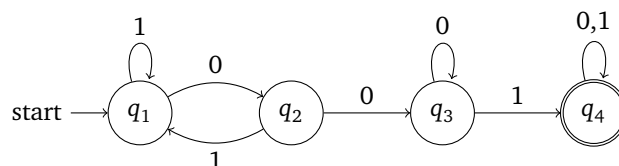


ASSIGNMENT 6 (DUE ON 1 OCTOBER 2021 AT 11:59PM)

MATH2301, SEMESTER 2, 2021

INSTRUCTOR: ASILATA BAPAT

- (1) Let $\Sigma = \{a, b\}$. For each of the following **regular expressions r** , give two different strings that are in $L(r)$, and two different strings that are not in $L(r)$. Justification is not required.
 - (a) $r = a(ba)^*b$.
 - (b) $r = (\varepsilon|a)b$.
 - (c) $r = (a|b)^*a(a|b)^*b(a|b)^*a(a|b)^*$.
- (2) Let $\Sigma = \{0, 1\}$. For each language L described below, write down a regular expression r such that $L(r) = L$. That is, the strings of Σ^* that match r are exactly the strings of L . Be careful to make sure that nothing else matches the regular expression you write down! Justification is not required.
 - (a) $L = \emptyset$
 - (b) $L = \{0, 1, 11\}$
 - (c) $L = \{w \in \Sigma^* \mid w \text{ starts with a } 1\}$
 - (d) $L = \{w \in \Sigma^* \mid w \text{ any ones in } w \text{ are next to each other in a single block}\}$
 - (e) $L = \{w \in \Sigma^* \mid w \text{ contains an even number of zeroes}\}$
- (3) Let $\Sigma = \{a, b, c\}$. For each regular expression r written below, describe in words the language $L(r)$. Justify your answers.
 - (a) $r = (\varepsilon|bc|c)(abc)^*(\varepsilon|a|ab)$.
 - (b) $r = ((b|c|\varepsilon)^*a(b|c|\varepsilon)^*a(b|c|\varepsilon)^*a(b|c|\varepsilon)^*)^*$
- (4) Let $\Sigma = \{0, 1\}$. Let $L = \{1^k y \mid y \in \Sigma^* \text{ and } y \text{ contains at least } k \text{ 1s, for } k \geq 1\}$. Find a regular expression r such that $L = L(r)$. Justify your answer.
- (5) Answer the following questions about the DFA shown in the figure. Justifications are not required.



- (a) What sequence of states does the DFA go through on input 0011?
- (b) Does the machine accept the string 0011? What about the string ε ?
- (c) Write down two more accepted strings and two more rejected strings.
- (d) Can you figure out what language this DFA recognises? Justify your answer.