

Solutions for Midterm, CSE 355

1. (10 points)

$$abba \notin L_1 \cup L_2 \cup L_3$$

$$abab \notin L_1 \cup L_2 \cup L_3$$

$$\lambda \notin L_1 \cup L_2 \cup L_3$$

$$bbba \in L_1$$

2. (10 points)

$$(a \cup b)^*$$

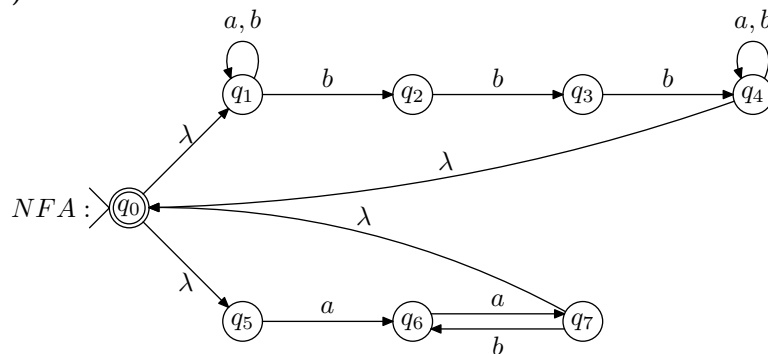
3. (10 points)

$$(a \cup ba \cup bba)^*(\lambda \cup b \cup bb)$$

4. (10 points)

There is a one-to-one and onto function (one-to-one correspondence) between the two sets.

5. (15 points)



6. (15 points)

$$S \rightarrow aS \mid ES \mid SE \mid a$$

$$E \rightarrow aEb \mid bEa \mid EE \mid \lambda$$

7. (15 points)

Base case: $(0, 1) \in R$.

Recursive step: if $(x, y) \in R$, then $(s(x), y) \in R$ and $(x, s(y)) \in R$.

Closure: $(x, y) \in R$ iff it can be obtained by applying finite number of the above steps.

8. (15 points)

$$L = \{a^n a^k b^n \mid n \geq 0, k \geq 0\}$$