Study Guide for Final
Anth/Bio 5471: Spring 2008
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The final is *NOT* comprehensive.

Covariance selection There will be nothing about this on the final. However, it is the subject of a new movie that is discussed at `http://www.pandasthumb.org` (Search for "waz.")

Kin selection Be prepared for a table such as those on pages 78–79 and for an inclusive fitness problem such as: Suppose that the average individual sacrifices 0.2 units of fitness helping siblings and that these benefits flow to 3 siblings, each of which receives 0.09 units of fitness. Would kin selection favor this sort of altruism? Be prepared for questions such as exercises 12.3 and 12.4, but with different functional forms. I will choose some easy function. Here is a potential essay question: What factors influence the opportunity for conflict between mother and fetus. (Assume that this opportunity is greatest when the optima under maternal control and fetal control differ most.)

Costly signalling We didn't cover this. It won't be on the exam.

Population growth I will give you a small demographic data set and ask you to write out the corresponding renewal equation and leslie matrix. I will *NOT* ask you to solve for r or λ. Here are some terms you should know: female demographic dominance, stable age distribution, dominant eigenvalue of the Leslie matrix, exponential rate (r) of increase, ratio (λ) of increase. How do you calculate r from λ (and vice versa)? Be able to state conditions that guarantee that a Leslie matrix will have a stable age distribution. If population size (N) is increasing exponentially with time (t), what does the graph of $\log N$ against t look like?

Implicit functions Use the implicit function rule to find dy/dx when $1 = y/x^2$ (or some equally simple variant). (Note: with a function like this, you can check yourself by solving for y and then calculating dy/dx the usual way.)

Life history

1. Why is λ (or r) a sensible measure of fitness?
2. Be familiar with Hamilton's famous formulas (Eqns. 4.2 and 4.3). What do they imply about the force of selection on alleles that act at particular ages.
3. Be familiar with the theories of antoganistic pleiotropy and of mutation-selection balance.
4. Consider a contour plot of r (fitness) against m_{15} (horizontal axis) and m_{35} (vertical). How would the contour lines look? Would they be more nearly horizontal or more nearly vertical? As you ponder this, bear in mind that r is more sensitive to fertility at younger ages.
5. Once you have some sense of what the contours ought to look like, use the implicit function rule to find a formula for their slope, dm_{35}/dm_{15}. Hint: write the renewal equation like this

   $$1 = \text{constant} + e^{-15r} l_{15} m_{15} + e^{-35r} l_{35} m_{35}$$

   where "constant" stands for terms that have neither m_{15} nor m_{35}. The answer should be negative. Is its magnitude consistent with your answer to the preceeding question? (Hint: Remember that $l_{35} \leq l_{15}$ and assume that $r \geq 0$.)
6. I may ask an essay question about the evolution of menopause. Does the childbirth mortality model provide a plausible explanation? The grandmother hypothesis leads to inequalities involving parameters (γ, β, and ϕ) whose values are unknown. What do these parameters measure? What data might be useful in estimating their values?