CSCC63 Assignment 2

REDUCTIONS, POLYTIME REDUCTIONS, AND NP 辅导

Warning: For this assignment you may work either alone or in pairs. Your electronic submission of a PDF to Crowdmark affirms that thi ent is your own work and that of your partner, and no one else's, and is also in accordance ■ f Toronto Code of Behaviour on Academic Matters, the Code iding plagiarism in CSCC63. Note that using Google or any of Student Conduct, an other online resource is

1. (20 marks) Consid

CFGs and no $x \in L(G_1)$ is a substring of any $y \in L(G'_1)$.

Is L_1 decidable, recognizable, co-recognizable, or neither? Prove your answer.

2. (10 marks) Conside Victoria guaga at: CStutores

$$L_2 = \{ \langle M, N \rangle \mid L(M) \leqslant_m L(N) \}.$$

Prove that ALLTASSIGNMENT Project Exam Help

3. (5 marks) Consider the language

FACT-LANGE $\{n \mid a, b\}$ tract $\{n \mid a, b\}$ tract $\{n \mid a \mid b\}$ from the property $\{n \mid a \mid b\}$.

Now, consider the following program to solve Fact-Range:

FIND-FACT=
$$(a, b)$$
 (a, b) (a, b)

- 3. For $i = \max(a, 1)$ to b:
- If nhittps://tutorcs.com
- 5.
- 6. Reject.

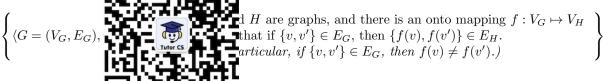
Is this a polytime algorithm? Why or why not?

4. (10 marks) If L is any language, let T(L) the the language of strings x such that x has at least two different substrings in L.

Prove that if L_2 is in NP, then so is $T(L_2)$.

- 5. (10 marks) Prove that if L_3 is in co-NP, then so is $T(L_3)$.
- 6. (15 marks) Let SQUARE-PARTITION= $\left\{ \langle S \rangle \; \middle| \; \begin{array}{l} S \text{ is a a multiset (it can have repeated elements),} \\ \text{and there is some } A \subseteq S \text{ such that } \sum\limits_{x \in A} x = \Big(\sum\limits_{x \in S \backslash A} x\Big)^2. \end{array} \right\}.$
 - (a) (5 marks) Show that SQUARE-PARTITION \in NP.
 - (b) (10 marks) Assuming that SUBSET-SUM is NP-COMPLETE, show that SQUARE-PARTITION is NP-complete.

- 7. (15 marks) Let HITTING-PATH= $\left\{ \langle G = (V, E), S, s, t \rangle \middle| \begin{array}{c} G \text{ is a directed graph, } S \subseteq E, s, t \in V, \\ \text{and } G \text{ has a path from } s \text{ to } t \\ \text{that passes through the regidge in } S. \end{array} \right\}$
 - (b) (10 marks) Assuming that HAM-PATH is NP-COMPLETE, show that HITTING-PATH is NP-COMPLETE.
- 8. (15 marks) Let G nguage



Note: In graph the state of a graph homomorphism.

- (a) (5 marks) Show that GRAPH-MAP \in NP.
- (b) (10 marks) Assuming that 3COL is NP-COMPLETE, show that GRAPH-MAP is NP-COMPLETE.
- 9. Bonus (10 marks—your mark will be rounded to the nearest multiple of 2.5)

In class we stated that a language L_B is in Σ_2 – that is, it can be recognized by a TM with access to a HALT oracle – iff it can be expressed in the form

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Where P(x, y, z) is decidable with a regular (non-oracle) TM.

Prove this assertio Email: tutorcs@163.com

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