

Problem

Give regular expressions with exponentiation that generate the following languages over the alphabet $\{0, 1\}$.

- Aa. All strings of length 500
- Ab. All strings of length 500 or less
- Ac. All strings of length 500 or more
- Ad. All strings of length different than 500
- e. All strings that contain exactly 500 1s
- f. All strings that contain at least 500 1s
- g. All strings that contain at most 500 1s
- h. All strings of length 500 or more that contain a 0 in the 500th position
- i. All strings that contain two 0s that have at least 500 symbols between them

Step-by-step solution

Step 1 of 8

Regular expressions:

Regular expression are the expression by which searching is done very easily. It is used for matching the combination of character in the string.

Regular expression consists of normal characters or the combination of the special character.

Power of an alphabet is donated by Σ^k . It is basically the combination of the string of the power length which is k and the power is donated by the symbol Σ .

a) Given:

Every string is of the length 500

Regular expression with the exponentiation:

$$\Sigma^{500}$$

- Power of an alphabet is donated by Σ^k . Here, as the string is of length 500 so value of k is assigned to 500.
- It represents the combination of the 500 string with exponentiation.

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b) Given:

Every string is of length 500 or it is less than 500

Regular expression with the exponentiation:

$$(\Sigma \cup \epsilon)^{500}$$

- In the above regular expression ϵ is donated by the empty string. The union of Exponentiation and ϵ will be less than or equal to 500.
- If there is an empty string then combination will of less than 500 strings. If there is no empty string then the combination will be equal to 500.

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c) Given:

Every string is of length 500 or it is more than 500

Regular expression with the exponentiation:

$$\Sigma^{500} \Sigma^+$$

- In the above regular expression is Σ^* donates all the string which is more than 500. Σ^{500} donate the string of the length 500.
- The multiplication of both the exponentiation will result the string of the length 500 or more than 500.

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d) **Given:**

Every string should have length different than 500.

Regular expression with the exponentiation:

$$(\Sigma \cup \epsilon)^{499} \cup \Sigma^{501} \Sigma^*$$

- In the above regular expression is $(\Sigma \cup \epsilon)^{499}$ donates all the string which is 499 or less than 499 as ϵ donate an empty string.
- Whereas the regular expression $\Sigma^{501} \Sigma^*$ donates all the string which is equal to 501 and more than 501.
- The union of the both the regular expression gives the string either greater than 500 or less than 500 but not the string of length 500.

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e) **Given:**

String containing total 500, 1's exactly.

Regular expression with the exponentiation:

$$(0)^n (1)^{500}, \text{ where } n \geq 0$$

- In the above regular expression is $(0)^n (1)^{500}$ donates all the string which contains exactly 500 1's and number of 0's in the string are greater than or equal to 0.

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f) **Given:**

String contains at least 500, 1's.

Regular expression with the exponentiation:

$$0^n 1^{500} 1^*, \text{ where } n \geq 0$$

- In the above regular expression is $0^n 1^{500} 1^*$ donates all the string which contains 500 1's or more than 500 1's and number of 0's in the string are greater than or equal to 0.

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g) **Given:**

String containing maximum 500 1's

Regular expression with the exponentiation:

$$0^n (1 \cup \epsilon)^{500}, \text{ where } n \geq 0$$

- In the above regular expression is $0^n (1 \cup \epsilon)^{500}$ donates all the string which contains less than or equal to 500 1's and number of 0's in the string are greater than or equal to 0.
- If there is no empty string then the combination will be equal to 500.

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Step 8 of 8

h) **Given:**

String of minimum 500 lengths and the position of 500th position are fixed with 0

Regular expression with the exponentiation:

$$(\Sigma)^{499}(0)(\Sigma)^*$$

• In the above regular expression Σ^* donates all the string which is more than 500. Σ^{499} donate the string of the length 499. 0 is present after writing all the string of length 499 which implies 0 is present in the 500 position.

i) **Given:**

String containing minimum 500 symbols between two 0's

Regular expression with the exponentiation:

$$(0)(\Sigma^{500})(\Sigma)^*(0)$$

• In the above regular expression there are minimum 500 1's between two 0's.

• Σ^* donate all the string which is more than 500.

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