

Quiz 3 SOLUTION

1. 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.

If L can be reduced to N and L is known to be a recognizable language, then N is also a recognizable language.

From theorem discussed in class, we know if a language is recognizable, then its complement will be unrecognizable.

Therefore N -complement will be unrecognizable.

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

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

Give valid justification of your answer by giving an algorithm.

Using the following algorithm

- a. For every $w \in \Sigma^*$
 - i. Run M_1 for w
 - ii. Run M_2 for w
 - iii. If M_1 accepts and M_2 also accepts, reject
- b. Accept

We can see then the loop in statement a will run forever and we will never goto statement b, therefore if

1. $L(M_1) \cap L(M_2) \neq \Phi$, the algorithm will reject
2. $L(M_1) \cap L(M_2) = \Phi$, the algorithm will loop forever

Hence the given problem is not Recognizable