

CFG

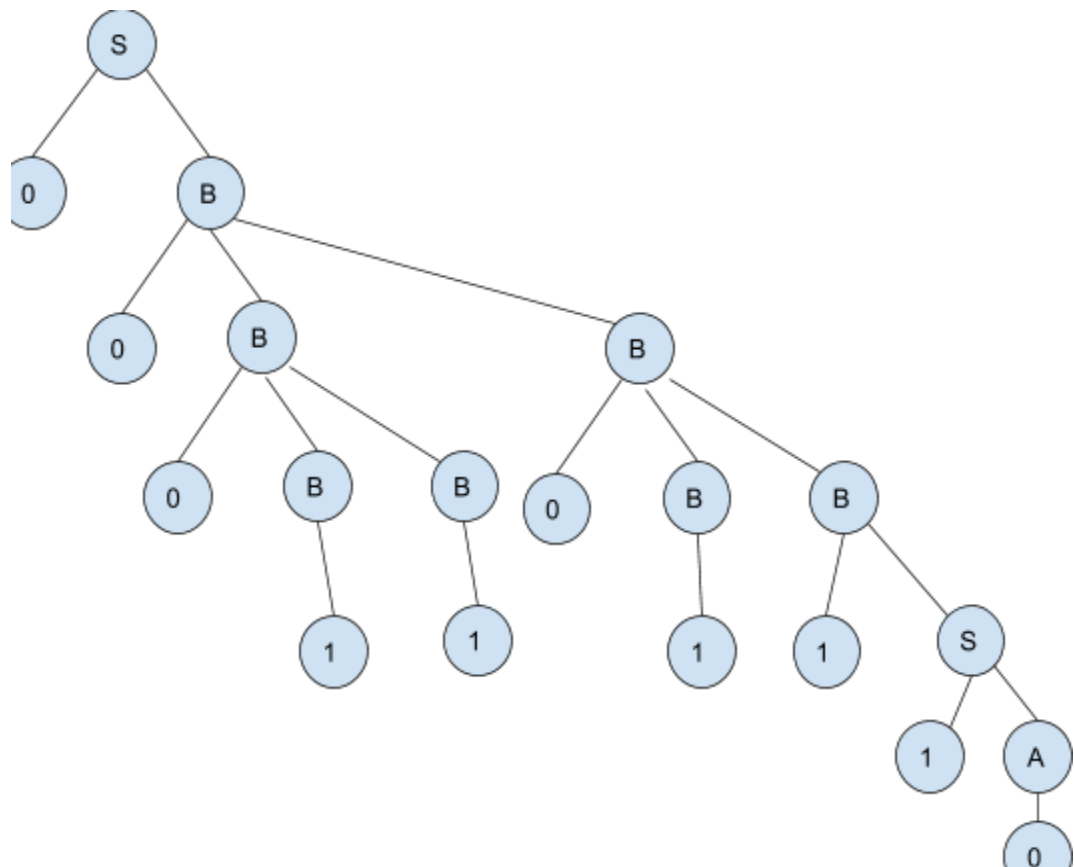
1. Given the CFG grammars below, give a leftmost/rightmost derivation for w .

- a. $G = (\{S, A, B\}, \{0, 1\}, \{S \rightarrow 0B \mid 1A, A \rightarrow 0 \mid 0S \mid 1AA, B \rightarrow 1 \mid 1S \mid 0BB\})$,
 $w = 0001101110$

Sol. XXXXXXXXXX

Leftmost: 1886686723

$S \Rightarrow 0B \Rightarrow 00BB \Rightarrow 000BBB \Rightarrow 0001BB \Rightarrow 00011B \Rightarrow 000110BB \Rightarrow 0001101B$
 $\Rightarrow 00011011S \Rightarrow 000110111A \Rightarrow 0001101110$



Rightmost: 1887236866

$S \Rightarrow 0B \Rightarrow 00BB \Rightarrow 00B0BB \Rightarrow 00B0B1S \Rightarrow 00B0B11A \Rightarrow 00B0B110 \Rightarrow 00B01110 \Rightarrow$
 $00B01110 \Rightarrow 000BB01110 \Rightarrow 000B101110 \Rightarrow 0001101110$

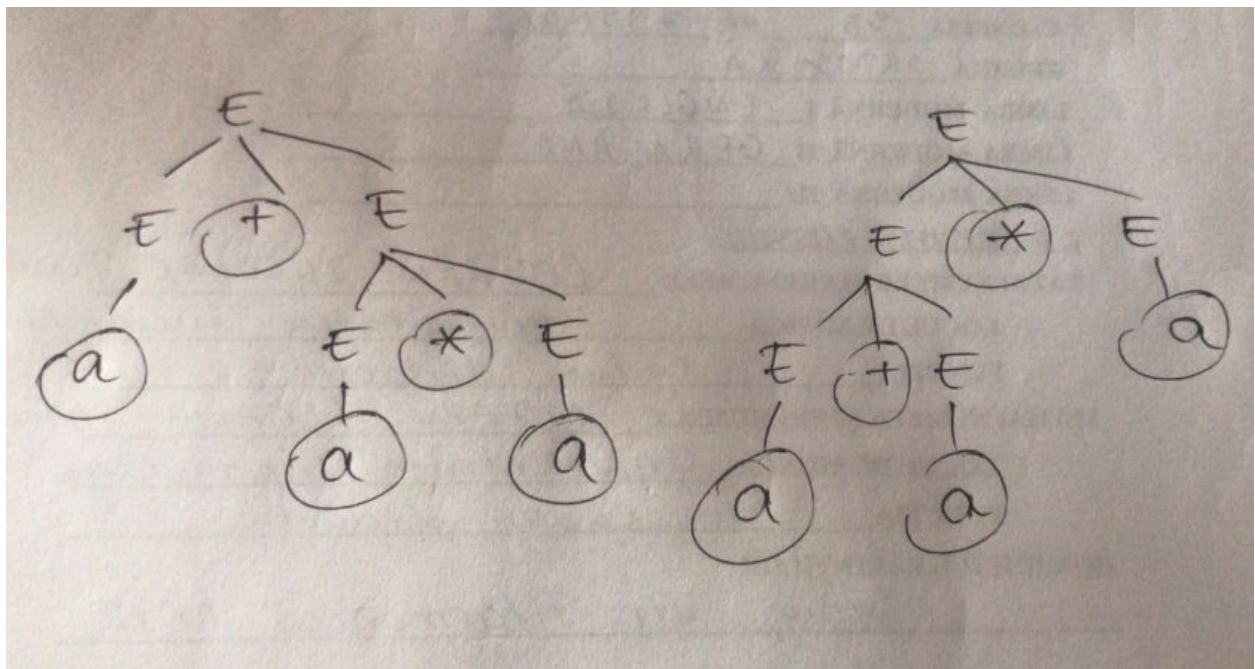
- b. $G = (\{E, T, F\}, \{a, +, *, (,)\}, \{E \rightarrow E + T \mid T, T \rightarrow T * F \mid F, F \rightarrow (E) \mid a\})$
 $w = a * (a + a) \rightarrow \text{HW}$

2. Prove that the following grammars are ambiguous

- a. $G_1 = (\{S, B, C\}, \{a, b, c\}, \{S \rightarrow abC \mid aB, B \rightarrow bC, C \rightarrow c\}, S) \rightarrow \text{HW}$
- b. $G_2 = (\{E\}, \{a, +, *, (,)\}, \{E \rightarrow E + E \mid E * E \mid (E) \mid a\})$

Sol.:

$w = a * a + a$



- c. $G_3 = (\{S\}, \{if, then, else, a, b\}, \{S \rightarrow if\ b\ then\ S \mid if\ b\ then\ S\ else\ S \mid a\}, S) \rightarrow \text{HW}$

Recursive descent parser

1. Given the CFG $G = (\{S\}, \{a, b, c\}, \{S \rightarrow aSbS \mid aS \mid c\})$, parse the sequence $w = aacbc$ using rec. desc. parser.

Sol. : //B: 

$(S_1) S \rightarrow aSbS$

$(S_2) S \rightarrow aS$

$(S_3) S \rightarrow c$

$(q, 1, \varepsilon, S) \mid - \exp(q, 1, S_1, aSbS) \mid - \text{adv}(q, 2, S_1a, SbS) \mid - \exp(q, 2, S_1aS_1, aSbSbS) \mid -$
 $\mid - \text{adv}(q, 3, S_1aS_1a, SbSbS) \mid - \exp(q, 3, S_1aS_1aS_1, aSbSbSbS) \mid -$
 $\mid - \text{mi}(b, 3, S_1aS_1aS_1, aSbSbSbS) \mid - \text{at}(q, 3, S_1aS_1aS_2, aSbSbS) \mid -$
 $\mid - \text{mi}(b, 3, S_1aS_1aS_2, aSbSbS) \mid - \text{at}(q, 3, S_1aS_1aS_3, cbSbS) \mid -$
 $\mid - \text{adv}(q, 4, S_1aS_1aS_3c, bSbS) \mid - \text{adv}(q, 5, S_1aS_1aS_3cb, SbS) \mid -$
 $\mid - \exp(q, 5, S_1aS_1aS_3cbS_1, aSbSbS) \mid - \text{mi}(b, 5, S_1aS_1aS_3cbS_1, aSbSbS) \mid -$
 $\mid - \text{at}(q, 5, S_1aS_1aS_3cbS_2, aSbS) \mid - \text{mi}(b, 5, S_1aS_1aS_3cbS_2, aSbS) \mid -$
 $\mid - \text{at}(q, 5, S_1aS_1aS_3cbS_3, cbS) \mid - \text{adv}(q, 6, S_1aS_1aS_3cbS_3c, bS) \mid -$
 $\mid - \text{mi}(b, 6, S_1aS_1aS_3cbS_3c, bS) \mid - \text{back}(b, 5, S_1aS_1aS_3cbS_3, cbS) \mid -$
 $\mid - \text{at}(b, 5, S_1aS_1aS_3cb, SbS) \mid - \text{back}(b, 4, S_1aS_1aS_3c, bSbS) \mid -$
 $\mid - \text{back}(b, 3, S_1aS_1aS_3, cbSbS) \mid - \text{at}(b, 3, S_1aS_1a, SbSbS) \mid -$
 $\mid - \text{back}(b, 2, S_1aS_1, aSbSbS) \mid - \text{at}(q, 2, S_1aS_2, aSbS) \mid - \text{adv}(q, 3, S_1aS_2a, SbS) \mid -$
 $\mid - \exp, \text{mi}, \text{at}, \text{mi}, \text{at}(q, 3, S_1aS_2aS_3, cbS) \mid - \text{adv}(q, 4, S_1aS_2aS_3c, bS) \mid -$
 $\mid - \text{adv}(q, 5, S_1aS_2aS_3cb, S) \mid - \exp, \text{mi}, \text{at}, \text{mi}, \text{at}(q, 5, S_1aS_2aS_3cbS_3, c) \mid -$
 $\mid - \text{adv}(q, 6, S_1aS_2aS_3cbS_3c, \varepsilon) \mid - \text{success}(f, 6, S_1aS_2aS_3cbS_3c, \varepsilon)$

$\Rightarrow w$ is syntactically correct

Parse tree: $S_1 S_2 S_3 S_3$