$A \rightarrow B \& A \mid B$ (1)

$B \rightarrow B @ C \mid C$ (2)

$C \rightarrow C * X \mid X \mid (A)$ (3)

#6a Which has higher precedence & v. @

Derive the string $X \& X @ X$

$A \rightarrow B \& A$

$\rightarrow C \& A$

$\rightarrow X \& A$

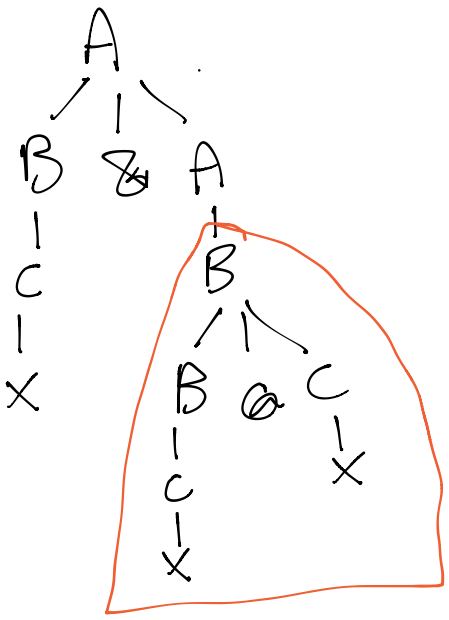
$\rightarrow X \& B$

$\rightarrow X \& B @ C$

$\rightarrow X \& C @ C$

$\rightarrow X \& X @ C$

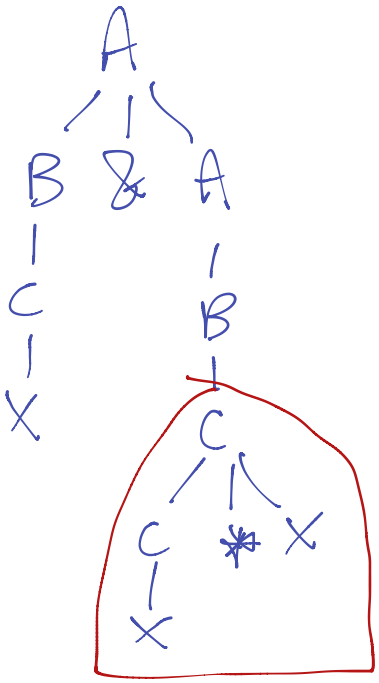
$\rightarrow X \& X @ X$



#6b Which has higher precedence & v. *

Derive the string X & X * X

A → B & A
→ C & A
→ X & A
→ X & B
→ X & C
→ X & C * X
→ X & X * X



#6c associativity of &

x & x & x

A → B & A (RIGHT RECURSIVE)

↳ left assoc. (x & x) & x

↳ right assoc. x & (x & x)

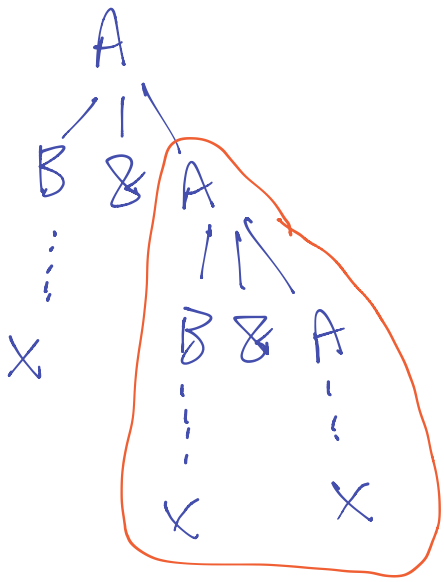
A → B & A

→ x & A

→ x & B & A

→ x & x & A

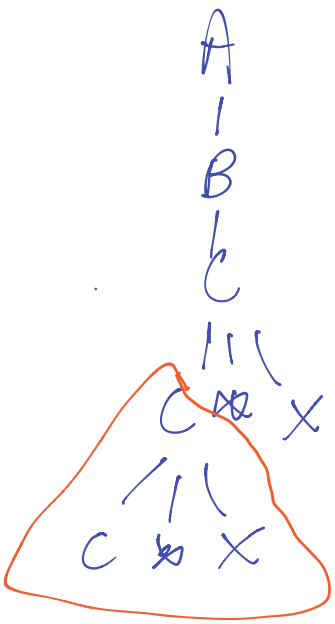
→ x & x & x



6d) associativity of $*$

Derive $x * x * x$

$A \to B$
$\to C$
$\to C * x$
$\to C * x * x$
$\to x * x * x$



left assoc.

$\underline{\underline{C}} \to \underline{\underline{C}} * x$

Left recursive

Derive $x * x \,\&\, x @ x @ x$

$A \to B \,\&\, A$

$\to C \,\&\, A$

$\to C * x \,\&\, A$

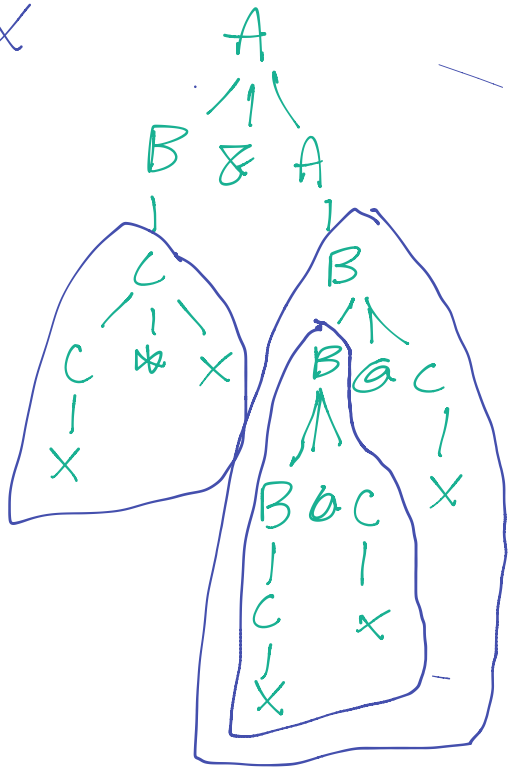
$\to x * x \,\&\, A$

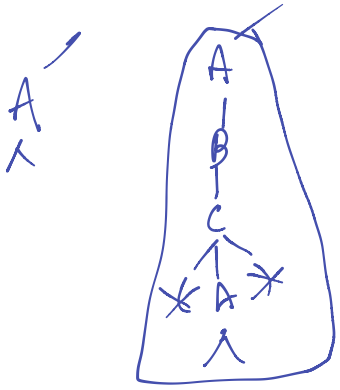
$\to x * x \,\&\, B$

$\to x * x \,\&\, B @ C$

$\to x * x \,\&\, B @ C @ C$

$\to x * x \,\&\, x @ x @ x$





$(x * x) \,\&\, ((x @ x) @ x)$

$(x * x) \,\&\, ((x @ x) @ x)$

x & x @ x

A → B & A

→ B & B

→ B & B @ C

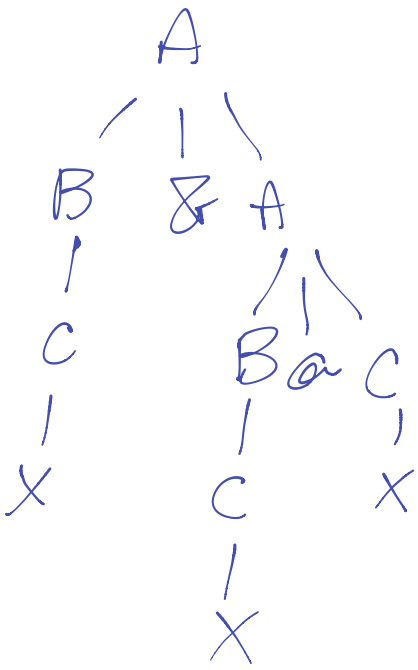
→ B & B @ x

→ B & C @ x

→ B & x @ x

→ C & x @ x

→ x & x @ x



#10

a)

RG

$S \to aA$

$A \to bB$

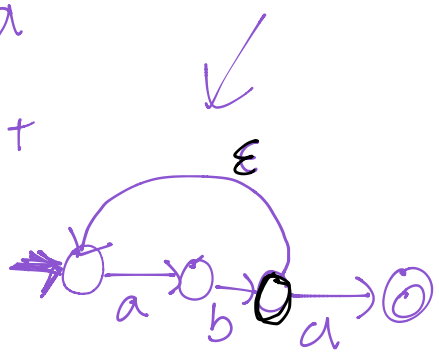
$B \to aA \mid a$

RE

$(ab)+a$

$a(ba)+$

FSM



aba

abaaba

ababaaba

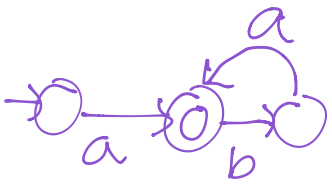
b)

$S \to aA$

$A \to bS \mid \varepsilon$

RE

$a(ba)^*$



a

aba

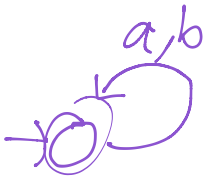
abaaba

c)

$S \to \varepsilon \mid aS \mid bS$

RE

$(a \mid b)^*$



ε	ab
a	ba
b	abb