

Study Guide for Exam 1
Anth/Bio 5471: Spring 2008
Alan Rogers

1 Maple

Here is an example of the sort of question that I plan to ask:

1. Write down the output that would be produced by the following code fragment:

```
unassign('i');
j := 0;
for i from 0 to 3 do
  j := j+i;
end do;
j;
```

I would expect to see something like this as an answer:

Program prints "6", the sum of 1, 2, and 3.

You only need to know about Maple constructs that have been used in the labs. Here are a few more examples:

2. `f := x^2;`
`subs(x=2, f);`
3. `x := [2,3,4];`
`x[2];`
4. `2/3, 2/3.0, evalf(2/3);`
5. `unassign('x', 'y');`
`f := proc(x) x^2 end proc;`
`f(y);`
6. `unassign('i');`
`sum(i, i=1..3);`
7. `f := x - x^2;`
`xhat := solve(diff(f,x)=0, x);`

I may also ask you to write a short Maple program or two. For example:

8. Write Maple code that would sum the integers from 1 through 100. Use any method you please.

2 Optimization

Here are some examples of the sort of questions you may get on optimization. The problems on the test will be similar, but probably not identical.

9. What is the local maximum or minimum of $f(x) = x^2 - 2x + 1$. Use the 2nd-order condition to determine whether it is a maximum or a minimum.
10. Solve the following problem in constrained optimization:

$$\begin{aligned} \text{Max: } w &= x^{1/2}y^{1/3} \\ \text{Subject to: } K &= x + y \end{aligned}$$

where K is a constant. Don't forget the 2nd-order condition.

3 Selection

Suppose that at some locus the *genotypic* fitnesses of A_1A_1 , A_1A_2 , and A_2A_2 are 1, 2/3, and 1/3. In the current generation, the frequency of A_1 is $p = 0.2$.

11. What is mean fitness, \bar{W} ?
12. What is the expected frequency of A_1 in the next generation?
13. What is the change per generation, Δp ?

Suppose now that the *genic* fitnesses of A_1 and A_2 are 1 and 2/3. As before, $p = 0.2$.

14. What is mean fitness, \bar{W} ?
15. What is the expected frequency of A_1 in the next generation?
16. What is the change per generation, Δp ?

I may also ask you to interpret graphs of \bar{w} , Δp , or $d\bar{w}/dp$. Here's an example question:

17. What equilibria are implied by Fig. 1? Which are stable?

4 Clutch size

18. What is the phenotypic gambit?

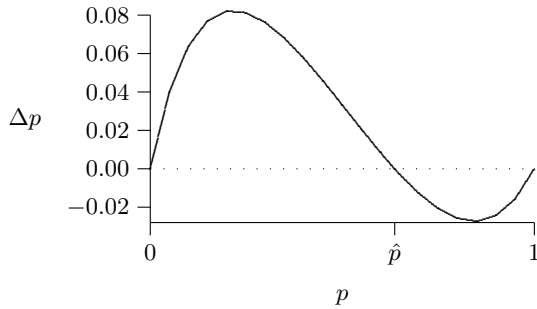


Figure 1: Change per generation under natural selection.

19. Evolutionary ecologists often search for character values that maximize fitness. How is this approach justified by the population genetic theory in Ch. 4?
20. What does the model of Smith and Fretwell assume? What does it predict? Are its predictions well supported by data?
21. In the Smith-Fretwell model, suppose that $s(x) = (x - 1)^{1/2}$. What is the optimal value of x ?
22. In the text, I modified the Smith-Fretwell model to incorporate sibling rivalry. What does the new model predict? Why is it a poor model of sibling rivalry?

5 Diet choice

Understand what it means (and does not mean) to say that selection maximizes the rate of return. Here are some sample questions: (1) Calculate an optimal diet either from tabular data or from a graph. (2) Discuss the bluegill sunfish study. (3) Discuss the diet choice model in the context of the species of your choice. Has anything important been left out? How might it be added?