

IMPERIAL COLLEGE LONDON
MSc COURSE IN COMPUTATIONAL METHODS IN ECOLOGY AND EVOLUTION
MULTIPLE CHOICE QUESTIONS

For Internal Students of Imperial College of Science, Technology and Medicine

Exam Date: Monday, 29th March 2021, 14:00 – 17:00

Length of Exam: 2 HOURS

Instructions:

- You will be expected to answer 30 multiple choice questions in this exam.
- A question may have more than one correct answer and this should be indicated clearly in the question's wording.
- There will be exactly 5 options to choose from in each question
- There is no negative marking
- Please **follow the instructions for the remote assessment carefully** .

Section A Ecological modelling

Question A1

Which **one** of the following assumptions does not need to be made for the Lotka-Volterra competition model?

- A) There are no delays in the interactions
- B) There is no spatial structure in the populations described
- C) There is no age structure in the populations described
- D) There is no density dependence
- E) The competition coefficients are assumed to be independent of the size of the populations

Section B Biological data and C

Question B1

Consider these lines of code.

```
int c;  
c = 1/2;
```

Which **one** of the following statements is true?

- A) The expression $1/2$ evaluates to an integer, assignment to c leaves this unchanged.
- B) The expression $1/2$ evaluates to a float, but assignment to c makes the result an integer.
- C) The expression $1/2$ evaluates to a double, but assignment to c makes the result an integer.
- D) The expression $1/2$ evaluates to a float, but assignment to c makes the result an integer rounded to the nearest whole value.
- E) The expression $1/2$ evaluates to an integer rounded to the nearest whole value.

Section C Maths

Question C1

The equation

$$N_{t+1} = \lambda N_t (1 + a N_t)^{-b}$$

where $\lambda, a, b > 0$ is often encountered in the biological literature as an empirical description for density-limited population growth. What are the fixed points of this equation?

(Hint: for difference equations $N_{t+1} = f(N_t)$, fixed points \bar{N} are given by $\bar{N} = f(\bar{N})$)

- A) $\bar{N} = 0$ or $\bar{N} = -\frac{1}{a}$
- B) $\bar{N} = 0$ or $\bar{N} = \frac{1}{a} \left[\left(\frac{1}{\lambda} \right)^b - 1 \right]$
- C) $\bar{N} = 0$ or $\bar{N} = \frac{1}{a} \left[\sqrt[b]{\lambda} - 1 \right]$
- D) $\bar{N} = 0$ or $\bar{N} = \frac{1}{a} \left[\sqrt[b]{\frac{1}{\lambda}} - 1 \right]$
- E) $\bar{N} = 1$ or $\bar{N} = \lambda$

Section D Generalised Linear Modelling

Question D1

Which link function would you implement in the generalised linear model: $\text{OocytesNumber} \sim \text{FSH}$? Select **one** from the following:

- A) Logit
- B) Log-linear
- C) Identity
- D) Inverse squared
- E) Exponential