Fall - 2014

doubt

1. Provide a context free grammar that gene-rates the following language over $\Sigma = \{0,1\}$: $\{\omega = 0^* 1^* : |\omega| \text{ is odd}\}$

→ $L = \{ \epsilon, 0, 1, 011, 010, \text{-----} \}$.

$S \longrightarrow A0B \mid A1B$

$A \longrightarrow \epsilon \mid A00$

$B \longrightarrow \epsilon \mid B11$

2. A clique ... ..

↔ Since, clique is NP problem and every NP problem is easy to verify in polynomial time.

Here, given 3 clique is a decidable problem means in fact problem statement is that a given graph $G\{V, E\}$ we determine whether given graph is 3 clique or not in polynomial time.

we can design any algorithm for detection of 3 clique like that

```
3clique (vertex V, edges E)
  {
// if graph has not 3 vertex then it's
// not 3clique.

if (vertex.size() != 3)
      return false.

// if there are only 1 to 2, 2 to 3
     and 3 to 1 edges then true.

if(edges.size() != 3)
        return false.

if (!edges 1 to 2 or !edges 2 to 3
      or !edges 1 to 3)
          return false

  return true
  }
```

just like any algorithm we can detect

in polynomial time whether given graph is 3 clique or not So given problem is decidable infact every NP problem is decidable and clique is NP problem.

3. Answer the following.

a. Define the class NP.

→ The NP in NP class stands for Non-deterministic polynomial time. It is the collection of decision problems that can be solved by a non-deterministic machine in polynomial time.

Features:

1) The solutions of the NP class are hard to find since they are being solved by a non-deterministic machine but the solutions are easy to verify.

2) Problems of NP can be verified by a Turing machine in a polynomial time.

b) Show that the class NP is closed under concatenation.

→ Let A and B be languages that are decided by NP-machines T_A and T_B

Now we want to show that, there is a non-deterministic poly time decider $T_{A \cup B}$ that decides concatenation of A and B.

The construction of $T_{A \circ B}$ is as follows:

$T_{A \circ B}$ = "on input S:

1) Split S into S_1, S_2 such that $S = S_1 S_2$.
2) Run the NP machine T_A on S_1. If T_A is rejected, then reject.
3) Else run T_B on S_2. If T_B is rejected, then reject
4) Else accept.

The time taken by Step 1 is $O(n)$ in a 2 tape Turing Machine. Thus, T is a poly-time non deterministic decider for A o B

Thus, it is proved that NP is closed under concatenation.