Problem 1

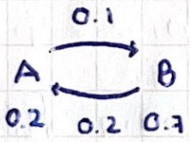
Campus: $N = 80$ $p = 0.7$ } 20
Forest: $N = ?$ $p = 0.5$

$$p_t = p_c + (p_0 - p_c)(1-m)^t$$
$$p_1 = 0.7 + (0.5 - 0.7)(1-0.25)^1 = 0.55$$

$p_5 = 0.7 + (0.5-0.7)(1-0.25)^5 = 0.625$
$p_{10} = 0.7 + (0.5-0.7)(1-0.25)^{10} = 0.6223$
$p_{15} = 0.7 + (0.5-0.7)(1-0.25)^{15} = 0.6973$
$p_{30} = 0.7 + (0.5-0.7)(1-0.25)^{30} = 0.699964$
$p_{50} = 0.7 + (0.5-0.7)(1-0.25)^{50} = 0.699999$

Allele freq. in equilibrium will be:
- $p = 1$
- $q = 0$

Problem 2



$m_{A \to B} = 0.1 \rightarrow 1 - 0.1 = 0.9$
$m_{B \to A} = 0.2 \rightarrow 1 - 0.2 = 0.8$

- A: $p_1 = (0.9 \cdot 0.2) + (0.2 \cdot 0.7) = 0.32$
- B: $p_1 = (0.8 \cdot 0.7) + (0.1 \cdot 0.2) = 0.58$

- A: $p_2 = (0.9 \cdot 0.32) + (0.2 \cdot 0.58) = 0.404$
- B: $p_2 = (0.8 \cdot 0.58) + (0.1 \cdot 0.32) = 0.496$

$m_{B \to A} > m_{A \to B}$ allele freq change faster in A
At eq. we expect both the same freq

Problem 3

$H_o = \frac{\Sigma 2pq}{N}$ $H_r = 2\bar{p}\bar{q}$ mean = 0.0179

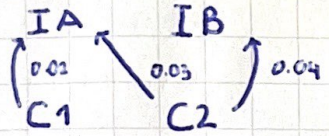
$F_{ST} = \frac{H_r - H_o}{H_r}$ $H_o = ((0.51 \cdot 0.49 \cdot 2) + (2 \cdot 0.19 \cdot 0.33) + (0.09 \cdot 0.91 \cdot 2))(2 \cdot 0.11)) / 43 =$

$H_r = 2 \cdot 0.0179 \cdot (1 - 0.0179) = 0.0351$ $= 0.02199$

$F_{ST} = \frac{0.0351 - 0.02199}{0.0351} = 0.5961$ ↑ level gen. diff.

$Nm = \frac{1 - F_{ST}}{4 F_{ST}} = 0.1694$ ↓ rate migration

Problem 4



IA: $(1-0.05)(0.4) + (0.02 \cdot 0.7) + (0.03 \cdot 0.3) = 0.403$

IB: $(1-0.04)(0.5) + (0.04 \cdot 0.3) = 0.492$

Problem 5

$f(FY^A) = 0.045$ $f(FY^B) = 0.955$ Black ↱ m?

$f(FY^A) = 0.422$ $f(FY^B) = 0.578$ White

12 gen

$p_t = p_c + (p_o - p_c)(1-m)^t \rightarrow m = 1 - \sqrt[t]{\frac{p_t - p_c}{p_o - p_c}}$

$m = 1 - \sqrt[12]{\frac{0.045 - 0.422}{0 - 0.422}} = 0.00935$ W → B

Problem 6

mean = 0.6458

1) $f(A_1) = \frac{2 \cdot 26 + 13}{2 \cdot 40} = 0.8125$ $\quad f(A_2) = 1 - f(A_1) = 0.1875$

2) $f(A_1) = \frac{2 \cdot 6 + 11}{2 \cdot 24} = 0.4791$ $\quad f(A_2) = 1 - f(A_1) = 0.5209$

$F_{ST} = \frac{H_T - H_S}{H_T}$ $\quad H_S = (2 \cdot 0.8125 \cdot 0.1875 + 2 \cdot 0.4791 \cdot 0.5209)/2 = 0.4019$

$H_T = 2 \cdot 0.6458 (1 - 0.6458) = 0.4574$

$F_{ST} = 0.1213$

Problem 7

Av $F_{ST} = 0.1267$ $\quad$ 4 farms → Same N

$N_m = \frac{1 - F_{ST}}{4 F_{ST}} = 1.7231$ migrants per gen

migr rate $\quad N = 20$

$N_m = m N \rightarrow m = \frac{N_m}{N} = 0.0861$

F_{ST} in eq $\quad N = 20 \quad m = 0.2 \quad \hat{F}_{ST} = \frac{1}{4 N_m + 1} = 0.0588$

Allele freq. more similar in eq

↑ F_{ST} greater diff.