

**CS321**  
**Theory of Computation**  
**Quiz 3**

Name:

1. [7pt] Consider the regular expression  $r = a^*(\lambda + b + bb)(ab)^*$ . Circle the strings from the following list that are in  $L(r)$ .

$\lambda$   
 $ab$   
 $aabbaa$   
 $bbb$   
 $babab$   
 $aababb$   
 $aaabbababab$

2. [15pt] For each of the following languages with  $\Sigma = \{a, b\}$ , give a corresponding regular expression. Recall that  $n_a(w)$  denotes the number of a's in string  $w$ .

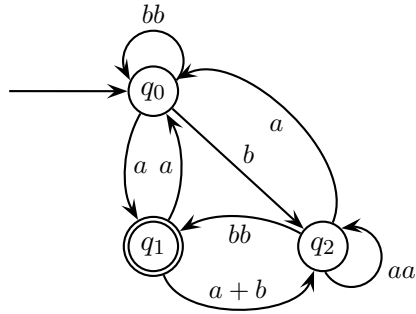
$$L = \{w : w \in \Sigma^*, n_a(w) = 3\}$$
$$r = b^*ab^*ab^*ab^*$$

$$L = \{w : w \in \Sigma^*, n_a(w) \leq 2\}$$
$$r = b^* + b^*ab^* + b^*ab^*ab^*$$

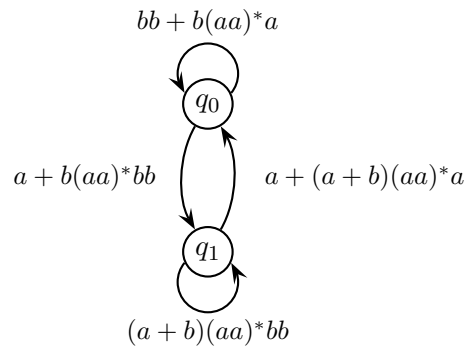
$$L = \{w : w \in \Sigma^*, n_a(w) \geq 1\}$$
$$r = (a + b)^*a(a + b)^*$$

$$L = \{w : w \in \Sigma^*, n_a(w) \text{ is even}\}$$
$$r = (b^*ab^*ab^*)^*$$

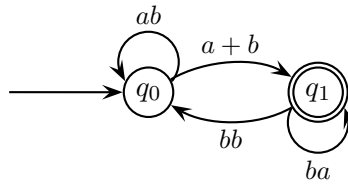
3. Consider the following generalized transition diagram.



Draw an equivalent decision diagram that results after removing node  $q_2$ .



4. Write a regular expression that is equivalent to the following generalized transition diagram.



$$r = (ab)^*(a+b)(ba+bb(ab)^*(a+b))^*$$