

2.

a.  $a^n (b^i c^j)^p a^m$

$n \geq 1$   
 $m \geq 1$   
 $p \geq 0$

Where  $x_i = x_j$  but for each  $i, j$ ,  $x_i$  and  $x_j$  are not necessarily the same as the previous  $x_i$  and  $x_j$ .

b.

1.  $S = AaBb$   
= baBb  
= ba ab

2. NO

3. NO

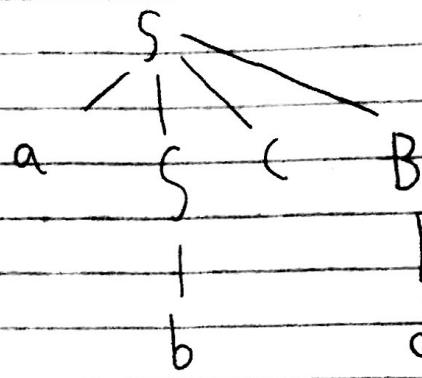
4.

$$S = AaBb$$

$$\begin{aligned} &= AbaBb \\ &= bbaBb \\ &= bba ab \end{aligned}$$

C.

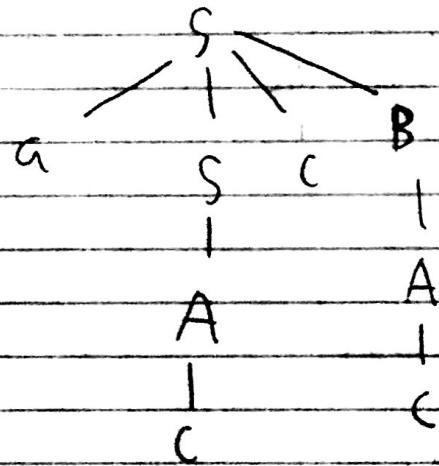
1.



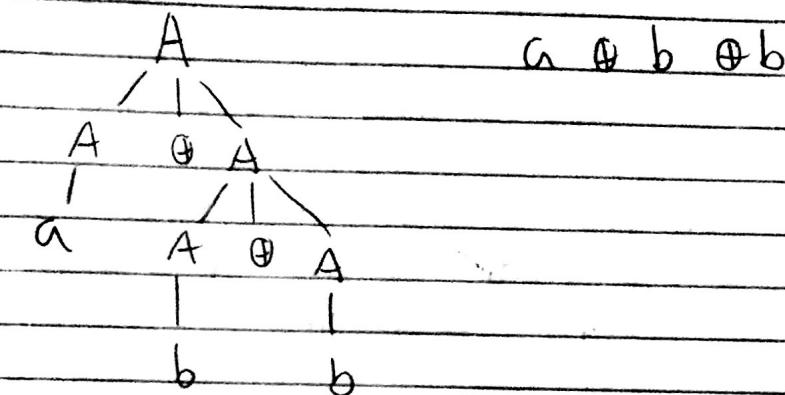
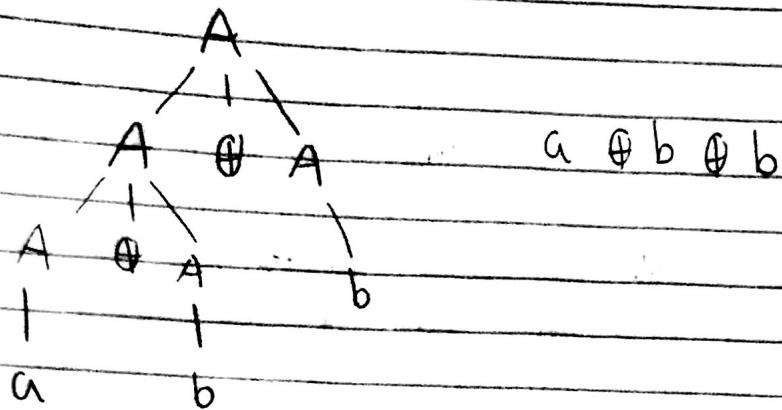
2. no

3. no

4.



d.



e.

eval(a)  $a \Downarrow 1$

eval(b)  $b \Downarrow 0$

$$\begin{aligned} \text{eval}(A \oplus A) &= \overline{A_1 \vee n_1} \cdot \overline{A_2 \vee n_2} \quad n' = n_1 + n_2 \\ &\quad A \oplus A \Downarrow n' \end{aligned}$$

3.

a.

i.  $e ::= \text{operand} \mid e \text{ operator } \text{operand}$

this grammar performs binary operations on n operands

$e ::= \text{operand } e\text{suffix}$

$e\text{suffix} ::= \text{operator } \text{operand } e\text{suffix} \mid \epsilon$

this grammar does the same

ii. No because the first one is left associative while the second is right associative.

b. val v1 =  $(5-1) \ll 1$  // should return 8  
val v2 =  $5-(1 \ll 1)$  // should return 3  
val v3 =  $5-1 \ll 1$  returned 8

when I put v3 into node it returned 8 so '-' has higher precedence over ' $\ll$ '

C.

S<sub>i</sub> = TFIIFE

I<sub>i</sub> = -18

F<sub>i</sub> = J.N

N<sub>i</sub> = D1DN

D<sub>i</sub> = 0|1|2|3|4|5|6|7|8|9

J<sub>i</sub> = 1|2|3|4|5|6|7|8|9

E<sub>i</sub> = eN where e is the E in scientific notation.