



Grade 12 GS

Probability ex 22

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Exercise 22:

In a given population, 15% of the individuals have a disease D_a .

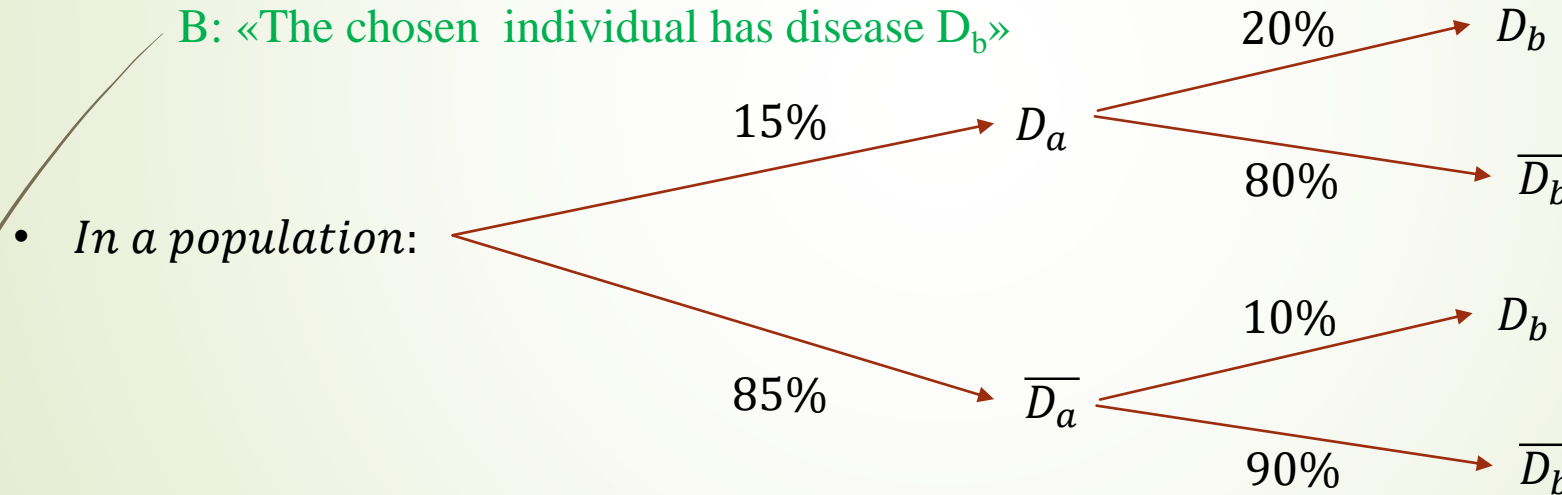
Out of the individuals having disease D_a , 20% have another disease D_b .

Out of the individuals not having disease D_a , 90% don't have disease D_b .

An individual is randomly chosen from this population. Consider the following events:

A: «The chosen individual has disease D_a »

B: «The chosen individual has disease D_b »

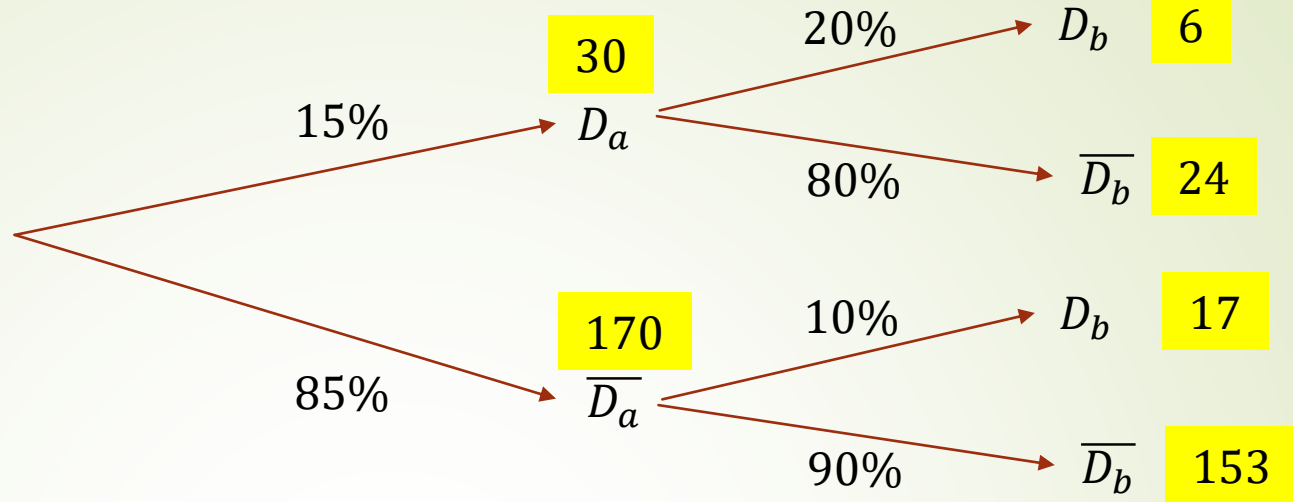


1) Calculate the probability $P(A \cap B)$ and prove that $P(B) = 0.115$.

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$$P(A \cap B) = \frac{15}{100} \times \frac{20}{100} = 0.03$$

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$$P(B) = P(B \cap A) + P(B \cap \bar{A}) = 0.03 + \frac{85}{100} \times \frac{10}{100} = 0.115$$

- In a population:



- 2) An individual of the population declares that he doesn't have disease D_b , calculate the probability that he has disease D_a .

- $$P(A/\bar{B}) = \frac{P(A \cap \bar{B})}{P(\bar{B})} = \frac{\frac{15}{100} \times \frac{80}{100}}{1 - P(B)} = \frac{8}{59}$$

- 3) In this question, suppose that this population counts **200** individuals. A group of 4 individuals is randomly chosen from this population. Calculate the probability that at most 2 individuals among the chosen 4 have the disease D_a .

- $$P(\text{at most 2 individuals have the disease } D_a) = P(4\bar{A} \text{ or } 1A \ 3\bar{A} \text{ or } 2A \ 2\bar{A})$$

$$= \frac{C_{170}^4 + C_{30}^1 \times C_{170}^3 + C_{30}^2 \times C_{170}^2}{C_{200}^4} = 0.98$$