Exercises day 2

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Spouses' HT status NOT independent

- Asked:
  - A = P(f=ht, m=ht)
  - B = P(f=notht, m=ht)
  - C = P(f=ht, m=notht)
  - D = P(f=notht, m=notht)
- And…
  - P(m=ht) = 0.55 = A + B.
  - P(f=ht) = 0.4 = A + C.

- $P(f=ht|m=ht)/P(f=ht|m=notht)=1.5$
- $(P(f=ht,m=ht)/P(m=ht))/(P(f=ht,m=notht)/P(m=notht))=1.5$
- $(A/0.55)/(C/0.45)=1.5$
- $A/C * 0.45/0.55=1.5$
- $A/C=1.5*(0.55/0.45)$ and $C=0.4-A$ gives:
  - $A/(0.4-A)=1.833$
  - $A=1.833(0.4-A)$
  - $A=0.7332-1.833A$
  - $2.833A=0.7332$ -> Gives $A=0.26$

- A = P(f=ht, m=ht)=0.26
- B = P(f=notht, m=ht)=0.4-A=0.14
- C = P(f=ht, m=notht)=0.55-A=0.29
- D = P(f=notht, m=notht)=1-A-B-C=0.31
- Question 2 of page 1 is same with different nummers.

Probability of disease in SNP genotypes

	A-D 0.07	**A-N 0.13**	**T-D 0.03**	**T-N 0.77**
A-D 0.07	**0.0049**	**0.0091**	**0.0021**	**0.0539**
A-N 0.13	**0.0091**	**0.0169**	**0.0039**	**0.1001**
T-D 0.03	**0.0021**	**0.0039**	**0.0009**	**0.0231**
T-N 0.77	**0.0539**	**0.1001**	**0.0231**	**0.5929**

	DD	$P(TT, DD)=P(TD)^2 = 0.0009$	
TT	DN	$P(TT, DN)=P(TD,TN)*2=0.0231*2=0.0462$	0.64=64%
	NN	$P(TT,NN)=P(TN)^2 = 0.5929$	
	DD	$P(AT,DD)=P(AD,TD)*2=0.0021*2=0.0042$	
AT	DN	$P(AT,DN)=P(AD,TN)+P(AN,TD)=0.0539+0.0039=0.0578$	0.26=26%
	NN	$P(AT,NN)=P(AN,TN)*2=0.1001*2=0.2002$	
	DD	$P(AA,DD)=P(AD)^2 =0.0049$	
AA	DN	$P(AA,DN)=P(AD,AN)*2=0.0091*2=0.0182$	0.04=4%
	NN	$P(AA,NN)=P(AN)^2 =0.0169$	

QUESTION 4

4. In a population, a mutation D is present with frequency of 20%. This mutation is neutral. At same point in the time, the environment changes and the mutation starts affecting survival. Namely when homozygous, it leads to 20% mortality (8 out of 10 survive). Assume no mutation, How many generation will it take before the frequency is reduced:

- 1. Two fold?
- 2. Four fold?
- 3. Ten fold?

Answer 4.1

- qo= 0.2 μ=0
- S = 0.2

  Two fold means q1 = 0.1
- q1 = qo/ 1 + s.qo = 0.2 / (1+(0.2x0.2)) = 0.1923
- 0.1923 / (1+(0.2x0.1923)) = 0.185
- You continue this calculation until you find a q1 of 0.1
- → after 23 generation (q1=0.099)

Answer 4.2 & 4.3

- 4.2 We try to find until the q = ¼ x 0.2 = 0.05
- 4.3 We try to find until the q = 1/10 x 0.2 = 0.02

QUESTION 5

- Repeat previous exercise, using initial frequency of 0.05 and mutation rate of 1 in billion (10-9)

Answer :

- qo= 0.05 $\mu=10^{-9}$
- $s = \mu/q^2 = 10^{-9} / 0.05^2 = 4x10^{-7}$
- q1 =

  Two fold means q1 = ½ x 0.05 = 0.025
- q1 = qo/ 1 + s.qo = 0.05 / 1+($4x10^{-7}$ x0.05) = 0.0499
- 0.0499 / 1+($4x10^{-7}$ x0.0499) = 0.0498

- We can find that the two fold frequency will be reached after …….