BRAC UNIVERSITY

Kha – 224, Merul Badda, Dhaka, Bangladesh

CSE331 : Automata and Computability

Assignment 02

Summer 2024

Q1. Which of the following statements about regular expressions is true? (2 points)

1. Regular expressions can describe only Regular Languages.
2. Regular expressions can describe only Context Free Languages.
3. Regular expressions can describe both Regular Language and Context Free Languages.

Write an explanation for your answer.

Q2. Which is the correct regular expression for the language L = {w ∈ {0,1}*: 0^n , where n is even}? (2 points)

1. 0 (00)*
2. (00)*
3. 0* (00)* 0*
4. None of the above

Write an explanation for your answer.

Q3. Which is the correct regular expression for the language L = {w ∈ {0,1}*: 0^n1^n , where n is even}? (2 points)

1. (00)* (11)*
2. ((0 ∪ 1) (0 ∪ 1)) *
3. (00 ∪ 11)*
4. None of the above

Write an explanation for your answer.

Q4. You are given two languages, A and B. You can construct a regular expression for A. However, it is impossible to construct a regular expression for B. Now read the options below. (2 points)

a) A is a regular language

b) B is a regular language.

c) B is a nonregular language.

d) A∪B is a regular language. Choose the best answer from below.

1. a and b
2. a and c
3. a and d
4. a, b and d
5. a, c and d

Write an explanation for your answer.

Q5. What does the regular expression (0 ∪ 1)* 0 (0 ∪ 1)* describe? (2 points)

1. L = {w ∈ {0,1}*: w contains exactly one 0}
2. L = {w ∈ {0,1}*: w contains at least three 0}
3. L = {w ∈ {0,1}*: w contains at least one 0}
4. L = {w ∈ {0,1}*: w contains at most one 0} Write an explanation for your answer.

Q6. (0 ∪ 1)* (0 (0 ∪ 1) 0 ∪ 1 (100 ∪ 001 ∪ 11*)) 00

Write down the shortest nonempty string generated by the given expression. Write down the string only. (2 points)

Write an explanation for your answer.

Q7. (00 ∪ 01) (101)* ((00)* ∪ 110)

What is the shortest string generated by the regular expression with exactly three 0s? Write down the string. (2 points)

Write an explanation for your answer.

Q8. Does the string 00100001011 belong to the regular expression 0 (0 ∪ 1)* 01 (0 ∪ 1)* ((0 ∪ 1)*)* 11 (0 ∪ 1)* 1? (2 points)

1. Yes
2. No

Write an explanation for your answer.

Q9. Let's, Σ = {a, b}. You are given a regular expression, **a (Σ* a^+ ε) ∪ b (Σ* b^+ ε)**, what is the correct language for this regex? Here, a^+ = aa*.

Note, for a regular language L, the regular expression will be correct if and only if it generates all the strings, w ∈ L, and doesn't generate any string, w ∉ L. (2 points) a) w starts and ends with the same symbols

b) w contains either at least two a or at least two b

c) w contains substring ab

d) w contains an a followed by a b

e) w contains equal numbers of ab and ba Choose the best answer from below.

1. a
2. a and b
3. c and d
4. a and e
5. a, b and e

Write an explanation for your answer.

Q10. Which of the following Regular expressions are equivalent to **a(a* b* ∪ b^+)b** (2 points) a) $a^*(ab^+)$

b) $a^+(ab^+)$

c) a^+b^+

d) a(aa*b*)b

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

Choose the best answer from below.

1. a and b

2. c and d
3. d and e
4. b and c

Write an explanation for your answer.

Q11. (01 ∪ 1010 ∪ 1) * (00 ∪ 010)

The length of a string, w can be expressed by |w|. Find out how many distinct strings can be generated using the given regular expression such that 3 <= |w| <= 5. Write a numeric value only. (2 points)

Write an explanation for your answer.

Q12. You have a regular expression (0 ∪ 1) (0 ∪ 1) 0 0* (0 ∪ 1)* 1* . And another regular expression (00 ∪ 11 ∪ 10 ∪ 01) 0 1* 0* (1 ∪ 0 ∪ ε)* 0*. Are these two the same? (2 points)

1. Yes
2. No

Write an explanation for your answer.

Q13. Let's ∑ = {0,1}. What is the regular expression for the strings that have even length and start with 1? (2 points) a) 1 (0 ∪ 1)*

b) (10 ∪ 11) ((0 ∪ 1) (0 ∪ 1))*

c) (1 (0 ∪ 1))*

d) 1 (0 ∪ 1) ((0 ∪ 1) (0 ∪ 1))*

e) 1 (0 ∪ 1) (00 ∪ 01 ∪ 11 ∪ 10)* ∪ ε Select the best answer.

1. d and e
2. b and e
3. b and d
4. b, d and e
5. a, c and e

Write an explanation for your answer.

Q14. L = {w ε {0,1}*: w doesn't contain 001}

Note, for a regular language L, the regular expression will be correct if and only if it generates all the strings, w ∈ L, and doesn't generate any string, w ∉ L. Which of the following Regular Expressions generate L:

- (1* (01)*)* (ε ∪ 0 ∪ 000*) (1 point)
    1. Correct
    2. Incorrect
- (1* (0 ∪ ε) 1*)* (1 point)
    1. Correct
    2. Incorrect
- (1 ∪ 10)* (ε ∪ 0 ∪ 000*) (1 point)
    1. Correct
    2. Incorrect
- (1 ∪ 01)* 0* (1 point)
    1. Correct
    2. Incorrect
- (1* (10)*)* 0* (1 point)
    1. Correct
    2. Incorrect

Q15. (0 ∪ ε) (10)* (1 ∪ ε)

Note, for a regular language L, the regular expression will be correct if and only if it generates all the strings, w ∈ L, and doesn't generate any string, w ∉ L.

Which of the following regular languages are generated by the given regular expression

- L = { w ∈ {0,1}*: w doesn't contain 00} (1 point)
    1. Correct
    2. Incorrect
- L = { w ∈ {0,1}*: 0 and 1 alternates in w} (1 point)
    1. Correct
    2. Incorrect
- L = { w ∈ {0,1}*: w doesn't contain either 00 or 11} (1 point)
    1. Correct

2. Incorrect

- L = { w ∈ {0,1}*: The period of w is either 01 or 10 }

The period of a string is the smallest prefix, when repeated one or more times, can recreate the entire string. (1 point)

1. Correct
2. Incorrect