

**CS 3313 Quiz 10: A group quiz – maximum of three persons per group. One submission for each group.**

**NAMES (max 3 per team)**\_\_\_\_\_

Recall the closure properties of Recursive Languages: They are closed under union, intersection, complement, set difference.

Prove that recursive languages are closed under the XOR operation, i.e., if  $L_1$  and  $L_2$  are recursive languages then  $L_1 \text{ XOR } L_2$  is a recursive language. Recall definition of XOR

$$L_1 \text{ XOR } L_2 = \{ w \mid (w \in L_1 \text{ and } w \text{ is not in } L_2), \text{ or } (w \in L_2 \text{ and } w \text{ is not in } L_1) \}$$

$$L_1 \text{ XOR } L_2 = (L_1 \text{ INTERSECT } (\text{NOT } L_2)) \cup ((\text{NOT } L_1) \text{ INTERSECT } L_2)$$

Apply the closure properties:

1. Since recursive languages are closed under complementation:

- $\text{NOT } L_2$  is recursive
- $\text{NOT } L_1$  is recursive

2. Since recursive languages are closed under intersection (AND)

- $A = L_1 \text{ INTERSECT } (\text{NOT } L_2)$  is recursive
- $B = L_2 \text{ INTERSECT } (\text{NOT } L_1)$  is recursive

3. Since recursive languages are closed under UNION (OR)

- $A \text{ UNION } B$  is recursive

You can also ‘draw’ the algorithm/flow-chart for the above.