

Q1.

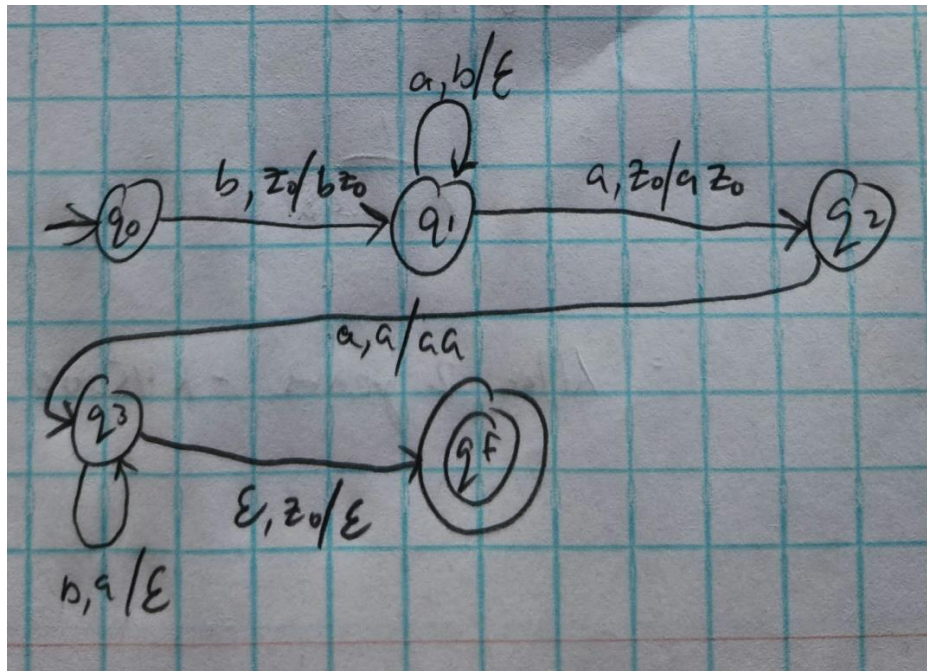
Shortest string: bababaaab

$$\delta(q_0, b, Z_0) = (q_1, bZ_0)$$

$$\delta(q_1, a, b) = (q_1, \epsilon)$$

$$\delta(q_1, a, Z_0) = (q_2, aZ_0)$$

$$\delta(q_2, a, a) = (q_3, aa)$$



Q2.

For $n = 1$:

Shortest string: babbaa

$$|vwx| = 4$$

$$|vx| = 3$$

$$i = 2$$

Thus, the following string is formed: bababbaaa.

Therefore, it is not part of language L and not a CFL.

Q3.

L_1 grammar (G_1) :

$$S_1 \rightarrow \epsilon$$

$$S_1 \rightarrow aaS_1$$

L_2 grammar (G_2):

$$S_2 \rightarrow AbaB$$

$$A \rightarrow \varepsilon \mid aA \mid bA$$

$$B \rightarrow \varepsilon \mid aB \mid bB$$

L_1L_2 grammar:

$$S \rightarrow S_1S_2$$

$$S_1 \rightarrow \varepsilon$$

$$S_1 \rightarrow aaS_1$$

$$S_2 \rightarrow AbaB$$

$$A \rightarrow \varepsilon \mid aA \mid bA$$

$$B \rightarrow \varepsilon \mid aB \mid bB$$

Q4.

Start with S:

$$S \rightarrow XY$$

Expand Y:

$$Y \rightarrow b$$

$$S \rightarrow Xb$$

Expand X:

$$X \rightarrow a$$

$$S \rightarrow ab$$

Therefore, the grammar generates words.