk} \sqcap \forall \text{attends}^{-}.(\text{Bored} \sqcup \text{Sleeping}))$$

Let attends- be the inverse role of attend (remember, a function r is the inverse of a function s if, and only if, whenever r(x,y) also s(y,x) holds, and vice versa.

A The concept of a bad speaker, someone who gives a talk, and everybody who attends the talk is either borded or sleeping

B The concept of someone who attends a bad talk by a speaker and gets bored or is already sleeping

C The concept of a speaker who either gives a talk, or is attended by someone boring or sleepy.

D The concept of a good speaker, someone who gives a talk where nobody gets bored or is sleeping

Question 14 − DL in English 2 − 289916.3.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 0.50 pt. / 25%
Status:
Last modified: 29/12/2021 12:26
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Which of the following English sentences is a faithful paraphrase of the following formula:

KRTeacher= Teacher $\sqcap$ $\exists$.teaches.(Course $\sqcap$ $\forall$ hasTopic(PL $\sqcup$ PGM $\sqcup$ DL))

A A KRteacher is a teacher who teaches a course that is only about PL, PGM or DL.

B A KRteacher is a teacher who teaches only courses that are about PL, PGM or DL.

C A KRteacher is a teacher who teaches a course that is either about PL, PGM or DL, or something else.

D A KRteacher is a teacher who teaches a course that is about PL, PGM as well as DL

Question 15 − DL model − 289907.1.5

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 5
Chance score: 0.00 pt. / 0%
Status:
Last modified: 29/12/2021 12:59
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given the following interpretation with domain {alice, bob, clair, c1, b1, l1} and a table that clarifies who and what are in the interpretation of the **loves** relation.

alice	**bob**	**clair**
c1	c1	
	b1	b1
	l1	l1

In other words, this table tells you that (alice,c1):loves, (bob,c1):loves, etc.

Moreover c1 is in the interpretation of the concept **cars**, b1 in the interpretation of the concept **bicycles** and l1 in the interpretation of concept **lion**.

We also have information that cars, bikes and lions are disjoint classes.

Give the value of the interpretation (set of persons) of each of the following formulas. Write the full names with commas (but not spaces) in alphabetic order: Write the empty set as {}

a) ∃ loves.cars {alice,bob}

b) ∀ loves.bicyles {}
c) ¬ ∃ loves.cars {clair}
d) ¬ ∀ loves. ¬ cars {alice,bob}
e) ∀ loves.¬ (lion ⊓ bikes) {alice}

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
{alice,bob}	**{}**	**{clair}**	**{alice,bob}**	**{alice}**
alice,bob		clair	alice,bob	alice

Question 16 − DL model 2 − 289913.2.2

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 3
Chance score: 1.50 pt. / 50%
Status:
Last modified: 14/12/2021 22:35
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider the following TBox :

$$Mule \equiv Animal \sqcap \exists hasParent.Horse \sqcap \exists hasParent.Donkey$$

$$\exists hasParent.Mule \sqsubseteq \bot$$

Consider the following interpretation I with domain {1,2,3,4} and interpretation function:

I(Mule) = {1,2}
I(Horse) = {3}
I(Donkey) = {3,4}
I(Animal) = {1,2}
I(hasParent)={(1,3),(1,4),(2,3),(2,4),(3,4),(4,4)}

The interpretation I is a model, true or false?

A True

B False

Question 17 − Reduction of reasoning − 289914.2.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 12/12/2021 00:00
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

ALC ABox consistency checking is reducible to ALC subsumption checking. True or false?

A True

B False

Question 18 – Tableau calculus – 289905.1.3

Question type: Open-ended
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 8
Chance score: 0.00 pt. / 0%
Status:
Last modified: 20/12/2021 11:16
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*
Word count: 1
Word count: No

Use a tableau algorithm to test whether $\exists$ s.(C $\sqcap$ D) $\sqcap$ $\forall$ s.(¬ C$\sqcup$ ¬ D) $\sqsubseteq$ $\exists$ s.(C $\sqcup$ ¬ D) (where $\sqsubseteq$ stands for DL subsumption)

Describe all the necessary steps in detail.

In case you have trouble typing the symbols use E (or exists) for $\exists$, V (or all) for $\forall$, v, &, - for disjunction, conjunction and negation as usual.

Grading instruction

Criterion 1 (Number of points: 1)

Adding the negated implication to the right hand side of the formula

Criterion 2 (Number of points: 1)

Transform the formula into NNF

Criterion 3 (Number of points: 1)

Apply Existential rule correctly

Criterion 4 (Number of points: 1)

Apply Universal rule correctly

Criterion 5 (Number of points: 1)

Branching correctly

Criterion 6 (Number of points: 1)

Correct conclusion (all branches are closed, thus inconsistent)

Criterion 7 (Number of points: 1)

Correct conclusion: Subsumption relation holds

Criterion 8 (Number of points: 1)

General idea is understood

PGMs

Question order: Fixed
10 questions on Probabilistic Graphical Models with 25 points.

Question 19 – PGM1: Conditional Independence – 291147.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 14/12/2021 13:01
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Given a state of belief Pr, event A is conditionally independent from the event B given C iff Pr(A , B | C) = Pr(B| A)* Pr(C|A) or P(C) = 0
True or false?

A True

B False

Question 20 – PGM1: Divergent valve – 291148.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 14/12/2021 13:02
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

A divergent valve (← W →) is closed iff either variable W or all of its parent appears in Z. True or false?

A True

B False

Question 21 – PGM1: dsep – 291150.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 14/12/2021 13:04
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

If I_Pr(X, Z, Y) then dsepG(X, Z, Y) . True or false?

A True

B False

Question 22 – PGM1: MAP – 291149.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 1
Chance score: 0.50 pt. / 50%
Status:
Last modified: 14/12/2021 13:03
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

In case of MAP, the basic idea is as follows: We first maximise-out all the variables, and then sum-out all the non-MAP variables.

A True

B False

Question 23 – PGM2: Semantics 1 – 291294.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 1.00 pt. / 50%
Status:
Last modified: 14/12/2021 15:41
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

---

if A|=B and B |= C then Pr(A|B)>=Pr(A|C)

True or false?

A True

B False

Question 24 – PGM2: Semantics 2 – 291295.1.0

Question type: Multiple choice
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Random
Partial scoring: No
Maximum score: 2
Chance score: 1.00 pt. / 50%
Status:
Last modified: 14/12/2021 15:42
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

If A |=B and Pr(A)=1, then Pr(B)=1
True or false?

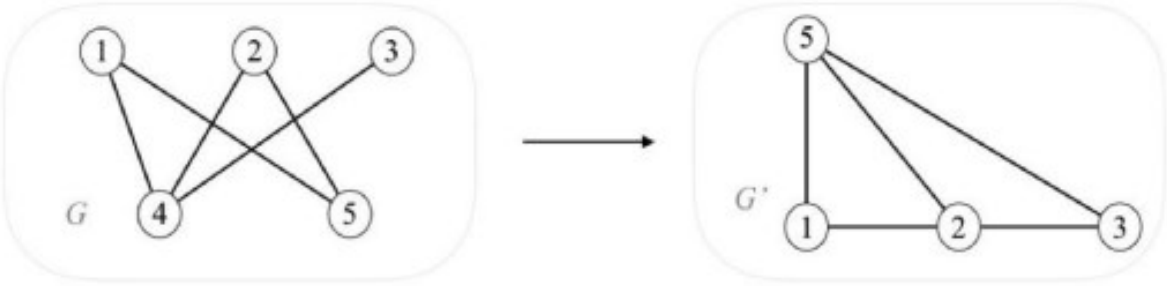
A True

B False

Question 25 – PGM3: Interaction Graph – 291299.1.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 6
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 15:46
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider the interaction graphs, and choose true or false for the following questions:



In the blanck fields, please just add the words True or False.

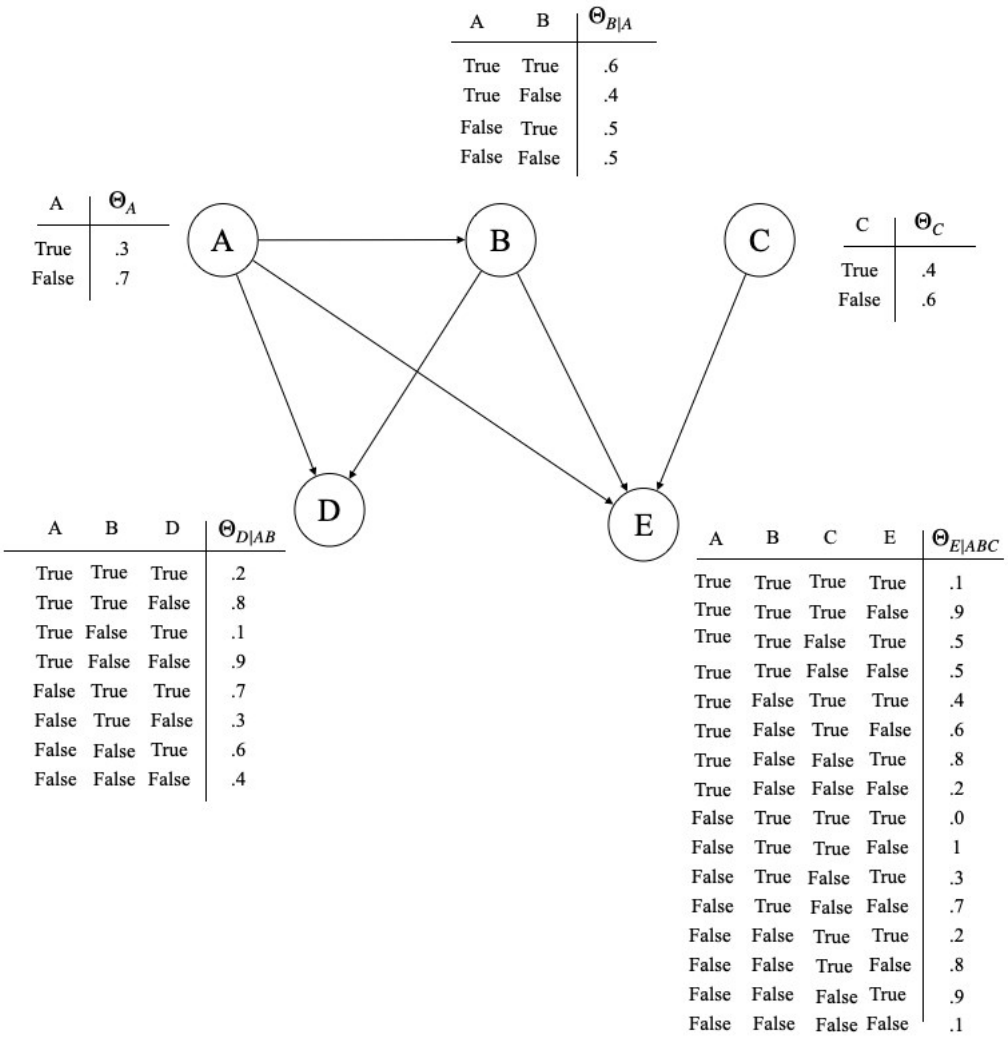
1. G corresponds to the following factors: f(1,4,5), f(2,4,5), f(3,4) True
2. If we eliminate 4 in G, then we get G' False
3. Assume G', according to min-degree heuristics, one possible elimination order is [1,2,3,5] True

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
True	**False**	**True**
true	false	true

Question 26 – PGM4: Rayesian Network, markov and dsep – 291306.1.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 4
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 15:50
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider the given Bayesian network:



A	Θ_A
True	.3
False	.7

A	B	$\Theta_{B\|A}$
True	True	.6
True	False	.4
False	True	.5
False	False	.5

C	Θ_C
True	.4
False	.6

A	B	D	$\Theta_{D\|AB}$
True	True	True	.2
True	True	False	.8
True	False	True	.1
True	False	False	.9
False	True	True	.7
False	True	False	.3
False	False	True	.6
False	False	False	.4

A	B	C	E	$\Theta_{E\|ABC}$
True	True	True	True	.1
True	True	True	False	.9
True	True	False	True	.5
True	True	False	False	.5
True	False	True	True	.4
True	False	True	False	.6
True	False	False	True	.8
True	False	False	False	.2
False	True	True	True	.0
False	True	True	False	1
False	True	False	True	.3
False	True	False	False	.7
False	False	True	True	.2
False	False	True	False	.8
False	False	False	True	.9
False	False	False	False	.1

Label each of the following statements as “true” or “false”, with respect to the given Bayesian network. (Recall that dsep(X, Z, Y) denotes “X and Y are d-separated by Z”).

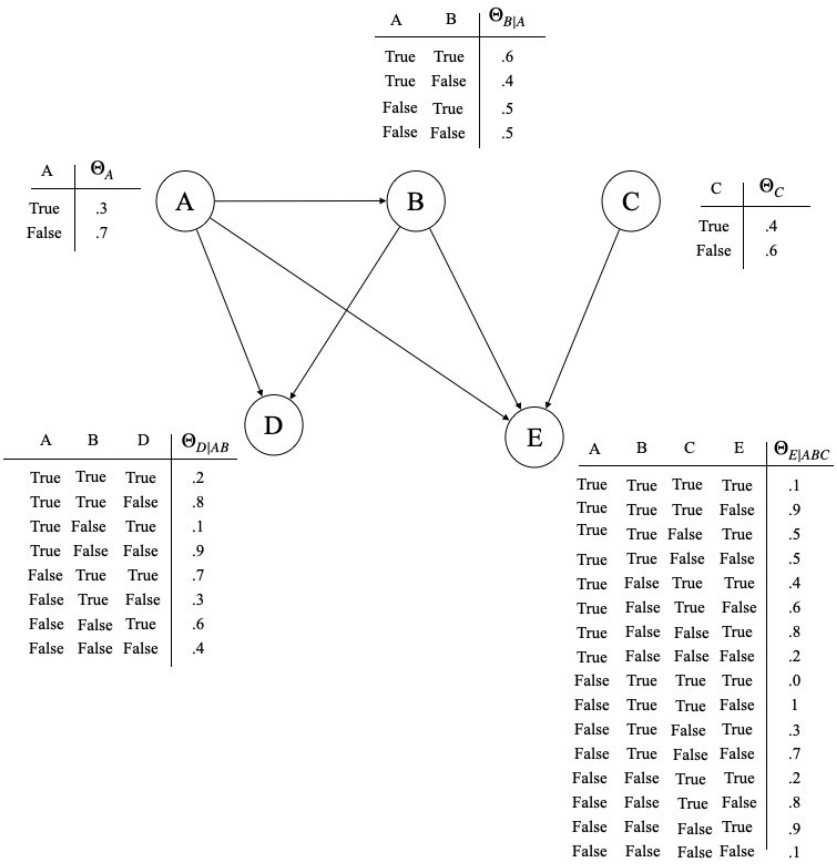
1. *I*(B, A, C) is a Markovian assumption. True
2. *I*(D, {B}, {C,E}) is not a Markovian assumption True
3. *d*sep(C,{EB},D) is the case. False
4. dsep(A, {B,D} E) is the case. False

[Alphanumeric]	[Alphanumeric]	[Alphanumeric]	[Alphanumeric]
True	**True**	**False**	**False**
true	true	false	false

Question 27 − PGM5: BN calculation − 291311.1.0

Question type: Open-ended
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 2
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 15:54
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*
Word count: 500
Word count: No

Consider again the same Bayesian network ,



A	Θ_A
True	.3
False	.7

C	Θ_C
True	.4
False	.6

A	B	$\Theta_{B\|A}$
True	True	.6
True	False	.4
False	True	.5
False	False	.5

A	B	D	$\Theta_{D\|AB}$
True	True	True	.2
True	True	False	.8
True	False	True	.1
True	False	False	.9
False	True	True	.7
False	True	False	.3
False	False	True	.6
False	False	False	.4

A	B	C	E	$\Theta_{E\|ABC}$
True	True	True	True	.1
True	True	True	False	.9
True	True	False	True	.5
True	True	False	False	.5
True	False	True	True	.4
True	False	True	False	.6
True	False	False	True	.8
True	False	False	False	.2
False	True	True	True	.0
False	True	True	False	1
False	True	False	True	.3
False	True	False	False	.7
False	False	True	True	.2
False	False	True	False	.8
False	False	False	True	.9
False	False	False	False	.1

Write out the formula that calculates Pr(B, D | A=True, C=True) in terms of the CPTs above.

Grading instruction

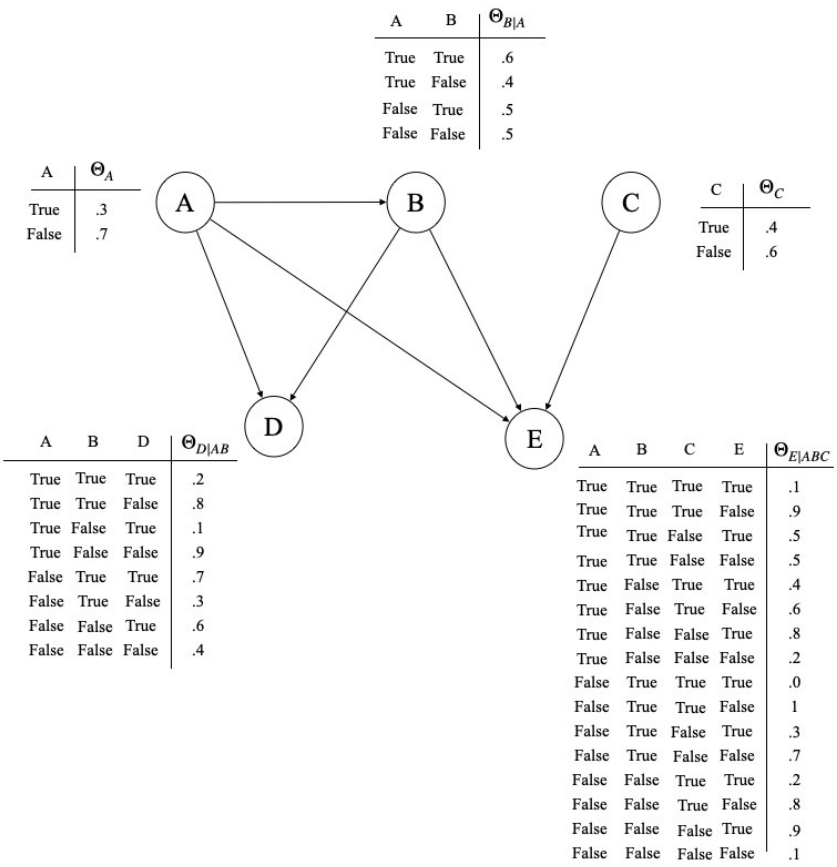
Criterion 1 (Number of points: 1)

Criterion 2 (Number of points: 1)

Question 28 − PGM5: BN calculation 2 − 291312.2.0

Question type: Fill in (multiple)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: Yes
Maximum score: 2
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 15:56
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider again the same Bayesian network ,



A	Θ_A
True	.3
False	.7

A	B	$\Theta_{B\|A}$
True	True	.6
True	False	.4
False	True	.5
False	False	.5

C	Θ_C
True	.4
False	.6

A	B	D	$\Theta_{D\|AB}$
True	True	True	.2
True	True	False	.8
True	False	True	.1
True	False	False	.9
False	True	True	.7
False	True	False	.3
False	False	True	.6
False	False	False	.4

A	B	C	E	$\Theta_{E\|ABC}$
True	True	True	True	.1
True	True	True	False	.9
True	True	False	True	.5
True	True	False	False	.5
True	False	True	True	.4
True	False	True	False	.6
True	False	False	True	.8
True	False	False	False	.2
False	True	True	True	.0
False	True	True	False	1
False	True	False	True	.3
False	True	False	False	.7
False	False	True	True	.2
False	False	True	False	.8
False	False	False	True	.9
False	False	False	False	.1

What is the most likely instantiation(s) of B and D, given A=False, C=True?

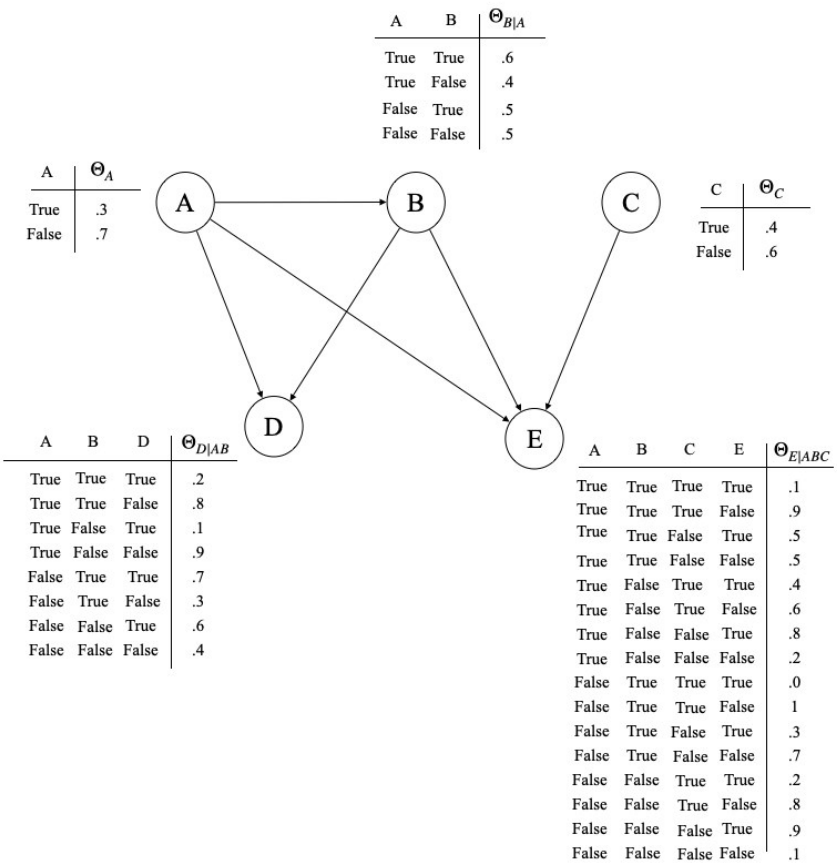
B= True , D= True

[Alphanumeric]	[Alphanumeric]
True	**True**
true	true

Question 29 − PGM5: BN calculation 3 − 291318.3.0

Question type: Fill in (numerical)
Pre-test item: No
Folder: /Top/SIS/XM_0059/2021 exam
Folder description: first exam KR 2021/22
Answer option order: Fixed
Partial scoring: No
Maximum score: 3
Chance score: 0.00 pt. / 0%
Status:
Last modified: 14/12/2021 15:57
Attributes: *Taxonomie/Taxonomy 00 Onbekend/Unknown*

Consider again the same Bayesian network ,



A	Θ_A
True	.3
False	.7

A	B	$\Theta_{B\|A}$
True	True	.6
True	False	.4
False	True	.5
False	False	.5

C	Θ_C
True	.4
False	.6

A	B	D	$\Theta_{D\|AB}$
True	True	True	.2
True	True	False	.8
True	False	True	.1
True	False	False	.9
False	True	True	.7
False	True	False	.3
False	False	True	.6
False	False	False	.4

A	B	C	E	$\Theta_{E\|ABC}$
True	True	True	True	.1
True	True	True	False	.9
True	True	False	True	.5
True	True	False	False	.5
True	False	True	True	.4
True	False	True	False	.6
True	False	False	True	.8
True	False	False	False	.2
False	True	True	True	.0
False	True	True	False	1
False	True	False	True	.3
False	True	False	False	.7
False	False	True	True	.2
False	False	True	False	.8
False	False	False	True	.9
False	False	False	False	.1

Calculate the result of the posterior probability Pr(B=false, D=false | A=True, C=False).

0.36