

Quiz 3

* Required

1. Email address *

2. If L and N are languages and L can be reduced to N . It is known that L is not decidable but recognizable then what can you say about the complement of N ? Is it recognizable or decidable or cannot be known and why? Answer in 2-3 lines. No marks without justification. Note: In class, we discussed that reducibility means converting a problem into a problem of which solution is already known. 6 points

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3. Consider three decision problems: A , B , and C . It is known that A is decidable and B is not. Which of the following is a correct option? 1 point

Mark only one oval.

- ☐ C is undecidable if C is reducible to B
- ☐ C is undecidable if B is reducible to C
- ☐ C is decidable if A is reducible to C
- ☐ C is decidable if C is reducible to B 's complement.

4. $\text{Rec-DFA} = \{M \text{ is a DFA and } M \text{ recognizes input } w\}$. Rec-DFA is _____ 1 point

5. Suppose A and B are recognizable languages such that $A \cup B = \Sigma^*$. Further, suppose $(A' \cap B) \cup (A \cap B')$ is decidable. What can you say about A and B ? 1 point *

Mark only one oval.

- ☐ Neither A nor B are decidable
- ☐ A is decidable but B is not
- ☐ B is decidable but A is not
- ☐ Both A and B are decidable

6. True or False? Give a small example for your answer. If L_1 is regular and L_2 is TM-decidable, then $L_1 \cap L_2$ is regular. 2 points *

7. True or False? Give a brief one line justification (or example) for your answer. 2 points
If L_1 reduces to L_2 and L_2 is undecidable, then L_1 is undecidable. *

8. True or False? Give a brief one line justification (or example) for your answer. 2 points
The complement of the ATM problem is recognizable, where ATM is the acceptance problem of Turing Machine. *

9.

10 points

Find out if the following problem is Turing Decidable or Turing Recognizable?

Problem: Given two Turing machines M_1 and M_2 . Find out if $L(M_1) \cap L(M_2) = \Phi$.

Notes:

1. $L(M_1)$ = language of M_1 i.e. all the strings accepted by M_1 .
2. Following terms are used interchangeably
 - a. Turing Recognizable = Recognizable = Recursively Enumerable
 - b. Turing Decidable = Decidable = Recursive

Give valid reason by giving an algorithm to solve this problem and by showing for which types of input the algorithm to solve this problem will accept, reject or loop forever.

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