CS253-TOCII

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Sample practice problems

Student Name	
Roll Number	
Signature	
Invigilator's Signature	

1. Write True or False for the following statements with justification. [10]
   (a) If any input of a language L can be reduced to some input of an undecidable language L', then L is undecidable. [2]
   (b) 3-SAT in decidable. [2]
   (c) CLIQUE is undecidable. [2]
   (d) If any input of a NP-complete language L can be reduced to some input of a language L', then L is NP-complete. [2]
   (e) There may exists some languages in P which are not in NP¿ [2]
2. Answer the following questions. [15]
   (a) Define Independent set of a undirected graph and give an example. [3]

Solution:

(b) Define The class NP [2]

Solution:

(c) What is Configuration of a turing machine. Define any turing machine and show its starting configuration. [5]

Solution:

(d) Define Decidable language [2]

Solution:

(e) Define SUBSET SUM problem with an example [3]

Solution:

3. Construct a turing machine M that accepts all the string that starts and ends with the same symbol (consider $\Sigma = \{0, 1\}$.). Taking this turing machine and the string 00100 as an input of A_{TM}, construct an instance of MPCP using the construction idea discussed in the class. Finally, show an arrangement of the constructed string pairs of MPCP that creates two mached strings in the top and bottom. [15]

4. Consider the function $\Phi = (x_1 v \bar{x_2} v \bar{x_3}) \wedge (\bar{x_1} v x_2 v \bar{x_3}) \wedge (x_3 v \bar{x_1} v \bar{x_4})$. Construct the instance of CLIQUE from Φ using the construction discussed in the class to show CLIQUE is NP-complete. [15]

5. Consider the function $\Phi = (x_1 v \bar{x_2} v \bar{x_3}) \wedge (\bar{x_1} v x_2 v \bar{x_3}) \wedge (x_3 v \bar{x_1} v \bar{x_4})$. Construct the instance of SUBSET SUM from Φ using the construction discussed in the class to show SUBSETSUM is NP-complete. [15]

6. Give an example of a deterministic turing machine that goes to infinite loop for every input $w \in \{0+1\}^*$. Call this turing machine M and let $w = 0011$. From the input $< M, w >$, construct an input M' of the language E_{TM}, where E_{TM}=$\{< M > | < M >$ is a turing machine and $L(M = \emptyset)\}$. Use the construction discussed in the class to prove E_{TM} is undecidable. [10]

Rough Work

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