

Exercises day 2

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Spouses' HT status NOT independent

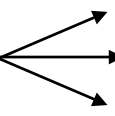
- Asked:
 - $A = P(f=ht, m=ht)$
 - $B = P(f=noht, m=ht)$
 - $C = P(f=ht, m=noht)$
 - $D = P(f=noht, m=noht)$
- And...
 - $P(m=ht) = 0.55 = A + B.$
 - $P(f=ht) = 0.4 = A + C.$

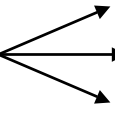
- $P(f=ht|m=ht)/P(f=ht|m=noht)=1.5$
- $(P(f=ht,m=ht)/P(m=ht))/(P(f=ht,m=noht)/P(m=noht))=1.5$
- $(A/0.55)/(C/0.45)=1.5$
- $A/C * 0.45/0.55=1.5$
- $A/C=1.5*(0.55/0.45)$ and $C=0.4-A$ gives:
 - $A/(0.4-A)=1.833$
 - $A=1.833(0.4-A)$
 - $A=0.7332-1.833A$
 - $2.833A=0.7332 \rightarrow$ Gives $A=0.26$

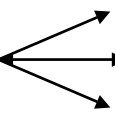
- $A = P(f=ht, m=ht)=0.26$
- $B = P(f=notht, m=ht)=0.4-A=0.14$
- $C = P(f=ht, m=notht)=0.55-A=0.29$
- $D = P(f=notht, m=notht)=1-A-B-C=0.31$
- Question 2 of page 1 is same with different nummers.

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

TT		DD	$P(TT, DD) = P(TD)^2 = 0.0009$	
		DN	$P(TT, DN) = P(TD, TN) * 2 = 0.0231 * 2 = 0.0462$	0.64 = 64%
		NN	$P(TT, NN) = P(TN)^2 = 0.5929$	

AT		DD	$P(AT, DD) = P(AD, TD) * 2 = 0.0021 * 2 = 0.0042$	
		DN	$P(AT, DN) = P(AD, TN) + P(AN, TD) = 0.0539 + 0.0039 = 0.0578$	0.26 = 26%
		NN	$P(AT, NN) = P(AN, TN) * 2 = 0.1001 * 2 = 0.2002$	

AA		DD	$P(AA, DD) = P(AD)^2 = 0.0049$	
		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

- $q_0 = 0.2$ $\mu = 0$
- $S = 0.2$

Two fold means $q_1 = 0.1$

- $q_1 = q_0 / (1 + s \cdot q_0) = 0.2 / (1 + (0.2 \times 0.2)) = 0.1923$
- $0.1923 / (1 + (0.2 \times 0.1923)) = 0.185$
- You continue this calculation until you find a q_1 of 0.1
- \rightarrow after 23 generation ($q_1 = 0.099$)

Answer 4.2 & 4.3

4.2 We try to find until the $q = \frac{1}{4} \times 0.2 = 0.05$

4.3 We try to find until the $q = \frac{1}{10} \times 0.2 =$
0.02

QUESTION 5

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

Answer :

- $q_0 = 0.05$ $\mu = 10^{-9}$
- $s = \mu/q^2 = 10^{-9} / 0.05^2 = 4 \times 10^{-7}$
- $q_1 =$
Two fold means $q_1 = \frac{1}{2} \times 0.05 = 0.025$
- $q_1 = q_0 / 1 + s \cdot q_0 = 0.05 / 1 + (4 \times 10^{-7} \times 0.05) = 0.0499$
- $0.0499 / 1 + (4 \times 10^{-7} \times 0.0499) = 0.0498$
- We can find that the two fold frequency will be reached after