Natthachan Eucumpon 6081213 Test 3

2(a) True

(b) True

(c) False

(d) False

(e) True

(f) True

5) Certificate : ~~Given~~ a subset of an Array A

verifier : Add number ~~of~~ in the subset and check if it equal to T.

Runtime : Let n be the number of element in A.

then to sum ~~all~~ the element take atmost O(n) time.

To solve for T take O(1) time

The computation take at most O(n) time so it is linear.

Therefore it is ~~str~~ in NP.

4) AFSOC that LOOP is decidable. This means there is a Turing Machine L that decides it. Then we can use $L = (\langle M, x \rangle)$ where x is an input.

~~Let define a new machine~~ N

$$L(\langle M, x\rangle) = \begin{cases} \text{ACCEPT IF } M \text{ loops on } x \text{ forever} \\ \text{REJECT otherwise} \end{cases}$$

From this we can create another machine N. To prove this we run R on $\langle M, \langle M \rangle \rangle$. From this we have

$$N(\langle M \rangle) = \begin{cases} \text{Accept if } M \text{ loops forever on } \langle M \rangle \\ \text{Reject otherwise.} \end{cases}$$

Applying M = N we have :

$$N(\langle N \rangle) = \begin{cases} \text{Accept if } D \text{ loop foreven on } \langle D \rangle \\ \text{reject otherwise.} \end{cases}$$

This contradict therefore ~~L~~ and N can't exist. Hence LOOP is undecidable.

4)(a) $INCL_{DFA} = \{\langle D_1$ and D_2 are DFAs such that $L(D_1) \subseteq L(D_2)\}$

~~I~~ Construct another DFA called D_3.

W~~here D_3~~ = ~~with a time~~ · Let L_1 be language of D_1 and L_2 be language of D_2 respectively.

Construct D_3 such that $L_3 = (L_1 - L_2) \cup (L_2 - L_1)$

If L_3 is empty then ~~D_1 and~~ D_2 accepts everything that D_1 accept.

(b) $INCL_{TM} = \{\langle M_1, M_2 \rangle \mid M_1$ & M_2 are TMs such that $L(M_1) \subseteq L(M_2)\}$

3) LOOP $\leq_T$ REJECT

WLOG let assume that there are 2 machine M_L and M_R where M_L decides LOOP and M_R decides Reject. The given input is $\langle M, x\rangle$ where x is an input string. Let:

1) Create M' from M by reversing it accepting and rejecting states.

2) Run M_D with $\langle M', x\rangle$

3) If M_D accept we reject ~~and ...~~ if M_L reject we accept.

From this we know that M_L is able to decide LOOP if given M_D. Therefore, LOOP $\leq_T$ REJECT