CENG 280 HOMEWORK 2

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1 Question 1

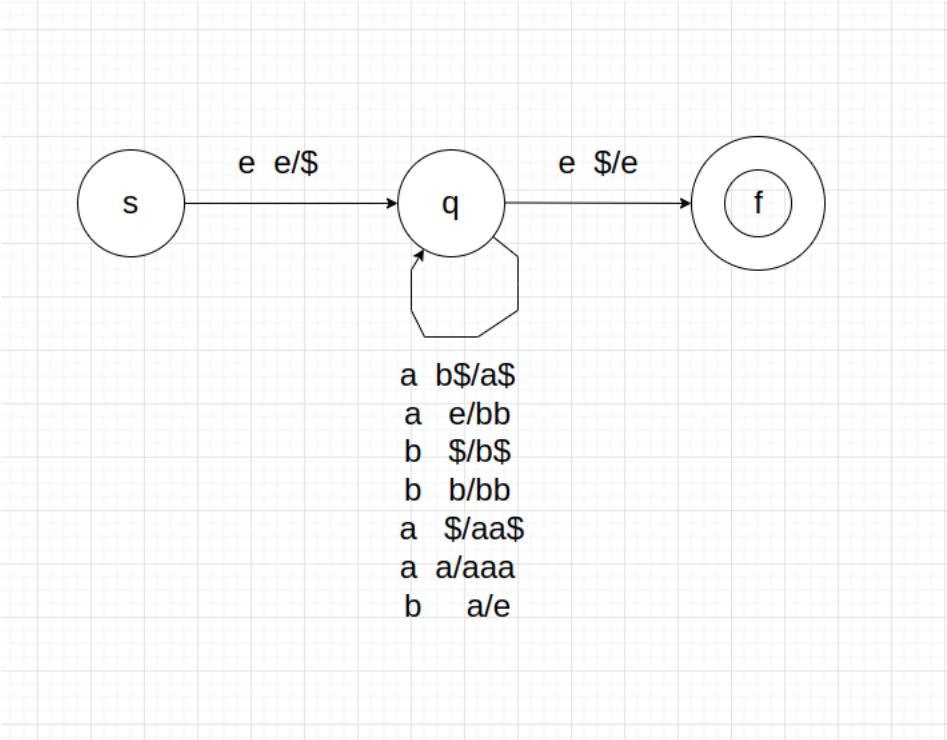
a)

$$S \rightarrow aSbSb|bSaSb|bSbSa|SS|e$$

b)

$$S \rightarrow aSb|aaSb|e$$

c)



$$PDA\ P = (Q, \Sigma, \Gamma, s, \$, \{f\}, \Delta) \quad where$$
$$Q = \{s, q, f\}$$
$$\Sigma = \{a, b\}$$
$$\Gamma = \{a, b, \$\}$$
$$s = initial\ state$$
$$\{f\}\ is\ the\ set\ of\ final\ states$$
$$\Delta = \{((s, e, e), (q, \$)),$$
$$((q, b, \$), (q, b\$)),$$
$$((q, b, b), (q, bb)),$$
$$((q, a, bb), (q, e)),$$
$$((q, a, b\$), (q, a\$)),$$
$$((q, a, \$), (q, aa\$)),$$
$$((q, a, a), (q, aaa)),$$
$$((q, b, a), (q, e)),$$
$$((q, e, \$), (f, e))\}$$

d) Let start variables for L1 nad L2 be S1 and S2 respectively.Also let start variable for L3 be S.We can define a grammar for their union as

$$S \rightarrow S_1|S_2$$

since context free languages are closed under union.Hence context free grammar for L3 can be written as follows :

$$S \rightarrow S_1|S_2$$
$$S_1 \rightarrow abS_1b|bS_1aS_1b|bS_1bS_1a|S_1S_1|e$$
$$S_2 \rightarrow aS_2b|aaS_2b|e$$

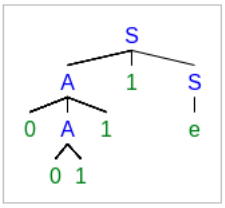
2 Question 2

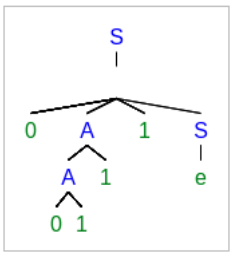
a)

For string 00111 there are two different parse trees as shown above.

$$S \to A1S \to 0A11S \to 00111S \to 00111$$

$$S \to 0A1S \to 0A11S \to 00111S \to 00111$$





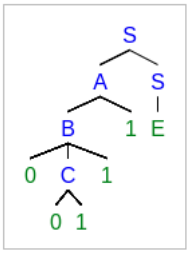
Since there are two different parse trees for the same string 00111 , the grammar is ambiguous.

b)

$$S \to AS|e$$
$$A \to B1$$
$$B \to 0C1|01$$
$$C \to 01$$

c)

$$S \to AS \to B1S \to 0C11S \to 00111S \to 00111$$


S
A
S
B
1
E
0
C
1
0
1