

Solution of question xl-65.2023

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Question: The frequencies for autosomal alleles A and a are $p = 0.5$ and $q = 0.5$, respectively, where A is dominant over a . Under the assumption of random mating, the mating frequency among dominant parents is.

Solution: Given: A and a are two alleles where A is dominant one.

Let Y be a random variable depicting the number of dominant alleles in zygote(AA, Aa, aA, aa).

Parameter	Value	Description
A	1	dominant allele
a	0	Recessive allele
n	2	number of Alleles
p	0.5	frequency of dominant one
q	0.5	frequency of recessive one
Y	0,1,2	Number of dominant allele in zygote

1) Theory:

Using binomial which states that

$$\Pr(Y = i) = {}^nC_i(p)^i(q)^{(n-i)} \quad (1)$$

For the mating frequency among the dominant parents, both parents must have atleast one dominant allele. The probability of getting atleast 1 dominant allele in parent zygote :

$$\Pr(Y \geq 1) = \Pr(Y = 1) + \Pr(Y = 2) \quad (2)$$

$$= {}^2C_1(p)(q) + {}^2C_2(p)^2(1) \quad (3)$$

$$= 2pq + p^2 \quad (4)$$

$$= 0.5 + 0.25 \quad (5)$$

$$= 0.75 \quad (6)$$

2) Step for Simulation of Random variable Y :

- Define the simulation size for simulation data set.
- Generate two different random distribution to get two different bernoulli showing A as 1 and a as 0 each having frequency of 0.5.
- The two bernoulli data for parents will mate with each other to form a zygote containig 1's and 0's.
- Add up two bernoulli to generate binomial distrubition for random variable Y showing the number of 1's or dominant allele in zygote.
- Count up the cases where there is atleast one 1 to generate the simulated probability.

