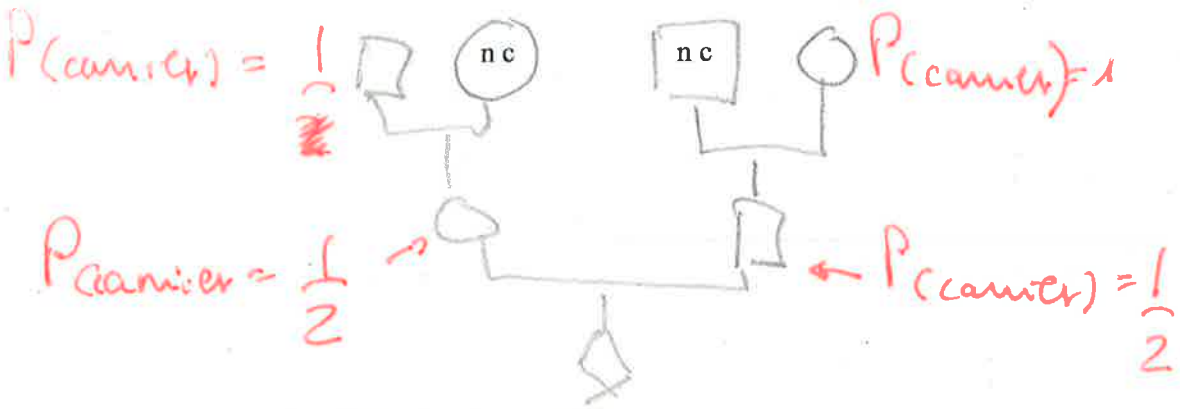
Question 3 20 pt

3.1

The pedigree shows a family in which the 2 women in the first generation (I) are albino.

Albinism is a phenotype transmitted on the autosomal recessive mode.




The couple of generation III is expecting a child.

- The pregnant woman has a paternal grand-mother with albinism.
- The father of the child to be born has a maternal grand-mother with albinism.

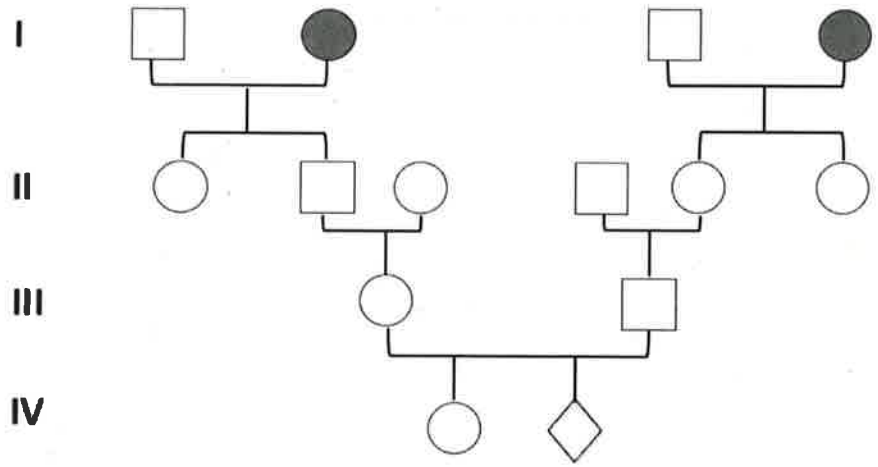
One assumes that the two people entering in the family by marriage are non-carrier for albinism (indicated as **n c** in the figure).

For the first child in the generation IV what is the probability to be born with albinism? (show your calculations)

1rst child : $\frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} \cdot \frac{1}{2} = \frac{1}{16}$

First name : _____ Last name : _____

3.2




The same family 4 years later: the couple is expecting a second child
Knowing that the first child is a girl non affected with albinism, what is the probability for the second child to be born with albinism ?
(show your calculation)

Bayes' : $P(\text{both parents carrier} \mid 1 \text{ ch OK}) = \dfrac{P_{(1\,OK)} \cdot P(\text{both carrier par})}{P_{1\,OK}}$

$\dfrac{\frac{3}{4} \cdot \frac{1}{4}}{\frac{15}{16}}$

$1 - \frac{1}{16}$

$\dfrac{\frac{3}{16}}{\frac{15}{16}}$ $\quad \frac{3}{15} = \frac{1}{5}$

$P(2^{nd} \text{ child} \mid 1^{st} \text{ OK}) = \frac{1}{5} \cdot \frac{1}{4} = \frac{1}{20}$

First name : _____ Last name : _____

3.4

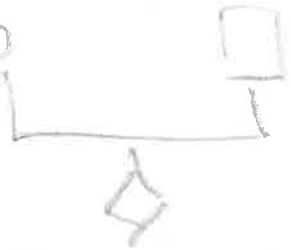
Red/green color blindness (daltonism) is affecting 3 members of the family whose pedigree is shown below. Red/green color blindness is a phenotype transmitted on the X-linked recessive mode.

I

II

III P(carrier) = 1

IV



The couple of generation III is expecting a child.
For the first child of this couple what is the probability to be born color blind ?

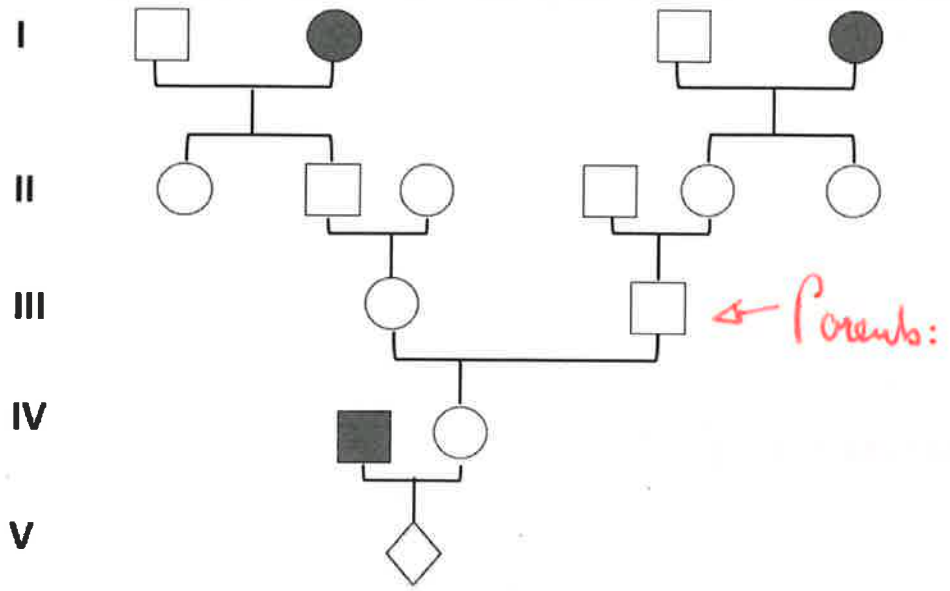
• if the first child is a girl ? _____ ∅ _____ $1 \cdot \frac{1}{2} \cdot 0$

• if the first child is a boy ? _____ $\frac{1}{2}$ _____ $1 \cdot \frac{1}{2}$

(show your calculations)

3.3

Same family 25 years later. The non-albino woman in generation IV is now expecting a child whose father is albino.




← Parents:

+/+ +/+ : $\frac{1}{2} \cdot \frac{1}{2} = \frac{1}{4}$

+/− +/+ $\frac{1}{4}$

+/+ +/− $\frac{1}{4}$

+/− +/− $\frac{1}{4}$

For the first child of this couple (generation V) what is the probability to be borne with albinism ? (show your calculations)

Parents :

+/+ +/+ : $\frac{1}{4}$

+/− +/+ : $\frac{1}{4}$

+/+ +/− : $\frac{1}{4}$

+/− +/− : $\frac{1}{4}$

Daughter:

| | +/+ | +/− | −/− |
|---|---|---|---|
| +/+ +/+ | $\frac{1}{4}$ | 0 | 0 |
| +/− +/+ | $\frac{1}{8}$ | $\frac{1}{8}$ | 0 |
| +/+ +/− | $\frac{1}{8}$ | $\frac{1}{8}$ | 0 |
| +/− +/− | $\frac{1}{16}$ | $\frac{2}{16}$ | $\frac{1}{16}$ |
| Σ | $\frac{9}{16}$ | $\frac{6}{16}$ | $\frac{1}{16}$ |

P(daughter +/−) = $\frac{\frac{6}{16}}{\frac{9}{16}} = \frac{6}{9} = \frac{2}{3}$

P(child −/−) : $\frac{2}{3} \cdot \frac{1}{2} = \frac{1}{3}$