Quiz 2

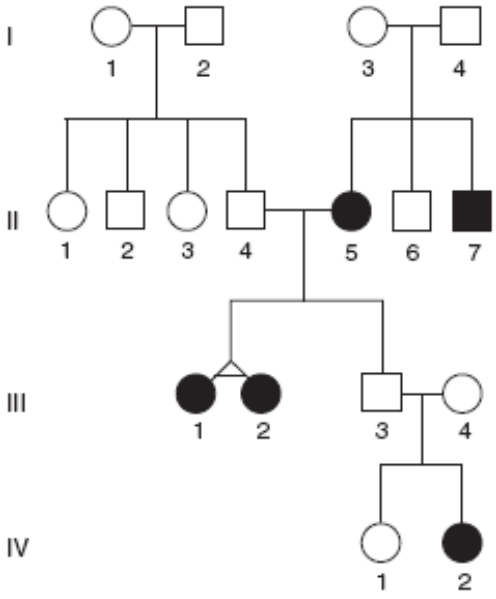
Cluster 70 — Winter 2021

You may consult the lectures and your notes during this exam. You may not collaborate with anyone else and all answers must be your own work.

FREE RESPONSE. 10 pts total.

FOLLOW THESE GUIDELINES FOR FULL CREDIT

- Submit single-page (one side) response on a blank piece of paper
- Label responses and draw a horizontal line between the different questions
- For each question, keep your written responses under 5 sentences.
- If photographing submission, ensure that the submitted file can be easily read (proper lighting, photograph resolution)



Use the pedigree above to answer the questions on the following page. The black-filled symbols indicate individuals with an autosomal (not sex-linked) recessive phenotype. Squares and circles represent males and females, respectively. Individuals III-1 and III-2 are identical twins In your answers, indicate the dominant allele with 'R' and the recessive allele with 'r.' **Explain all your answers with <u>one</u> sentence.**

What is the genotype of individual III-1?

What is the genotype of individual III-3?

What are the two possible genotypes of individual II-2?

If you knew that the incidence of the recessive phenotype in the general population was .04, what would be the probability that individual 2 had each genotype in your previous answer? (Give a quantitative answer and show your work!)

Individual III-1 = rr

In order to exhibit the recessive phenotype, the individual must have not inherited any dominant R alleles.

Individual III-3 = Rr

This individual has the dominant phenotype but we also know that it had to inherit an r allele from its homozygous recessive mother, meaning it must be a heterozygote.

Individual II-2 = RR or Rr

The fact that two of this individual's nieces display the recessive phenotype while this individual's parents and siblings exhibit the dominant phenotype reveals that its brother and at least one of its parents are heterozygotes, meaning we cannot guarantee that II-2 is homozygous dominant.

$$f(rr) = .04 \rightarrow \quad q = f(r) = \sqrt{.04} = .2$$

$$p = f(R) = 1 - f(r) = 1 - .2 = .8$$

$$f(RR) = p^2 = (.8)^2 = .64$$

$$f(Rr) = 2pq = 2(.8)(.2) = .32$$

$$f(\text{Dominant Phenotype}) = f(RR) + f(Rr) = .96$$

Given that individual II-2 has the dominant phenotype:

$$\frac{f(RR)}{f(\text{dominant})} = \frac{.64}{.96} = \boxed{2/3 \text{ Chance of } RR}$$

$$\frac{f(Rr)}{f(\text{dominant})} = \frac{.32}{.96} = \boxed{1/3 \text{ Chance of } Rr}$$