OLD FINAL KEY BIOL 434

1. a. R= h^2 S. h^2 – 0.82, S = 9.96-9.42= 0.54, Therefore R = (0.82)(0.54) = 0.44. Therefore the new mean is expected to be 9.42+0.44 = 9.86.

1b. The true value could be different for a number of reasons. The heritability is estimated with error, so the true value might be different. There could be other sources of mortality, or other kinds of selection involving other fitness components (like fertility or male mating success) that also cause selection on one way or another on bill depth. This is a relatively small population so genetic drift could cause the answer to be different than expected by selection alone. Migration from other populations could change the mean. Etc.

2.a. Each population is founded by N=2 individuals., and the subsequent drift in the next few generations is trivial because they grew to large populations sizes. Therefore F is approximately 1/(2N) = 0.25.

2b. Decline, because of inbreeding depression.

3. Selfing creates inbred offspring, and so if there is inbreeding depression an individual which selfs will have fewer grandchildren than an individual which outcrosses, for a given number of offspring. Selfing is expected to evolve if the inbreeding depression is less than a half, but outcrossing is favored if inbreeding depression is greater than ½.

Inbreeding depression can evolve to lower values with repeated selfing, through purging. Therefore if selfing is imposed on a population for another reason, it may evolve to favor selfing even after the external forcing is removed.

4. $F_{ST} = \frac{Var(p)}{\bar{p}(1-\bar{p})} = \frac{0.0144}{(0.61)(0.39)} = 0.0605$

5. Individual E: $F_E = (1/2)^3 = 1/8$

Individual I: $F_I = (1/2)^5 + (1/2)^5 = 0.0625$

6. No, because the phenotypic correlation between identical twins includes effects of shared environment correlations (including maternal effects) as well as non-additive genetic variance.

7. Probability of fixation = 2s = 2 (0.001) = 0.002

8. Consult midterm

9. With 10 males, $N_e = 4N_m N_f / (N_m + N_f) = 4(10)(10)/(20) = 20$, and

$$F = 1 - \left(\left(1 - \frac{1}{2N_e} \right)^t \right) = 1 - \left(\left(1 - \frac{1}{2(20)} \right)^{10} \right) = 0.224$$

With 4 males, $N_e = 4N_m N_f / (N_m + N_f) = 4(4)(10)/(14) = 11.4$, and

$$F = 1 - \left(\left(1 - \frac{1}{2N_e} \right)^t \right) = 1 - \left(\left(1 - \frac{1}{2(11.4)} \right)^{10} \right) = 0.361$$

10.

Factor	Increased or decreased response to selection?
Population bottleneck before the selection	Decreased
Stronger selection for cows with higher milk production	Increased
Cows with high milk yield have fewer calves	decreased
Larger total population size	increased