

Discrete Population Models for a Single Species

Quiz 2002: Comments

This quiz was challenging and your score should provide a a good idea of how well you know the material. If you scored much less than 8 this suggests that you didn't do much, if any, revision: you deserve your mark! If you scored between about 8 and 12 you should identify the areas you need to revise. If your scored above 12 you can be satisfied with your understanding of the material in the course.

I awarded bonus marks for answers that were particularly outstanding. The highest mark achieved was 17/15.

Here are some of the common errors.

Question 1.

All three parts of this question were very similar to the first question in *last year's* quiz. The difference being that last year the question dealt with a period-2 solution whereas this year it was period-3.

This question covers **basic results** which you are expected to know. If you couldn't answer this question it suggests that your revision for the quiz didn't include doing last year's quiz.

Furthermore, we went through a period-2 calculation immediately before the quiz. If you couldn't answer this question then you were obviously not paying attention prior to the quiz!

Question 2.

(i) "Show that the fixed points of this model are $x_2^* = 0.44365$ and $x_1^* = 0.05635$."

1. A large number of you remembered that if x^* is a fixed point of the map $f(x)$ then

$$x^* = f(x^*)$$

You therefore calculated $f(x^*)$ and showed that it was equal to x^* .

However, you have not answered the question. The question asked "Show that the fixed points of this model are..." *not* "Show that $x_2^* = 0.44365$ and $x_1^* = 0.05635$ are fixed points of this model".

2. A number of your found different fixed points to those given in the question. When this happens in an exam or quiz/test there are two possible explanations:
 - (a) The examiner has made an error.
 - (b) You have made an error.

What do you think is the most likely explanation?

3. Sometimes you managed to get the right answers even though you had made an error earlier in the question. For instance, the fixed point equation reduces down to the quadratic equation

$$2x^{*2} - x^* + 0.05 = 0.$$

If instead you had

$$2x^{*2} + x^* + 0.05 = 0.$$

and you still managed to get the right answers did you think I wouldn't notice you fiddled the answer?

4. Some of you did not know how to solve a quadratic equation. This is school-level mathematics.

(ii) The stability of a fixed point is given by its eigenvalue (λ) where

$$\lambda = f'(x^*).$$

This is **basic result** which you are expected to know. There was a question on this on *last year's* quiz. If you couldn't answer this part of the question it suggests that your revision for the quiz didn't include doing last year's quiz.

If

$$f(x) = rx(1 - x) - h \tag{1}$$

then

$$f'(x) = r(1 - 2x). \tag{2}$$

This is basic first-year calculus. The answer is neither

$$f'(x) = r(1 - 2x) - h \tag{3}$$

nor

$$f'(x) = r(1 - 2x) - 1. \tag{4}$$

(iii)

(a) "Sketch the functions... *indicating the location of the fixed points*"

If the question asks you to "indicate the location of the fixed points" and you sketch does not indicate their location do you expect to score full marks?

You also needed to make it clear that the function $y = 2x(1 - x) - 0.05$ doesn't pass through the origin.

(b) See the solution sheet.