程序代写代做 CS编程辅导

THE UNIVERSITY OF SYDNEY

NTIAL EXAM PAPER

Thi e removed from the exam venue.

mputer Science

EXAMINATION

Semester 2 - Main, 2022

COMP2022 Models of Computation

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EXAM WRITING TIME: 3 hours
READING TIME: 10 minutes

Assignment Project Exam Help

EXAM CONDITIONS:

This is an OPEN book examination. You are allowed to use passive information sources (i.e., existing written materials such as books and websites); however, you must not ask other people for answers or post questions on forums; always answer in your own words. You must not reveal the questions to anyone else. All work must be done individually in accordance with the University's "Academic Dishonesty and Plagiarism" policies.

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INSTRUCTIONS TO STUDENTS:

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1. Type your answers in your text editor and submit a **single PDF** via Canvas; all prose must be typed. Figures/diagrams can be rendered any way you like (hand drawn, latex, etc), as long as they are perfectly readable and part of the submitted PDF.
2. Start by typing your student ID at the top of the first page of your submission. Do **not** type your name.
3. Submit only your answers to the questions. Do **not** copy the questions.
4. Start each of the five problems on a new page.
5. If the required level of justification is not stated, you should briefly justify your answer.

For examiner use only:

Problem	1	2	3	4	5	Total
Marks						
Out of	12	14	12	6	6	50

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Problem 1. These questions are about Regular Languages. They are worth a total of 12 marks. If the required level of justification is not stated, you should briefly justify your answer.

a) Show that [2 marks]
expressions then there is a regular expression
for $L(S) \cap$

b) Give an N [2 marks]
ge of strings over alphabet $0, 1$ that have 001
as a subst
w the NFA or type the transition relation. No
additional
ded.

c) Give a regular expression for the language $\{w \in \{0,1\}^* : w \neq 01\}$. No additional explanation is needed. [4 marks]

d) Fix $\Sigma = \{0,1\}$. Consider the operation del that maps a string u to the string in which every 0 is deleted. So, e.g., $del(0) = \epsilon$, $del(01101) = 111$, $del(1) = 1$, and $del(\epsilon) = \epsilon$. For a language $L \subseteq \Sigma^*$, let $del(L) = \{del(u) : u \in L\}$. Explain why if L is regular, then $del(L)$ is regular. [4 marks]

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Problem 2. These questions are about Turing Machines and Complexity. They are worth a total of 14 marks. If the required level of justification is not stated, you should briefly justify your answer. If you are describing a TM, give a high-level description specified.

a) Let M be a [illegible] alphabet $\{0,1\}$. Give a high-level description of a TM th[illegible]guage $L(M) \cap L(0^*)$. [4 marks]

b) Explain w[illegible]**ble** languages are closed under complement. [2 marks]

c) We know t[illegible]ree language is in **P**. Explain why if L_1, L_2 are context-free languages, then $L_1 \cap L_2$ is in **P**. [4 marks]

d) Fix $\Sigma = \{0,1\}$. Consider the operation *del* that maps a string u to the string in which every 0 is deleted. So, e.g. $del(0) = \epsilon$, $del(01101) = 111$, $del(1) = 1$, and $del(\epsilon) = \epsilon$. For a language $L \subseteq \Sigma^*$, let $del(L) = \{del(u) : u \in L\}$. Show that if L is decidable, then $del(L)$ is recognisable. [4 marks]

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Problem 3. These questions are about Propositional Logic. They are worth a total of 12 marks. If the required level of justification is not stated, you should briefly justify your answer.

a) Are the fo $p \vee p$ logically equivalent? Give a short explanation/jus nswer. [2 marks]

b) Using the rom the Table provided with the exam, show that $((A \wedge$ [2 marks]

c) Is it true $F \vee G$ is valid then either F is valid or G is valid? Give a short explanation/justification of your answer. [2 marks]

d) Write a CNF formula over variables p, q, r that says that the number of true variables is even. No additional explanation is needed. [2 marks]

e) Prove the following in Natural Deduction: [4 marks]

$$(p \vee p), (p \rightarrow \neg p) \vdash (q \rightarrow p) \rightarrow \neg r$$

Type your answer in a table or as a sequence of lines. No marks will be awarded for proofs that do not use the rules taught in this course and summarised in the Table provided with the exam.

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Problem 4. These questions are about Predicate Logic. They are worth a total of 6 marks. If the required level of justification is not stated, you should briefly justify your answer.

a) Consider t[illegible]UoS) domain, that includes the UoS `COMP2022`, `COMP2922`, [illegible]ongst others), and the following predicates: [4 marks]

1. `prere`[illegible] binary predicate expressing that x is a pre-requi[illegible]
2. `prohi`[illegible]inary predicate saying that x is a prohibition of y.

Use this to write the following statements in predicate logic:

1. `COMP2922` is a prohibition of `COMP2022`.
2. Every UoS that is a pre-requisite for `COMP2022` is also a pre-requisite for `COMP2922`.
3. `INFO1103` has no pre-requisite.
4. If two UoS have the same pre-requisites then they have the same prohibitions.

No additional explanation is needed.

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b) Prove the following in Natural Deduction: [2 marks]

$$\forall x(P(x) \to Q(x)), \exists x P(x) \vdash \exists x Q(x)$$

Type your answer in a table or as a sequence of lines. No marks will be awarded for proofs that do not use the rules taught in this course and summarised in the Table provided with the exam.

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Problem 5. These questions are about Context-free Grammars. They are worth a total of 6 marks. If the required level of justification is not stated, you should briefly justify your answer.

a) Consider the grammar: [4 marks]

$$S \to AS \mid SB \mid \epsilon$$
$$A \to Aa \mid \epsilon$$
$$B \to bB \mid \epsilon$$

Describe the language of the grammar, and show that the grammar is ambiguous.

b) Fix $\Sigma = \{0,1\}$. Provide a context-free grammar for the language [2 marks]

$$\{u0v1w : |v| = |u| + |w|\}$$

For instance, taking $u = 01, w = 11, v = 1100$ we get that $u0v1w = 0101100111$ is in the language. No additional explanation is needed.

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