程序代写代做 CS编程辅导



COMP44 nowledge Representation and Reas g

Propositional Logic 1

WeChat: cstutorcs

Maurice Pagnucco Assignment Project Exam Help

School of Computer Science and Engineering

COMP4418. Week 1 Email: tutorcs@163.com

QQ: 749389476



Knowledge Representation and Reasoning

程序代写代做 CS编程辅导

- A knowledge-based agentile its core a knowledge base
- A knowledge base is a set about the domain in which the agent finds itself, expressed in a suitable about the domain in which the agent finds
- These facts are called sentences
- Sentences are expressed in a fibrifially knowledge representation language
- Question: How do we writes down knowledge, can we automate or mechanise reasoning to deduce new facts?

 Once we have written down knowledge, can we automate or mechanise reasoning Email: tutorcs@163.com
- References: OO: 749389476
 - Stuart J. Russell and Peter Norvig, Artificial Intelligence: A Modern Approach, Prentice-Hall International, 1995. (Chapter 6)



Overview

程序代写代做 CS编程辅导

 The need for formal Knov epresentation

Propositions

• Formulae in Propositional Logic Weenat: cstutorcs

Syntax

Assignment Project Exam Help

The Notion of Proof

Email: tutores@163.com

Conclusion

Semantics

OO: 749389476



Knowledge Representation and Reasoning

程序代写代做 CS编程辅导

- A knowledge-based ager described on different levels:
 - ∘ Knowledge level (epist
 - Logical level
 - Implementation level WeChat: cstutorcs
- Knowledge Representation is concerned with expressing knowledge in a Assignment Project Exam Help
- Reasoning attempts to takenthis throw edge and draw inferences (e.g., answer queries, determine facts that follow from the knowledge base, etc.)



Why do we need formal Knowledge Representation?

• You will all be familiar with sentences in English like: "The boy saw a girl with a telescope"

Also:

"Our shoes are guar give you a fit" (lexical ambiguity)
"I heard about him a (structural ambiguity)
"As he uttered the all-important word he dropped his voice, but she just managed to catch it" Narabiguity of cross reference)

- Natural languages exhibit Azvibiguity Project Exam Help
- Not only does ambiguity make it difficult for us to understand what is the intended meaning of certain phrases and sentences but they also make it very difficult to make any were the sentences but they also make it
- We shall investigate symbolic logic as a form of knowledge representation and reasoning



Syntax vs Semantics

程序代写代做 CS编程辅导

Syntax Describes the lequation language (e.g., it is a graph under a graph under a knowledge representation language (e.g., it is graph under a graph under a knowledge representation language (e.g., it is graph under a graph

Semantics Refers to the me sentences. It determines the facts in the world referred to by the sentences in a knowledge representation language. Essentially intrelates syntactic descriptions to the "real world". Semantics talks about truth and falsity. (E.g., x < 4 is true when x is a strictly smaller number than 4 and false otherwise)

Note: a sentence does not mean a hything by fisel? It is up to the person who wrote the sentence to give it a meaning to do this the person has to provide an interpretation for the sentence. In English, interpretations are already fixed but they still needed to be supplied to some point in the past.



Propositions

程序代写代做 CS编程辅导

- Propositions are statements
- The English sentence "T blue" expresses the proposition that the sky is blue
- Other propositions:

"Socrates is hald" WeChat: cstutorcs

"The car is red"

"The text is readable", etc.

• Often we shall use single letters to represent propositions:

P: Socrates is bald

OO: 749389476

(it saves a lot of time!)

This is referred to as a scheme of abbreviation



Scheme of Abbreviation

程序代写代做 CS编程辅导

Q: the lectures are dull

T: the text is readable

P: Alfred will pass

S: the lectures are dull

Q: the lectures are dull

T: the text is readable

P: Alfred will pass

Q: the lectures are dull

Q: the text is readable

P: Alfred will pass



WeChat: cstutorcs

Assignment Project Exam Help

Email: tutorcs@163.com

QQ: 749389476



Formulae in Propositional Logic

程序代写代做 CS编程辅导

- Now that we have proposed vould be nice to combine them into more complex expressions (or least the second volume of the s
- Similarly to natural languages, we can do so through the use of *connectives*:

```
negation

∧ conjunction

∨ disjunction

→ implication

⇔ bi-implication

\frac{\text{WeChat:}}{\text{pstutorcs}} \text{ "not P"}

Assignment <math>\text{Project } \text{ "Rand Q"}

P ∨ Q \text{"P or Q"}

Email: pstorce @ 163. \text{ "P}, then Q"

OO: 74\( \text{389}\( \text{Q} \text{6} \) \text{"P if and only if Q"}
```



From English to Propositional Formulae

程序代写代做 CS编程辅导

- "it is not the case that the are dull": ¬Q
 (alternatively "the lecture declared dull")
- "the lectures are dull and the text is readable": $Q \wedge T$
- "either the lectures are dull or the text is readable": $Q \vee T$
- "if the lectures are dull, then the lectures are dull, the lectures
- "the lectures are dull if and only if the text is readable": $Q \leftrightarrow T$
- "if the lectures are dull, then if it is not the case that the text is readable, then it is not the case that Alfred Will 343894 $\stackrel{\frown}{Q}$ 6 \rightarrow ($\neg T \rightarrow \neg P$)



Formulae in Propositional Logic — Syntax

程序代写代做 CS编程辅导

```
More formally, we can specifically a grammar for formulae in propositional
logic as follows:
Sentence ::= AtomicSentence || ComplexSentence
AtomicSentence ::= True Traise 95 propro R | ...
ComplexSentence ::= ( Sentence | Project Exam Help | Sentence Connective Sentence
                     ∥ ¬ Selftendetutorcs@163.com
Connective ::= \land \parallel \lor \parallel \rightarrow 0:749389476
```



Semantics

程序代写代做 CS编程辅导

• The semantics of the control can be given by truth tables

P	Q	$\neg P$		$P \lor Q$	P o Q	$P \leftrightarrow Q$
True	True	False	True	True	True	True
True	False	False	₩ asbat	: c <mark>quite</mark> rc	False	False
False	True	True	False	True	True	lelp True
False	False	True	False	False	True	True

 Now we have a way of determining the semantics (i.e., truth value) for complex formulae. Just use the truth tables!



Semantics — Complex Formulae

程序代写代做 CS编程辅导



R	S	$\neg R$	$R \wedge \square$	S = S	$(R \wedge S) ightarrow (eg R ee S)$
True	True	False	True	True	True
True	False	False	Fals W	Chragesetut	orcs True
False	True	True	False	True, P	roject Exa <u>m</u> Help
False	False	True	False	True	True

Email: tutorcs@163.com

QQ: 749389476



The Notion of Proof

程序代写代做 CS编程辅导

Question: Now that we can value in valu reasoning (i.e., perform infere

- A proof of a formula from premises is a sequence of steps in which any step of the proof is:

 - An axiom or premise WeChat: cstutorcs
 A formula deduced from previous steps of the proof via some *rule of inference* The last line of the proof should be the combine we wish to prove
- This is intended to formally capture the notion of proof that is commonly applied in other fields (e.g., mathematics)
- We use the notation $\lambda \vdash \rho$ to denote that the formula(s) λ "prove" the formula(s) ρ . Alternatively, twe: say that confollows from (premises) λ



What is a Logic?

程序代写代做 CS编程辅导



- A logic consists of
 - A formal system for expressing knowledge about a domain consisting of
 Syntax Sentences (Welltformed formulae)
 Semantics Meaning.
 - 2. A proof theory rules of inference for deducing sentences from a knowledge base

 Email: tutores@163.com

QQ: 749389476



Terminology

程序代写代做 CS编程辅导

- A sentence is *valid* or net true if and only if it is true under all possible interpretations in any positive true if and only if it is true under all possible interpretations in any positive true (e.g., P ∨ ¬P).
 Put another way, a sentence is valid if and only if no matter what truth values are assigned to its constituent parts the sentence is always true
- Valid sentences are also referred to as tautologies Assignment Project Exam Help
- A sentence is *satisfiable* if and only if in some possible world there is some interpretation for which the sentence is satisfiable if and only if in some possible world there is some interpretation for which the sentence is satisfiable if and only if in some possible world there is some interpretation for which the sentence is satisfiable if and only if in some possible world there is some interpretation for which the sentence is satisfiable if and only if in some possible world there is some interpretation for which the sentence is some interpretation for which it is sentence in the sentence in the sentence is sentence in the sentence is sentence in the sentence is sentence in the sentence in the sentence is sentence in the sentence in the sentence in the sentence is sentence in the sentence in the sentence in the sentence is sentence in the sentence in t
- A sentence is unsatisfiable (e.g., $P \land \neg P$)



Provability

程序代写代做 CS编程辅导

- $\lambda \vdash \rho$ we can construct for ρ from λ using axioms and rules of inference
- For example, $P, P \rightarrow Q \vdash_{\mathbf{WeChat: cstutorcs}} Q$
- This is a syntactic notion involving pure symbol manipulation
- In fact, we can capture | Assignment Project Examulating Several exist)
- If λ is empty (i.e., $\emptyset \vdash \rho$) and pilistatesingle! formula, then we say that ρ is a *theorem* of the logic

QQ: 749389476



Entailment

程序代写代做 CS编程辅导

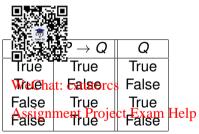
- $\lambda \models \rho$ whenever the foliation λ are true, one of the formula(s) in ρ is true
- This is a semantic notion; it concerns the notion of truth
- In the case where ρ is a syngle for multapiwe can determine whether $\lambda \models \rho$ by constructing a truth table for λ and ρ . If in any row of the truth table where all the formulae in λ are true, ρ is also true, then $\lambda \models \rho$.
- If λ is empty, we say that $\frac{\text{Email:}}{\rho}$ is a tather $\frac{1}{2}$ $\frac{1$

QQ: 749389476



Entailment

程序代写代做 CS编程辅导



Therefore, $P, P \rightarrow Q \models Q$

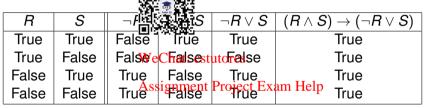
Email: tutorcs@163.com

QQ: 749389476



Entailment — Tautologies

程序代写代做 CS编程辅导



Therefore,
$$\models (R \land S) \rightarrow (\neg R \lor S)$$
 Email: tutorcs@163.com

QQ: 749389476



Soundness and Completeness

程序代写代做 CS编程辅导

- An inference procedure (truth
- e a logic) is *sound* if and only if it preserves
- In other words \vdash is sound iff whenever $\lambda \vdash \rho$, then $\lambda \models \rho$
- A logic is complete if and Villy lift is the proving all truths
- In other words, whenever Assignather Project Exam Help
- A logic is decidable if and only if we can write a mechanical procedure (computer program) which when asked λ ⊢ ρ it can eventually halt and answer "yes" or answer "no"
 QQ: 749389476



Conclusion

程序代写代做 CS编程辅导

- Due to the ambiguity in new graph guages there is a need to specify knowledge through the upper graph all languages
- Not only will these formal es give us a way to remove ambiguity but they will also help to provide methods for automating inference
- Propositional logic is a first move in this direction
- In the next lecture we look at automating ciriference lating the resolution rule on which Prolog is based Email: tutores@163.com
- We shall also investigate first-order predicate calculus
- Keep in mind that there are a large number of logics and knowledge representation schemes that we shall not look at

