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 ϵ Σ*
   i. Run M1 for w
   ii. Run M2 for w
   iii. If M1 accepts and M2 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(M1) ⋂ L (M2) != Φ, the algorithm will reject
2. L(M1) ⋂ L (M2) = Φ, the algorithm will loop forever

Hence the given problem is not Recognizable