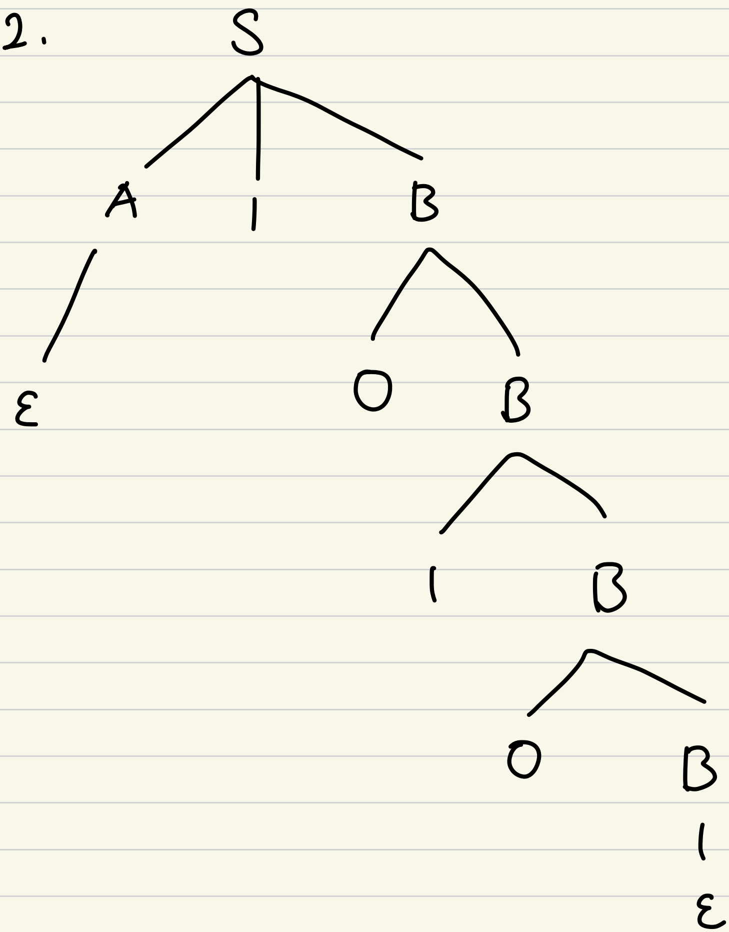
a)

1.

$S \to A1B \to 1A1B \to 1\varepsilon 1B \to 11B$

$\to 110B \to 1100B \to 1100\varepsilon \to 1100$

2.



$\varepsilon 1 0 1 0 \varepsilon = 1010$

3.

$|\Sigma^*|$

b)

1.

$L1 = \{ w \mid w \text{ is any binary string} \}$

$= \{ \varepsilon, 0, 1, 00, 01, 10, 11, \ldots \}$

2.

$L2 = \{ W \mid w \text{ end with } 0 \}$

$= \{ 0, 110, 000, 0100 \ldots \}$

3. This grammar is infinite and no terminal string. it's not CFL or regular language

$L = \{ \}$

c)

$S \rightarrow 0S \mid 1S \mid \varepsilon$

d)

$S \rightarrow 0S1 \mid A$

$A \rightarrow 0A \mid \varepsilon$

e) $S \rightarrow 0S1 \mid A \mid \varepsilon$

$A \rightarrow 1A0 \mid \varepsilon$

f)

$S \to 0S0 \mid 1S0 \mid 1S1 \mid 0S1 \mid 1$

g)

$S \to 0S0 \mid 1S0 \mid 1A1 \mid 0A1 \mid 1$

$A \to 0A0 \mid 0A1 \mid 1A0 \mid 1A1 \mid 0 \mid 1 \mid \varepsilon$

h

1. Given L1 and L2 are CFG, S_1 is the start for L1, S_2 is start for L2

Name L_A is the union L1 and L2

$L_A \Rightarrow$ new start $S \rightarrow S_1 \mid S_2$

2.

Name L_B is the concatenation of L1 and L2

$LB \Rightarrow S \rightarrow S1S2$

3.

Name L_C is the grammar of L_1^*

$LC \Rightarrow S \rightarrow \varepsilon \mid S_1S$