

ρ'''(121) ΒΝ
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 ΒΙΒΙΑΣ
 204459127

$\lambda f. \lambda x. \lambda y. f y x$ → $\lambda f. \lambda y. f y$ → $\lambda y. y$

$$\begin{aligned}
 1. \quad & \alpha \downarrow (\lambda f. \lambda x. \lambda y. f y x) (\lambda x. x) \quad 10 \quad (\lambda z. * s z) \\
 & \alpha \downarrow (\lambda f. \lambda w. \lambda y. f y w) (\lambda x. x) \quad 10 \quad (\lambda z. * s z) \\
 & \beta \downarrow (\lambda w. \lambda y. (\lambda x. x) y w) \quad 10 \quad (\lambda z. * s z) \\
 & \beta \downarrow (\lambda y. (\lambda x. x) y \quad 10) \quad (\lambda z. * s z) \\
 & \beta \downarrow (\lambda y. y \quad 10) \quad (\lambda z. * s z) \\
 & \beta \downarrow (\lambda z. * s z) \quad 10 \\
 & \beta \downarrow (* \quad s \quad 10) \\
 & \delta \downarrow \text{so}
 \end{aligned}$$

$$\begin{aligned}
 b. \quad & \alpha \downarrow (\lambda x. \lambda y. \lambda z. (x z) (y z)) (\lambda x. \lambda y. x) (\lambda x. \lambda y. x) \\
 & \beta \downarrow (\lambda x. \lambda y. \lambda z. (x z) (y z)) (\lambda w. \lambda u. w) (\lambda a. \lambda b. a) \\
 & \beta \downarrow (\lambda y. \lambda z. ((\lambda w. \lambda u. w) z) (y z)) (\lambda a. \lambda b. a) \\
 & \beta \downarrow (\lambda y. \lambda z. (\lambda u. z) (y z)) (\lambda a. \lambda b. a) \\
 & \beta \downarrow (\lambda y. \lambda z. (z)) (\lambda a. \lambda b. a) \\
 & \quad (\lambda z. z)
 \end{aligned}$$

$$c. \quad S (K S) K$$

$$\begin{aligned}
 & S ((\lambda x. \lambda y. x) S) K \\
 & \beta \downarrow S (\lambda y. S) K \\
 & = S (\lambda y. S) K \\
 & \alpha \downarrow (\lambda x. \lambda y. \lambda z. (x z) (y z)) (\lambda y. S) K \\
 & \beta \downarrow (\lambda x. \lambda a. \lambda z. (x z) (a z)) (\lambda y. S) K \\
 & \beta \downarrow (\lambda a. \lambda z. ((\lambda y. S) z) (a z)) K \\
 & \quad \lambda z. ((\lambda y. S) z) (K z) \\
 & \alpha + \beta \downarrow \lambda z. ((\lambda a. S) z) ((\lambda x. \lambda y. x) z) \\
 & \alpha + \beta \downarrow \lambda z. ((\lambda a. S) z) (\lambda y. z) \\
 & \alpha + \beta \downarrow \lambda z. ((\lambda a. (\lambda x. \lambda y. \lambda b. (x b) (y b))) z) (\lambda y. z) \\
 & \beta \downarrow \lambda z. ((\lambda x. \lambda y. \lambda b. (x b) (y b))) (\lambda a. z) \\
 & \beta \downarrow \lambda z. (\lambda y. \lambda b. ((\lambda a. z) b) (y b)) \\
 & \beta \downarrow \lambda z. \lambda y. \lambda b. (z (y b)) b
 \end{aligned}$$

2. a.
$$\begin{aligned}
 & (\lambda f. \lambda x. f(f x)) (\lambda y_0 + y_1) (+ 2 3) \\
 & \beta \downarrow (\lambda x. (\lambda y_0 + y_1) ((y_0 + y_1) x)) (+ 2 3) \\
 & \beta \downarrow (\lambda y_0 + y_1) ((y_0 + y_1) (+ 2 3)) \\
 & \beta \downarrow (\lambda y_0 + y_1) (+ (+ 2 3) 1) \\
 & \delta \downarrow + (+(+ 2 3) 1) 1 \\
 & \delta \downarrow + (+ (5) 1) 1 \\
 & \delta \downarrow + (6) 1 \\
 & \quad 7
 \end{aligned}$$

b.
$$\begin{aligned}
 & (\lambda x. (\lambda z. z x) (\lambda x. x)) y \\
 & \beta \downarrow (\lambda z. z y) (\lambda x. x) \\
 & \beta \downarrow (\lambda x. x) y \\
 & \quad y
 \end{aligned}$$

c.
$$\begin{aligned}
 & \lambda x_0 + ((\lambda y_0 ((\lambda x_0 * x y) 2)) x) y \\
 & \beta \downarrow \lambda x_0 + ((\lambda b_0 ((\lambda a_0 * a b) 2)) x) y \\
 & \beta \downarrow \lambda x_0 + ((\lambda a_0 * a x) 2) y \\
 & \beta \downarrow \lambda x_0 + (* 2 x) y
 \end{aligned}$$

d.
$$\begin{aligned}
 & (\lambda x. (\lambda y_0 + x y) 5) ((\lambda y_0 - y 3) 7) \\
 & \alpha \downarrow (\lambda x. (\lambda y_0 + x y) 5^2) ((\lambda a_0 - a 3)^3 7^3) \\
 & \beta \downarrow (\lambda x_0 + x 5) ((\lambda a_0 - a 3) 7) \\
 & \beta \downarrow (\lambda x_0 + x 5) (- 7 3) \\
 & \beta \downarrow + (-7 3) (5) \\
 & \delta \downarrow + 4 5
 \end{aligned}$$

$$\begin{aligned}
 e. & (\lambda x. \lambda y. x) (\lambda f. f(f 1)) ((\lambda x. x x x) (\lambda x. x x x)) \\
 |^{in'0} \Rightarrow & (\lambda x. x x x) = K \quad (\lambda y. * z y) \\
 & = (\lambda x. \lambda y. x) (\lambda f. f(f 1)) (K \ K) (\lambda y. * z y) \\
 \beta \downarrow & (\lambda y. (\lambda f. f(f 1))) (K \ K) (\lambda y. * z y) \\
 \beta \downarrow & (\lambda f. f(f 1)) (\lambda y. * z y) \\
 \beta \downarrow & (\lambda y. * z y) ((\lambda y. * z y) 1) \\
 \beta \downarrow & (\lambda y. * z y) (* 2 1) \\
 \beta \downarrow & (* 2 (* 2 1)) \\
 \delta \downarrow & (* 2 2) \\
 \sigma \downarrow & 4
 \end{aligned}$$

applicative order סדר ה- β ב- λ -בונד פוליאט, מתקיים תכונה דומה
 נספח מ- λ -בונד ש- β מושפע מ- σ ו- δ (ב- λ -בונד)
 $\beta \downarrow ((\lambda x. x x x) (\lambda x. x x x))$
 $\beta \downarrow ((\lambda x. x x x) (\lambda x. x x x) (\lambda x. x x x))$

$$3. Y = \lambda h. (\lambda x. h(x x)) (\lambda x. h(x x))$$

$\vdash H \rightarrow B C$

$$H = \lambda f. \lambda n. f(>n\ 100) (-n\ 10) (f(f(+n\ 11)))$$

$mcc \quad G_{N(12)} \in \text{MCC} \quad H \quad \text{not good}$

$$H\ mcc = (\lambda f. \lambda n. f(<n\ 100) (-n\ 10) (f(f(+n\ 11))))\ mcc$$

$\beta \downarrow$

$$= \lambda n. mcc(<n\ 100) (-n\ 10) (mcc(mcc(+n\ 11)))$$

$$= mcc$$

\Downarrow

$$H\ mcc = mcc$$

\Downarrow

mcc is fixed point of H

\Downarrow

$$Y\ H = \underline{mcc} \quad \text{(*)}$$

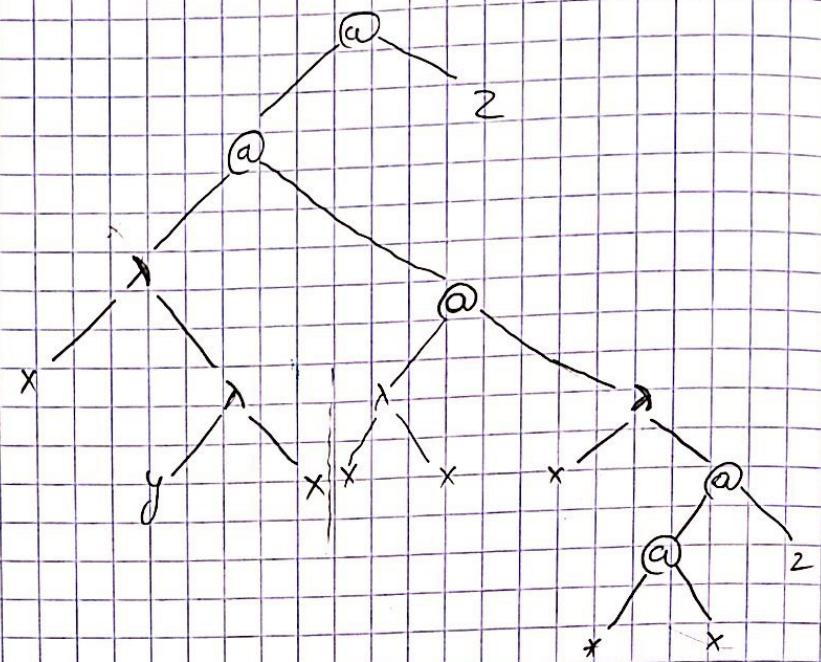
(*) Y combinator receive i a function
and return is fixed point

\Downarrow

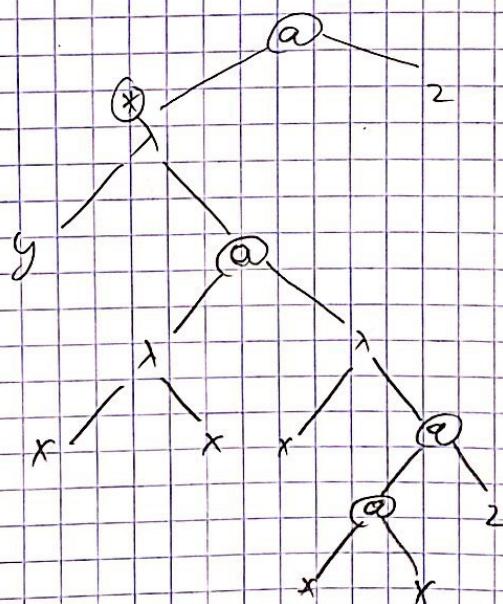
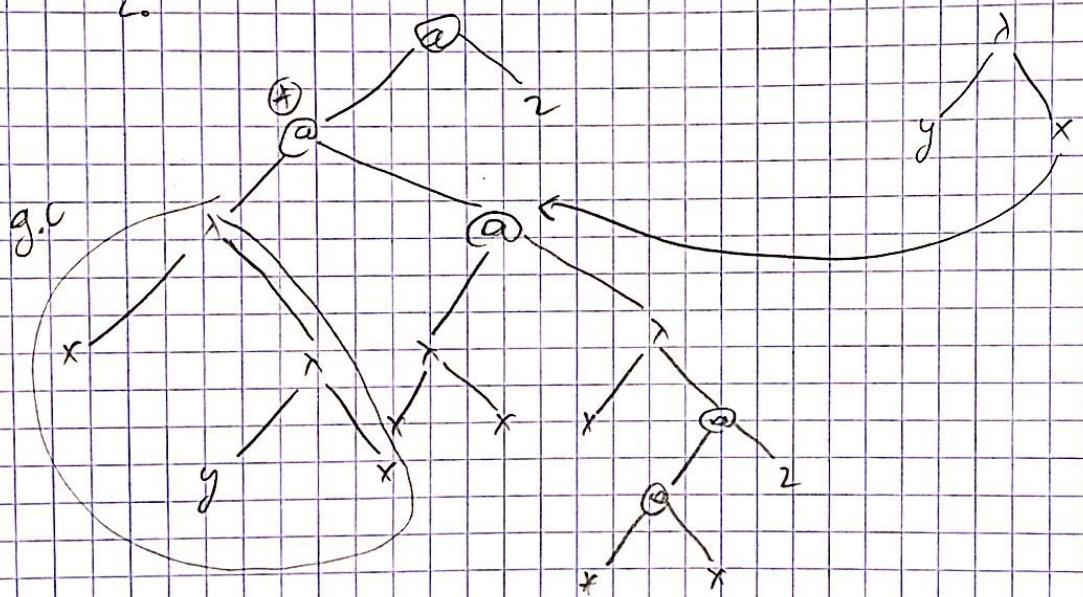
$$mcc = Y\ H = ((\lambda h. (\lambda x. h(x x)) (\lambda x. h(x x))) (\lambda f. \lambda n. f(>n\ 100) (-n\ 10) (f(f(+n\ 11)))))$$

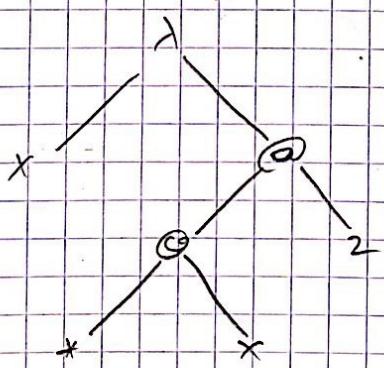
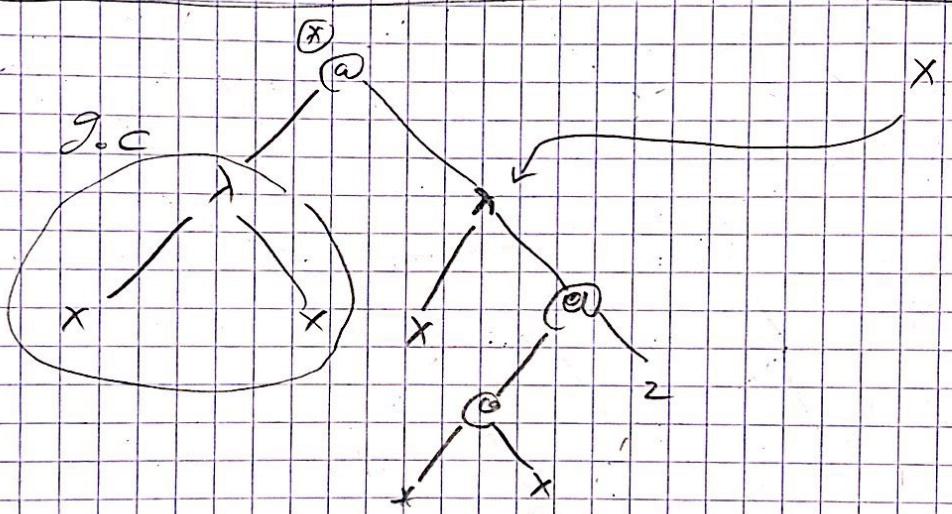
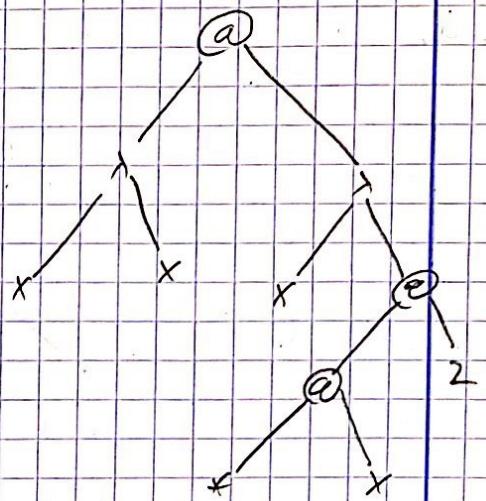
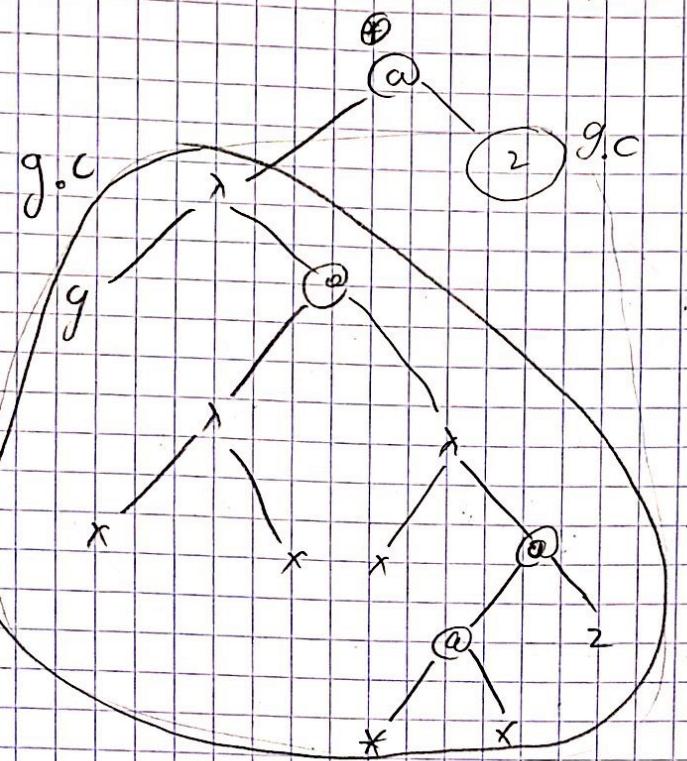
\Downarrow
mcc \in $\text{G}_{N(12)}$

U.a. 1.



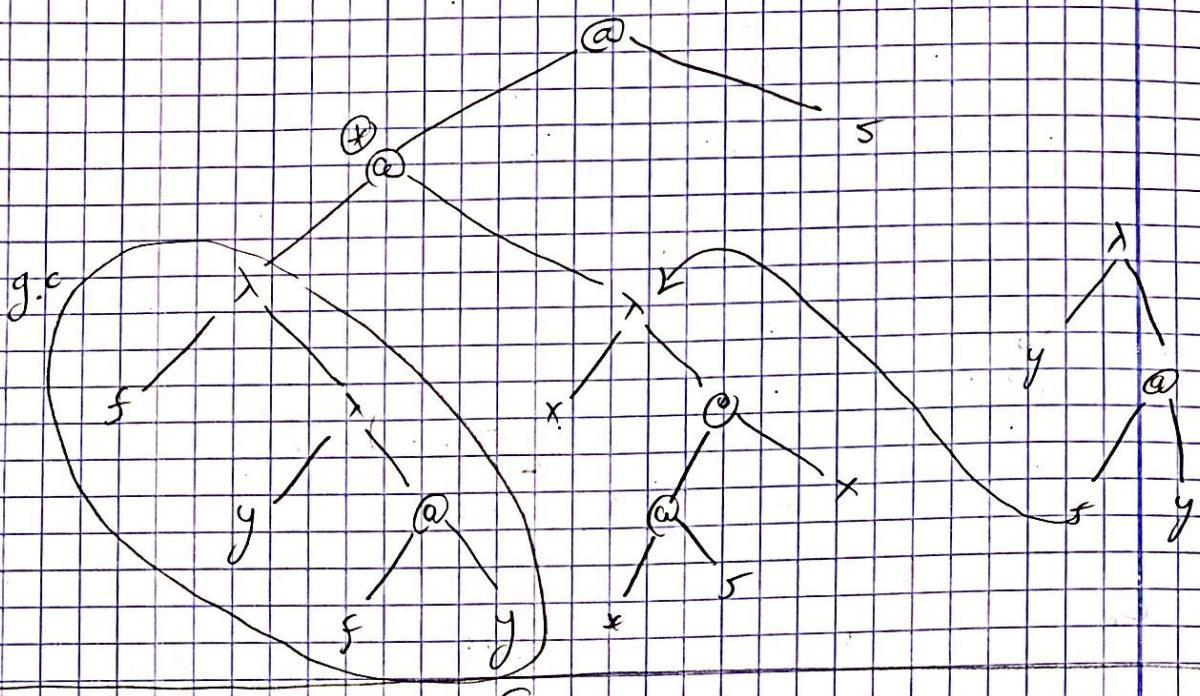
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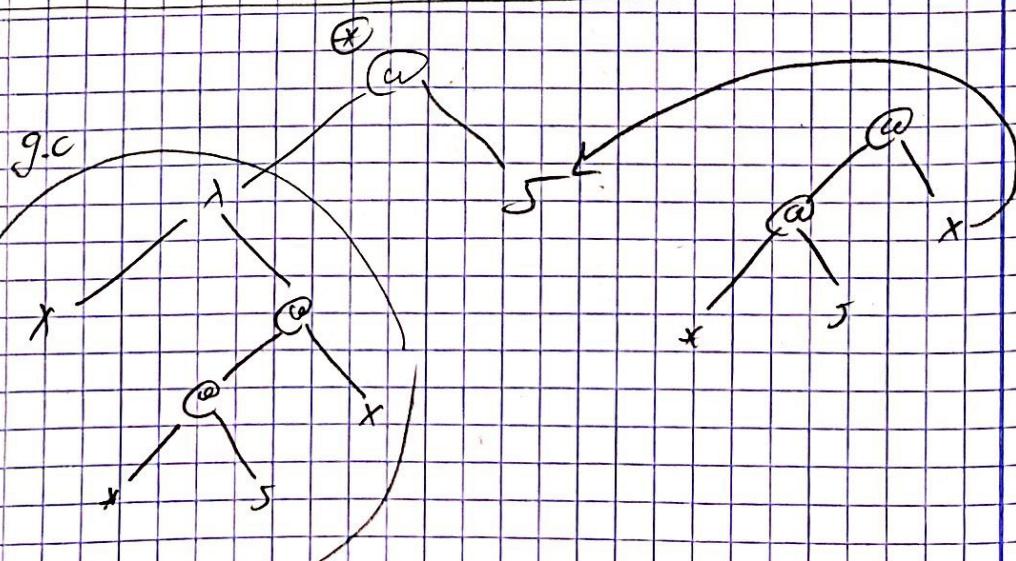
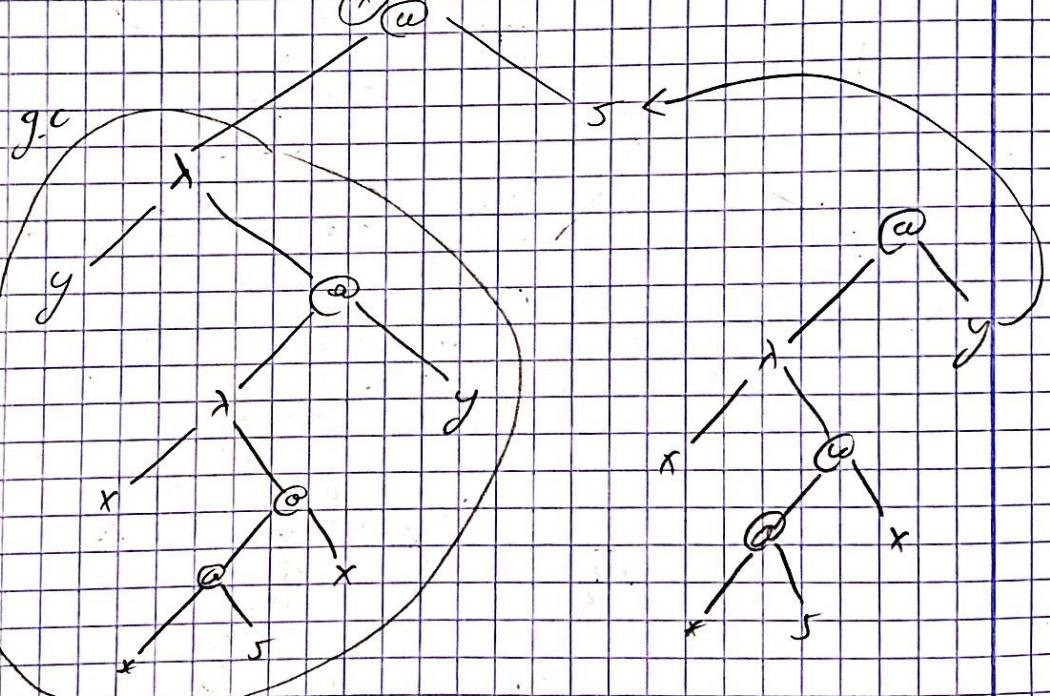


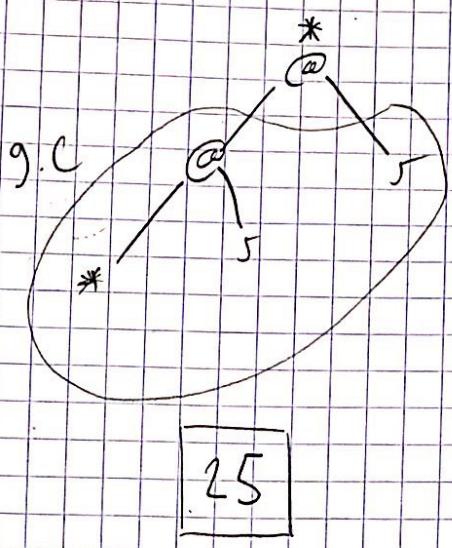
WHNF

b. 1.

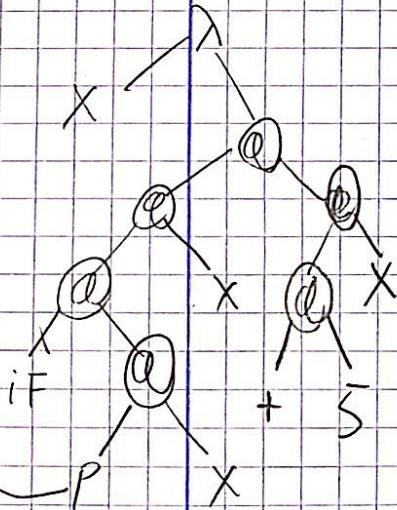
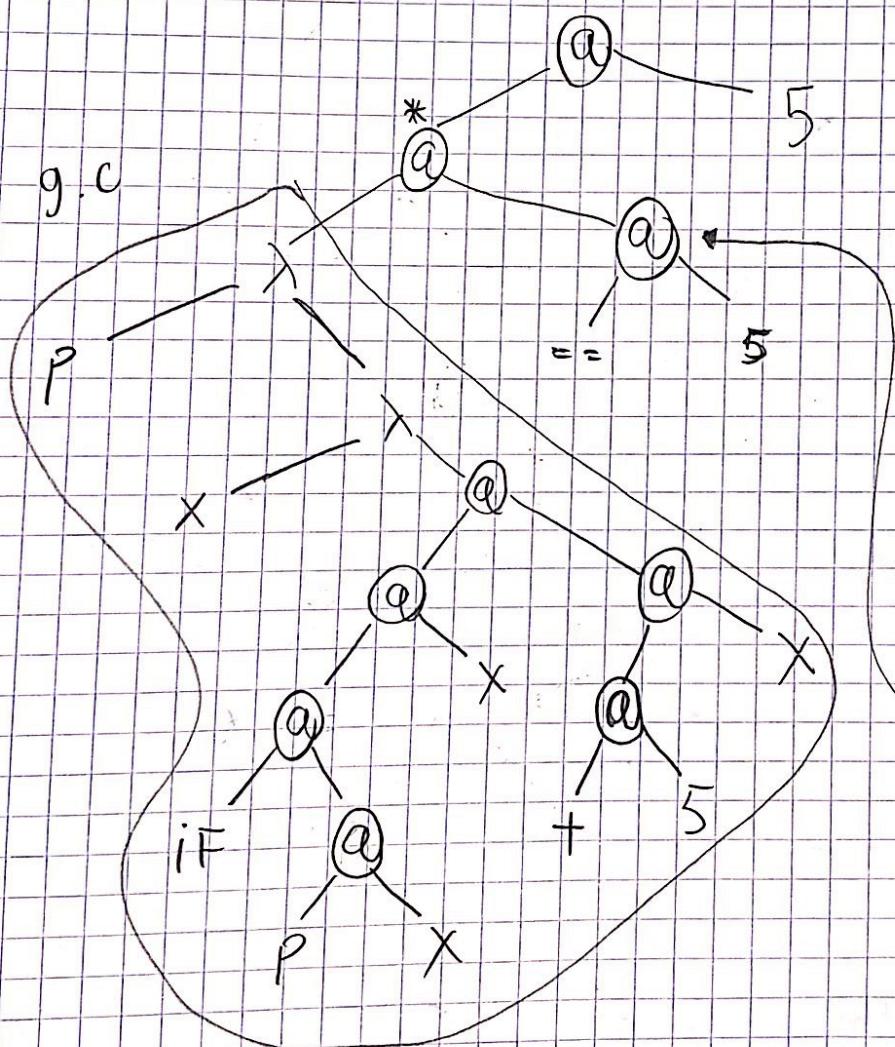


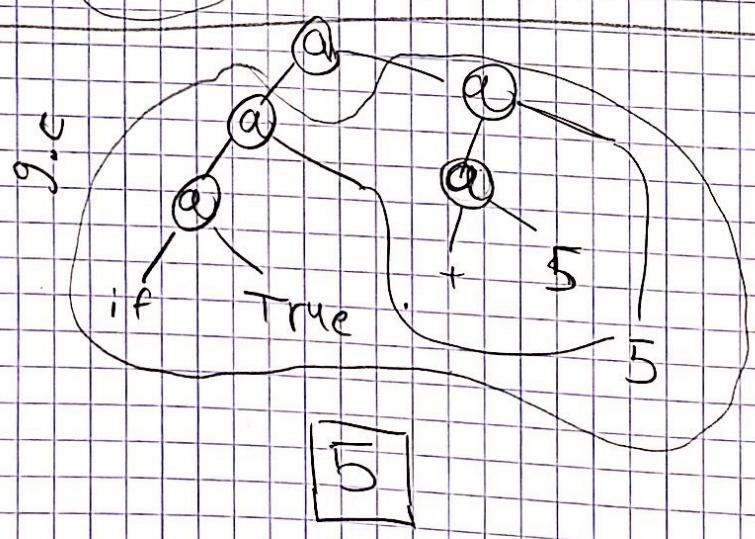
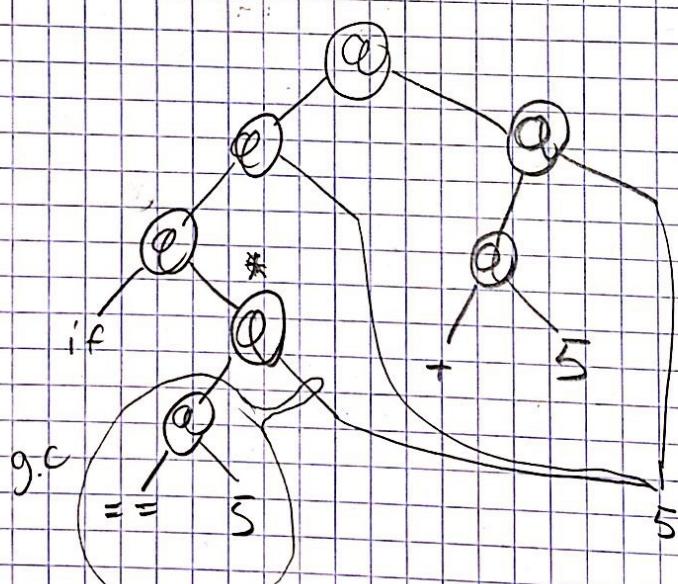
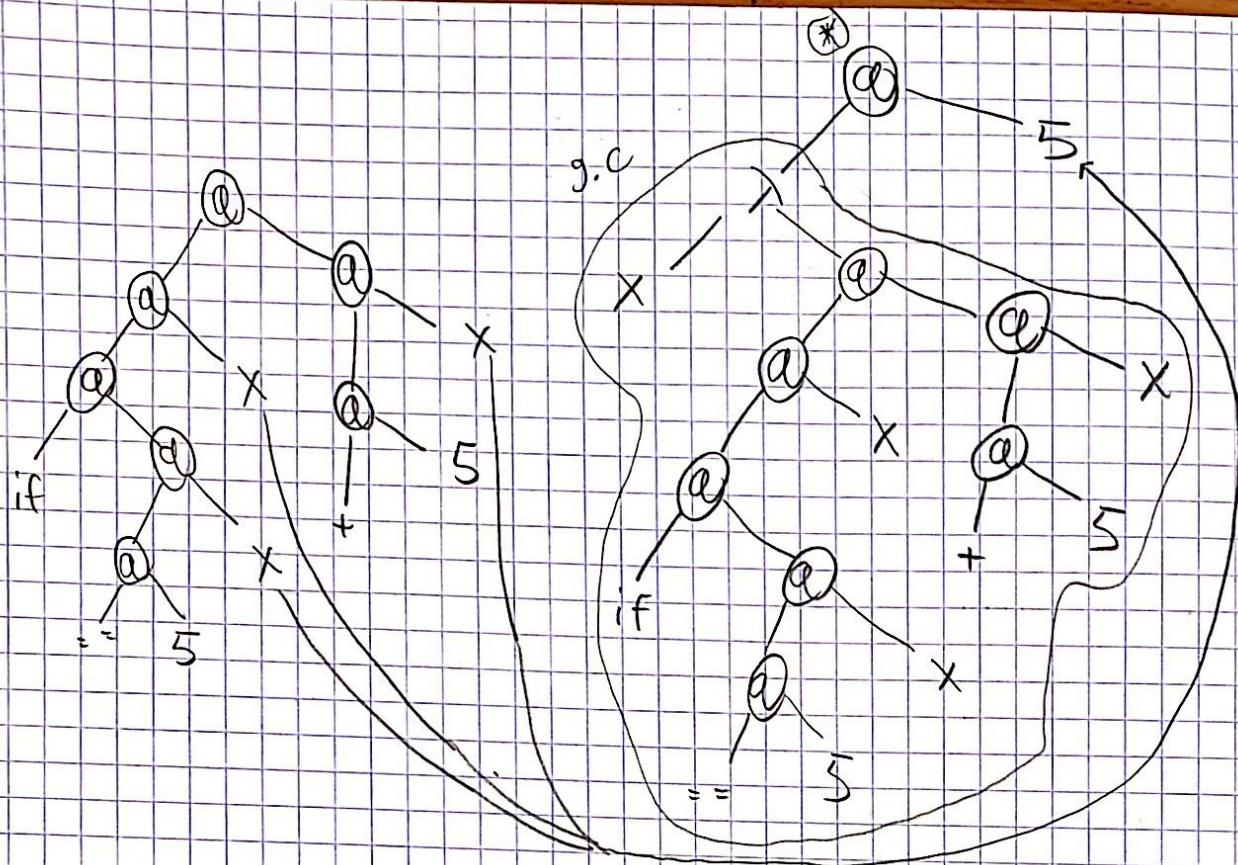
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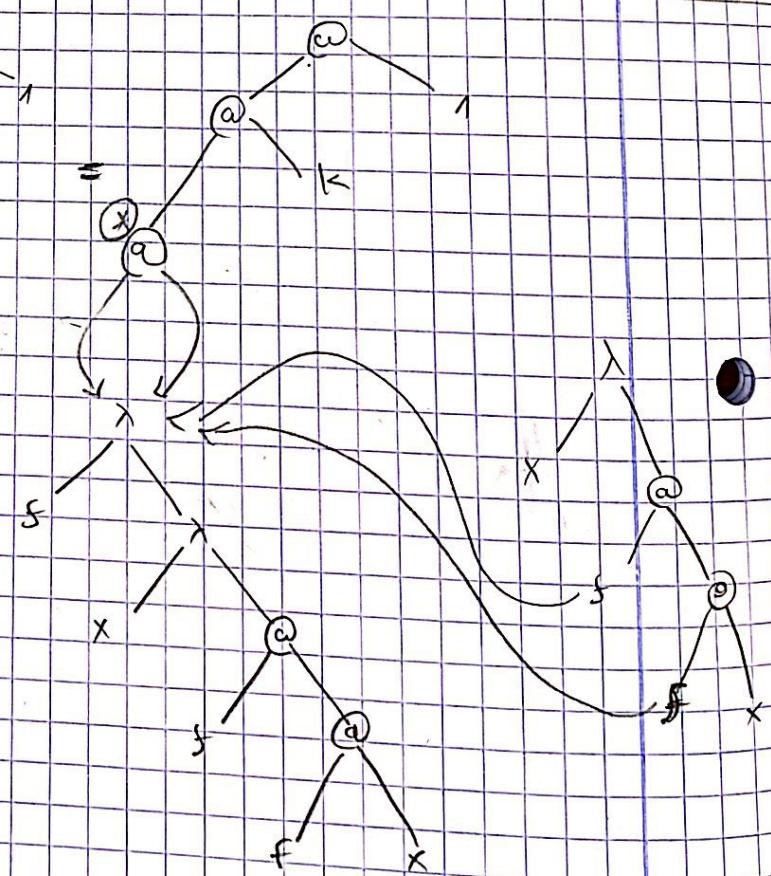
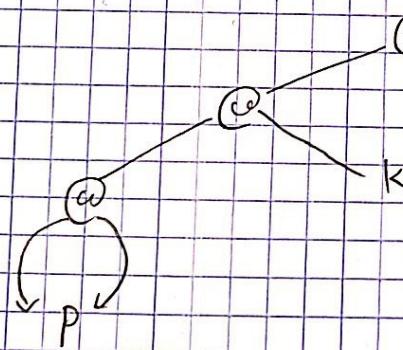
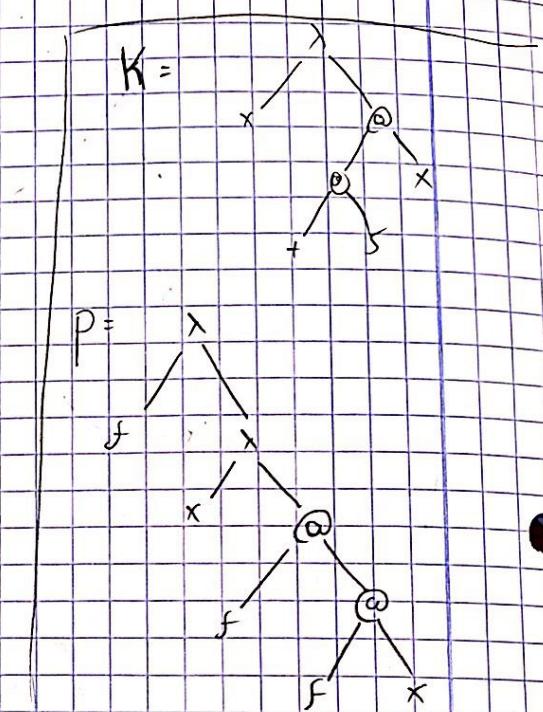
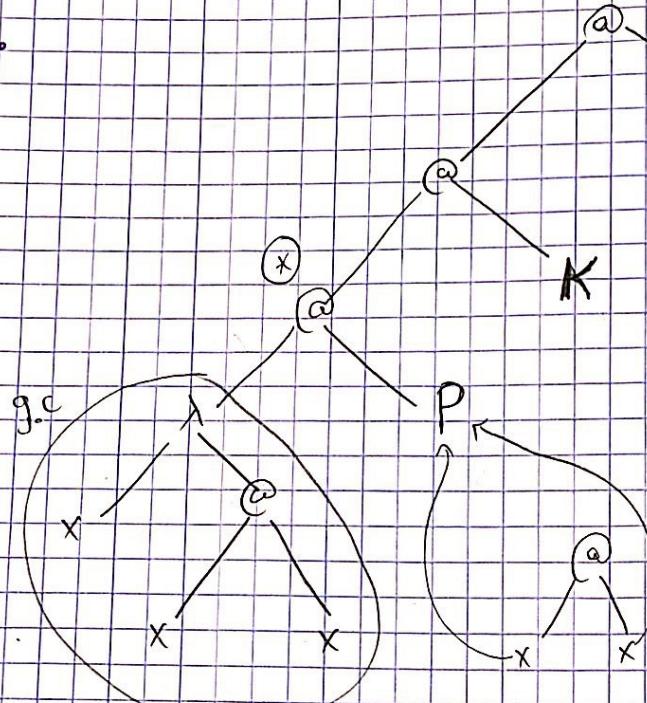


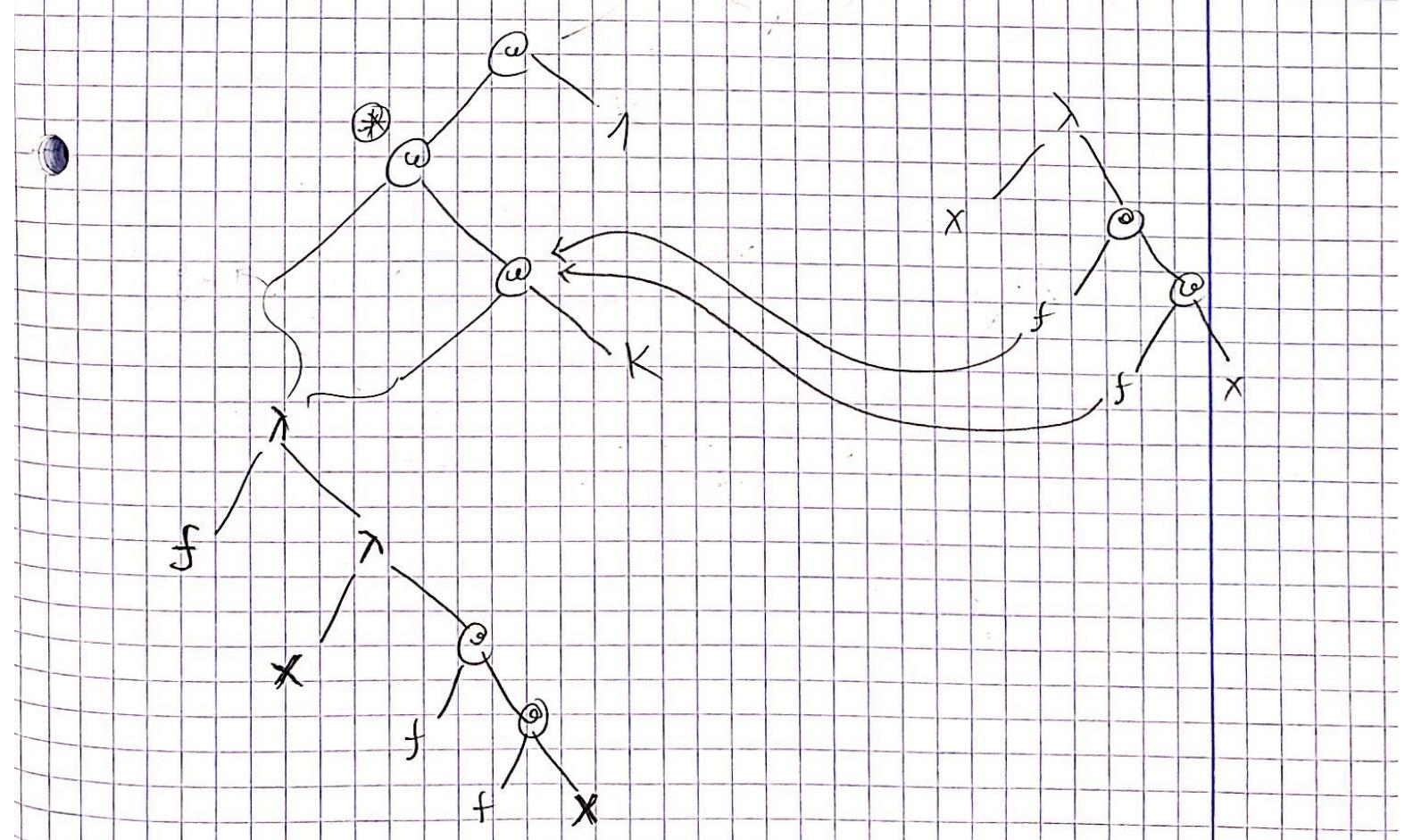
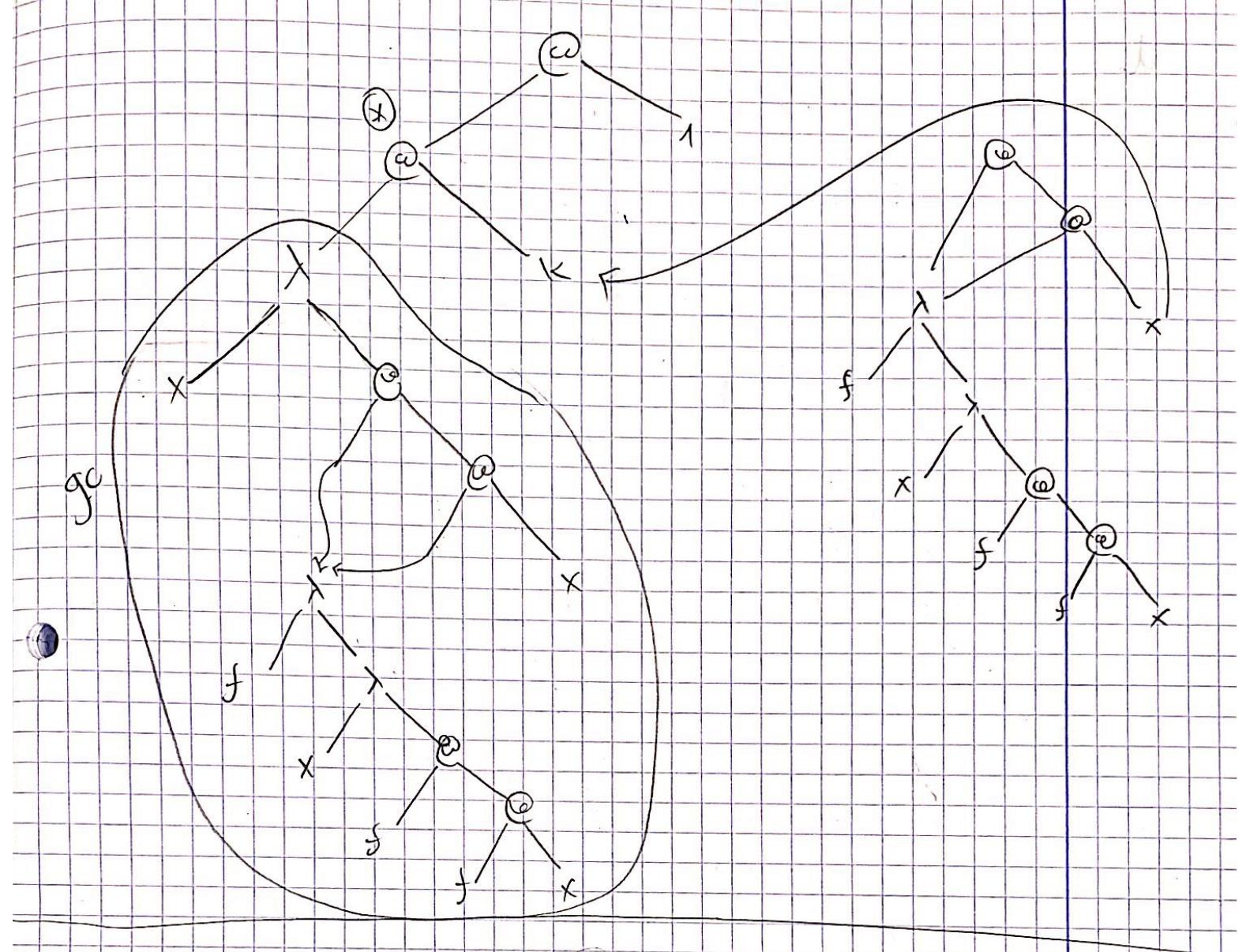
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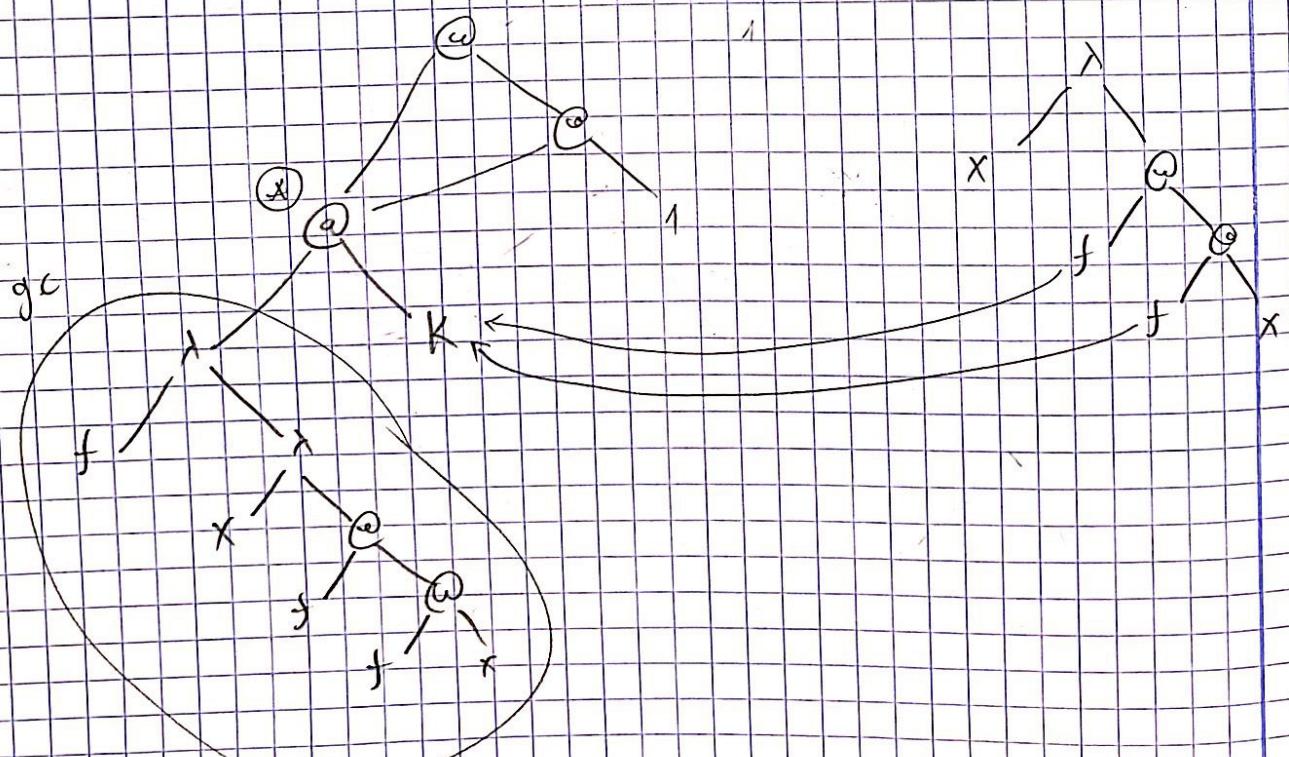
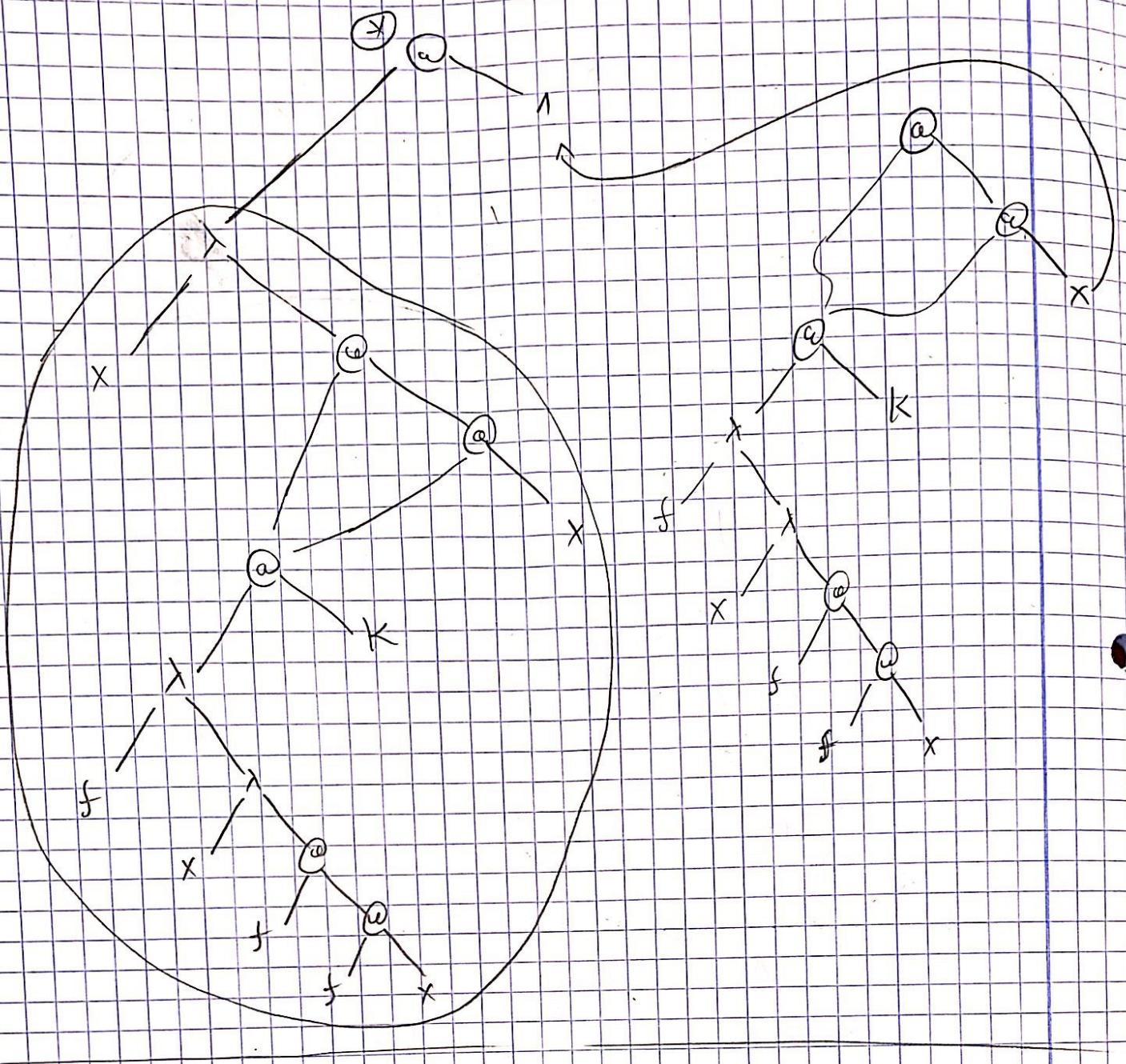


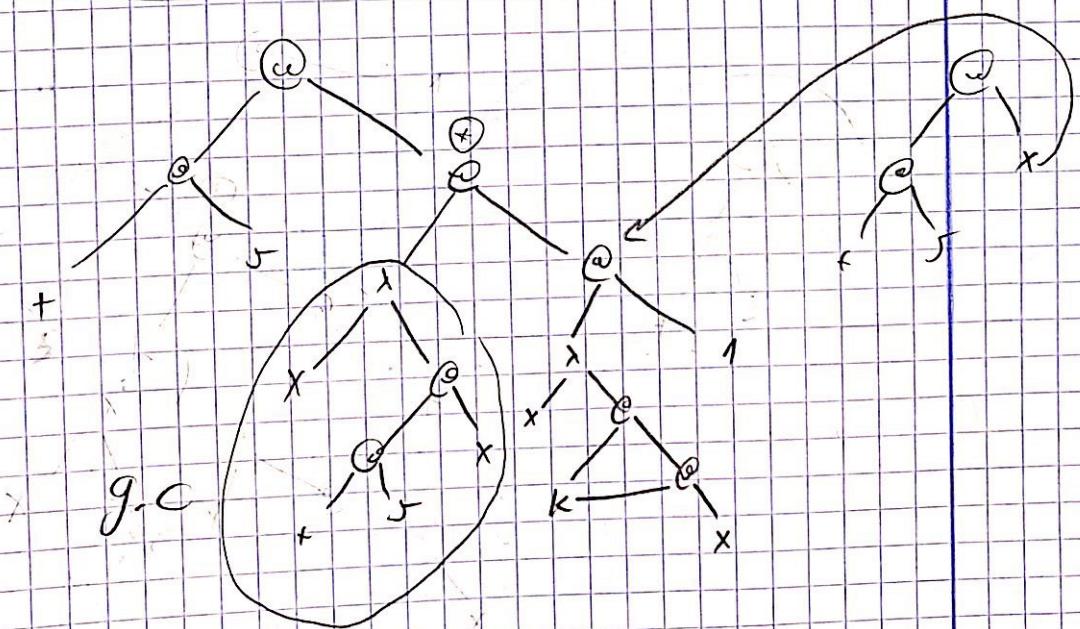
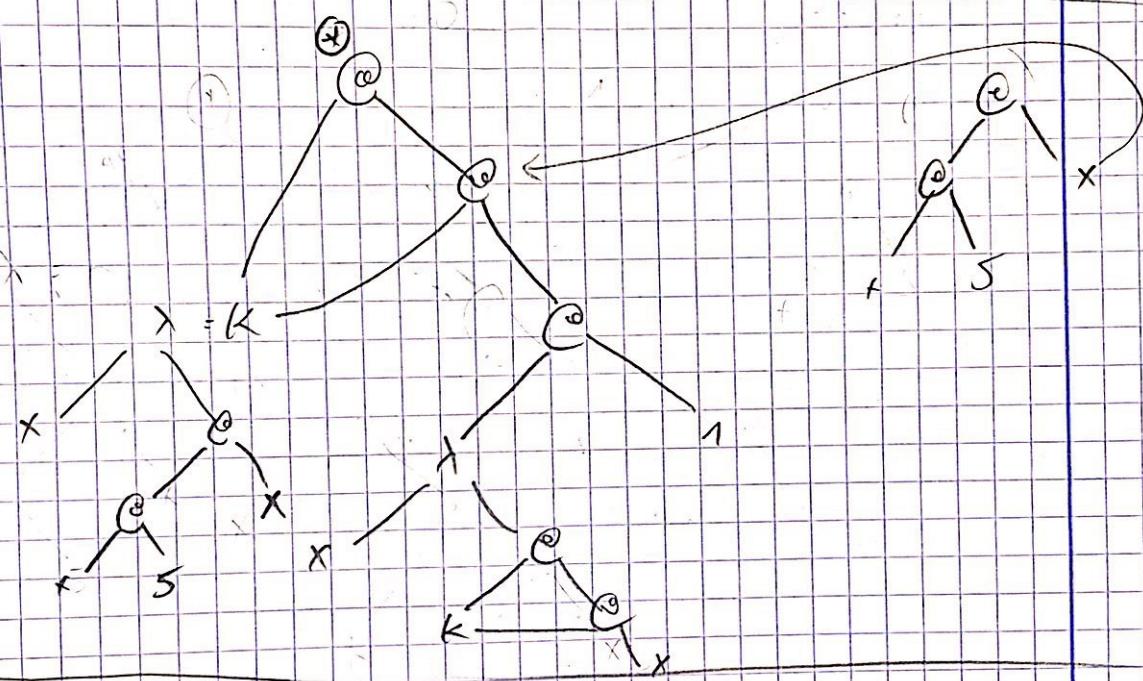
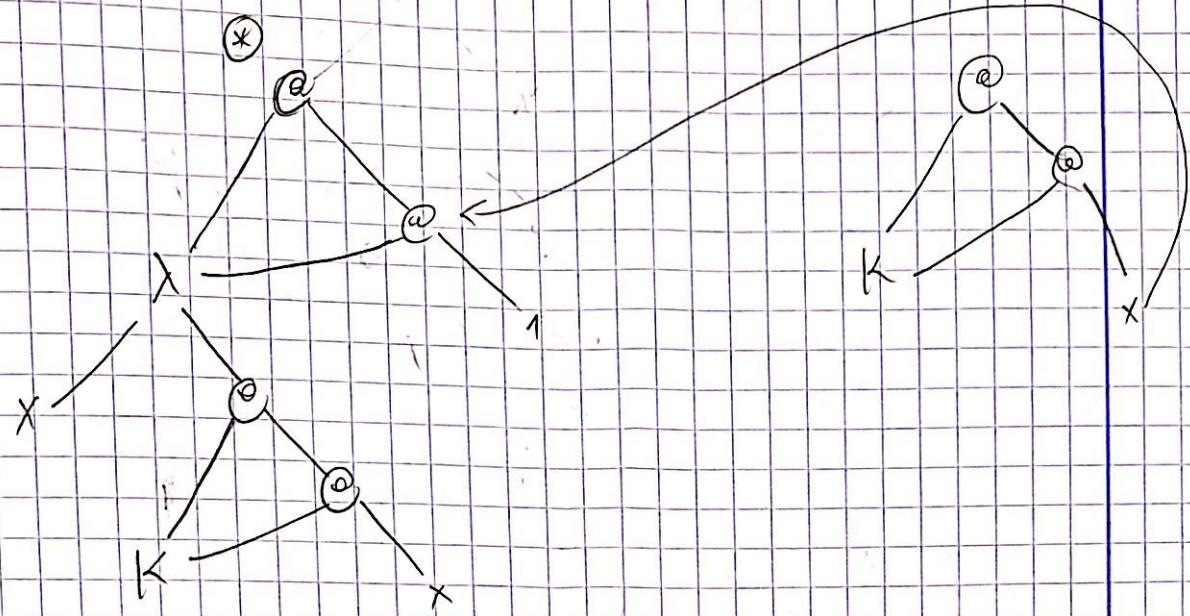


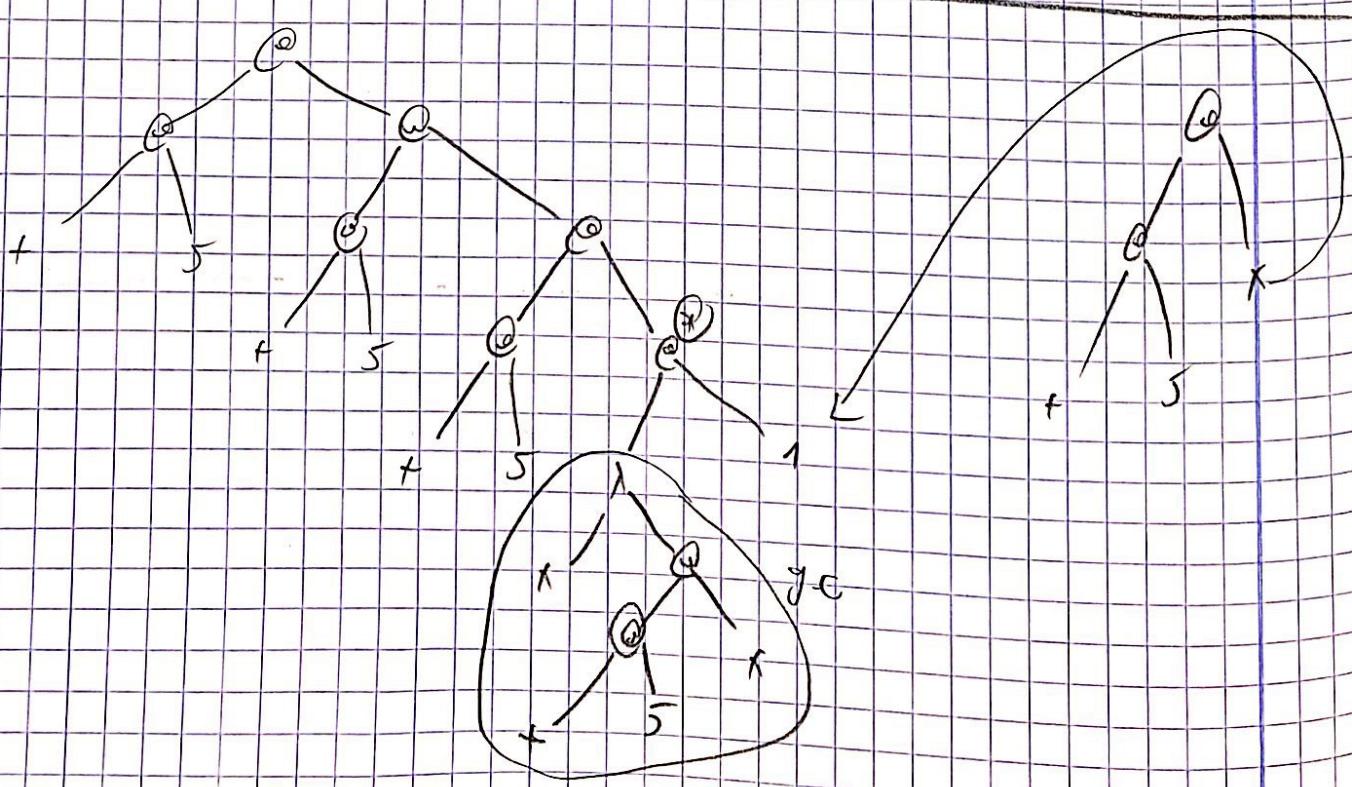
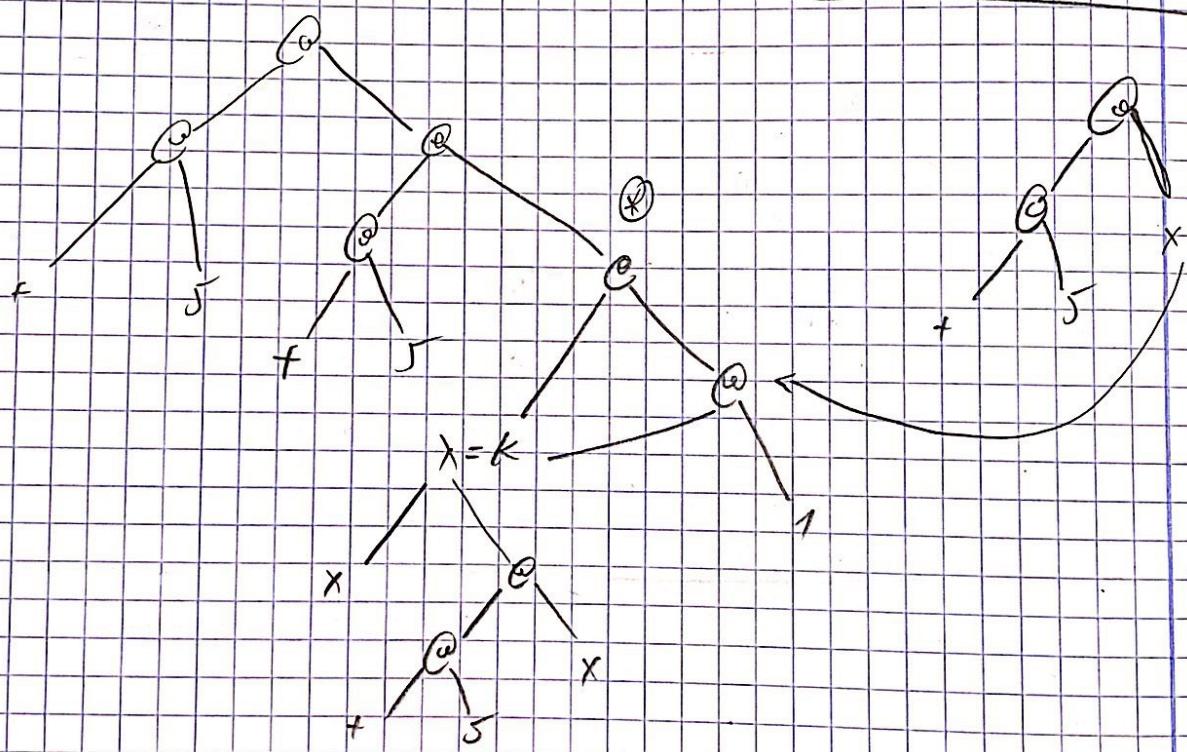
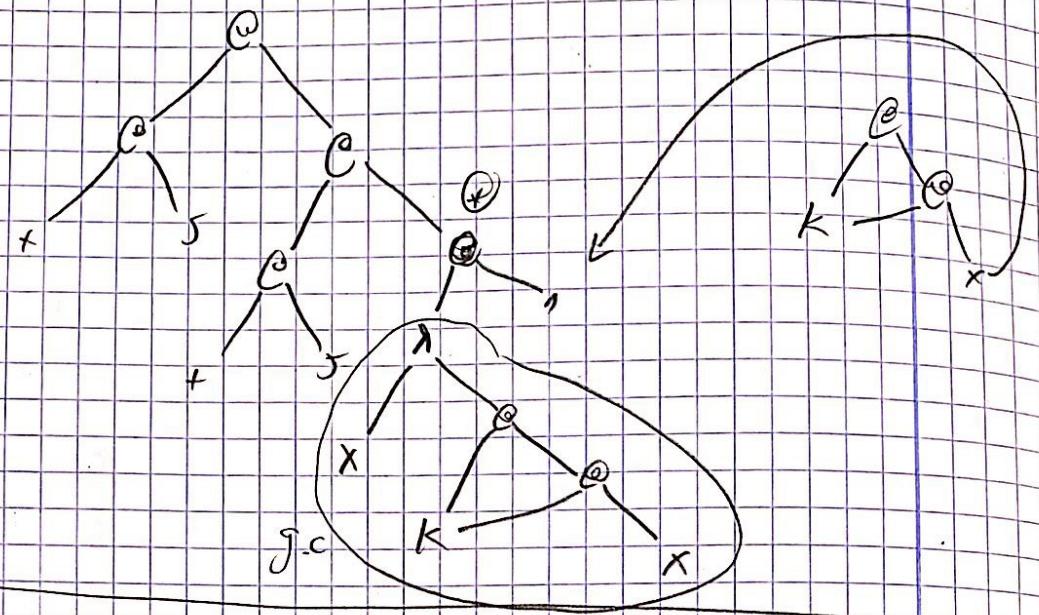
d.

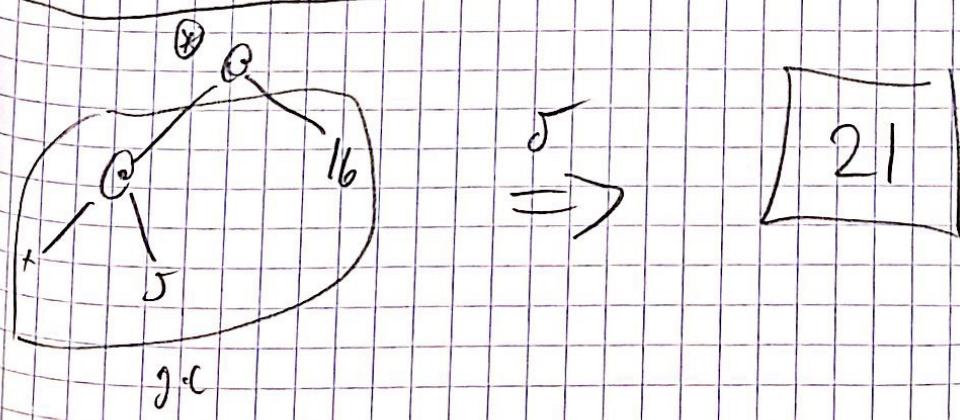
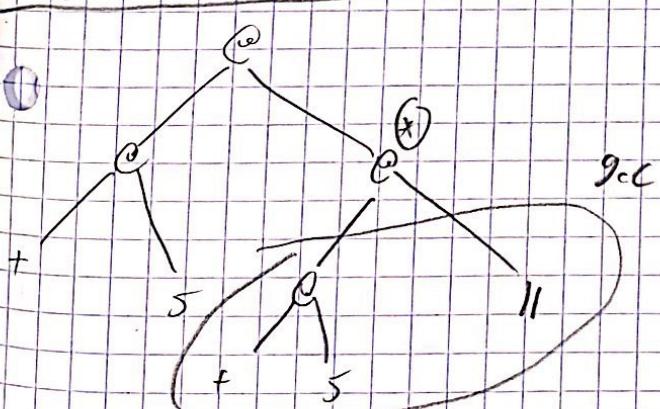
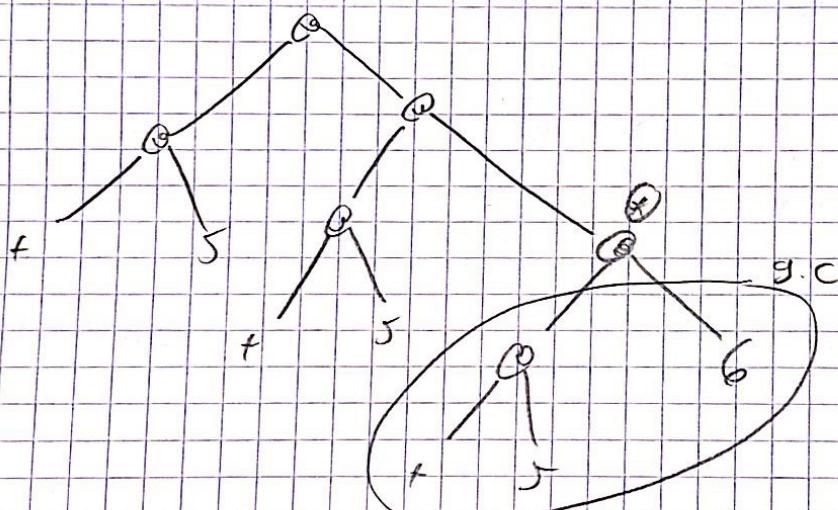
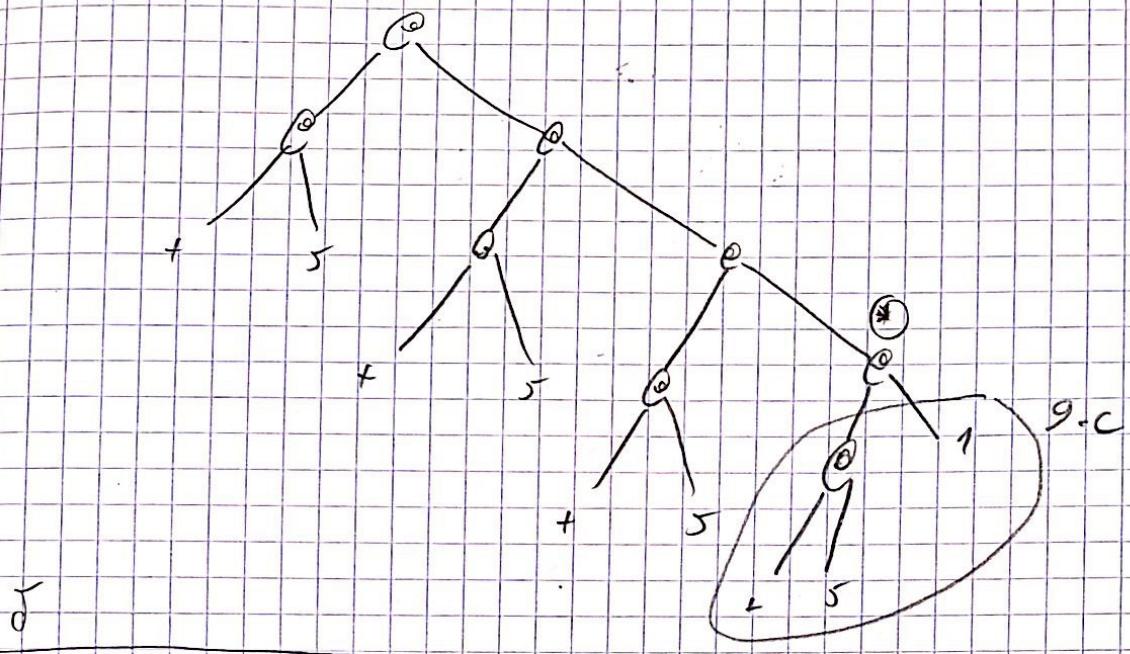












e, 1.

