CURRICULUM, PEDAGOGY AND BEYOND

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Writing investigation style Unit 3 and 4 General Mathematics SACs

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Background

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Rationale

- Why we failed our VCAA audit.

Assessment rubric

Outcome 1 (5 marks) *Define and explain key concepts as specified in the content from the areas of study, and apply a range of related mathematical routines and procedures to solve practical problems from a range of everyday and real-life contexts.*

Criterion	Marks	1	2	3	4	5
Appropriate use of mathematical conventions, symbols and terminology						
Definition and explanation of key concepts						
Accurate use of mathematical skills and techniques						
		Outcome 1 Total				

Outcome 2 (10 marks) *Apply mathematical processes in non-routine practical contexts, including situations with some open-ended aspects requiring investigative, modelling or problem-solving techniques or approaches, and analyse and discuss these applications of mathematics.*

Criterion	Marks	1	2	3	4	5
Identification of important information, variables and constraints						
Application of mathematical ideas and content from the specified areas of study						
Analysis and interpretation of results						
		Outcome 2 Total				

Outcome 3 (5 marks) *Apply computational thinking; use numerical, graphical, symbolic and statistical functionalities of technology to develop mathematical ideas, produce results and carry out analysis in practical situations requiring investigative, modelling or problem-solving techniques or approaches.*

Criterion	Marks	1	2	3	4	5
Appropriate selection and systematic use of technology						
Application of technology						
		Outcome 3 Total				

VCAA videos

- Pages - VCE General Mathematics

Unit 3 School-assessed Coursework – How to develop a modelling or problem-solving task for *Recursion and financial modelling*

The following videos, PowerPoint and task design template help teachers develop a modelling or problem-solving task for *Recursion and financial modelling*.

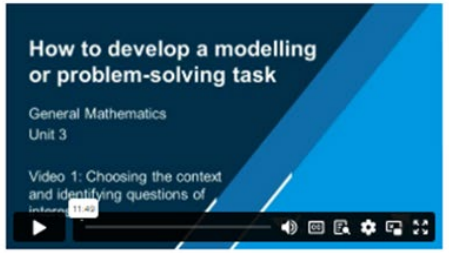
Please note these resources were developed for the previous Units 3 and 4 VCE Further Mathematics study design (2016-2022) and are still valid for the Units 3 and 4 VCE General Mathematics study design commencing in 2023. All references to Further Mathematics contained in these resources should be referred to as General Mathematics.

How to develop a modelling or problem-solving task for *Recursion and financial modelling*

Modelling or problem-solving task design template

Video 1: Choosing the context and identifying questions of interest

This describes how the context for the sample modelling or problem-solving task was selected, its title, introductory and background text, and source(s) of data or other information, as applicable.



Video 1: Choosing the context and identifying questions of interest transcript

Video 2: Part 1

This shows how the first part of the sample modelling or problem-solving task was developed, and identifies context, questions of interest, source(s) of data or information, possible scaffolding, as applicable, and relevant content. It specifies analysis required for this part and sub-parts of the task.

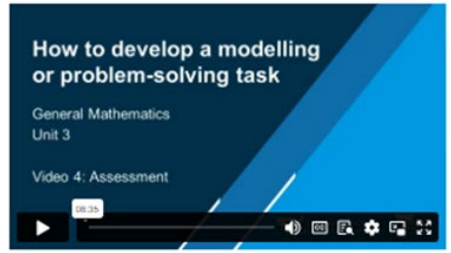
Video 3: Part 2

This shows how the second part of the sample modelling or problem-solving task was developed, and identifies context, questions of interest, source(s) of data or information, possible scaffolding, as applicable, and relevant content. It specifies analysis required for this part and sub-parts of the task.

Video 3: Part 2 transcript

Video 4: Assessment

This shows how to map mark weightings for the two parts of the sample application task with respect to the outcomes and identifies aspects of the task related to the VCAA performance criteria for the outcomes from the Support materials section of the study page.



Video 4: Assessment transcript

The completed sample modelling or problem-solving task for recursion and financial modelling

This sample application task includes mapping tables to the area of study, topics and content, and the outcomes and key knowledge and key skills covered.

See the full suite of tasks on the Support materials page.

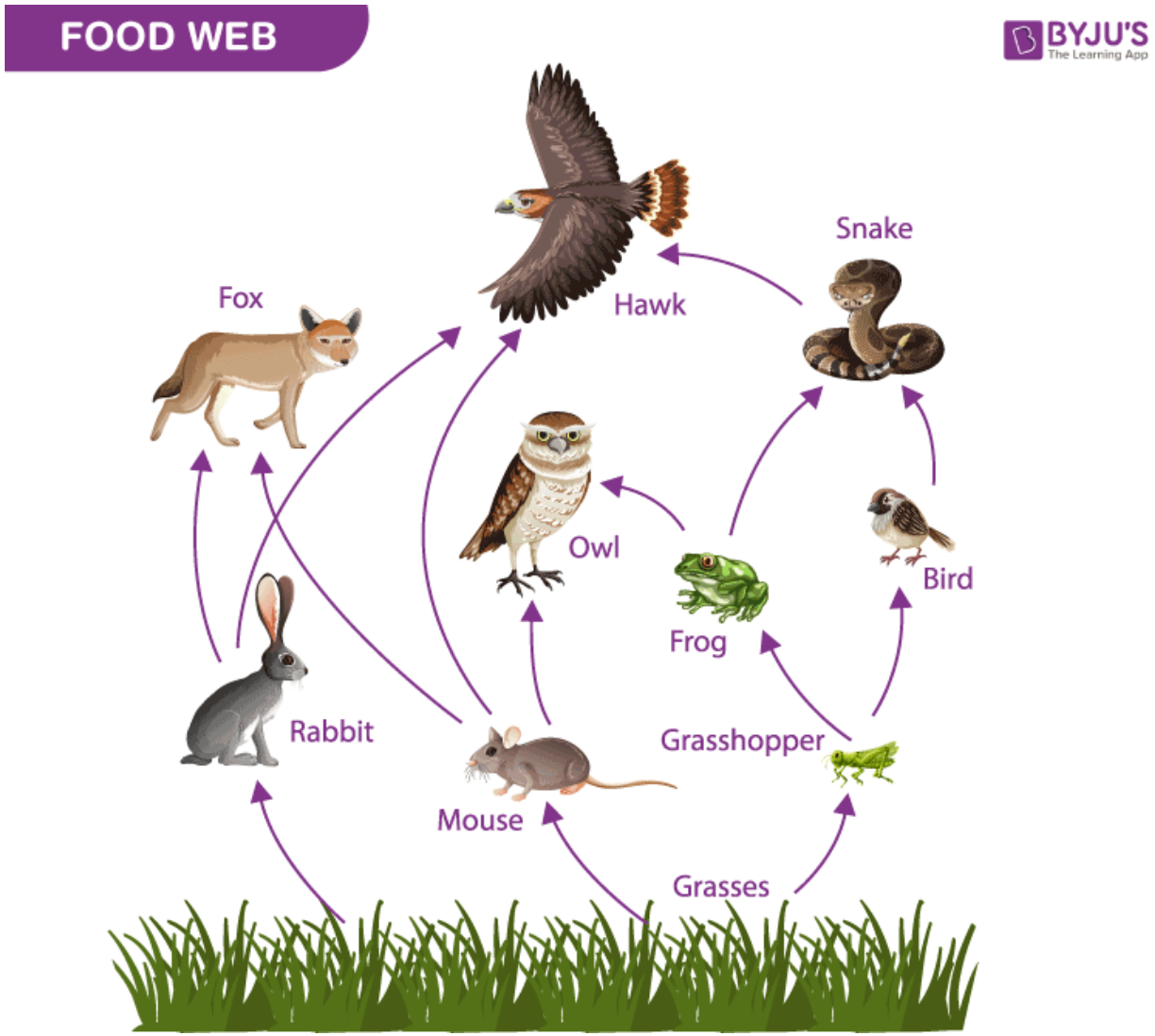
VCAA samples

VCAA Sample SACs

Unit 3

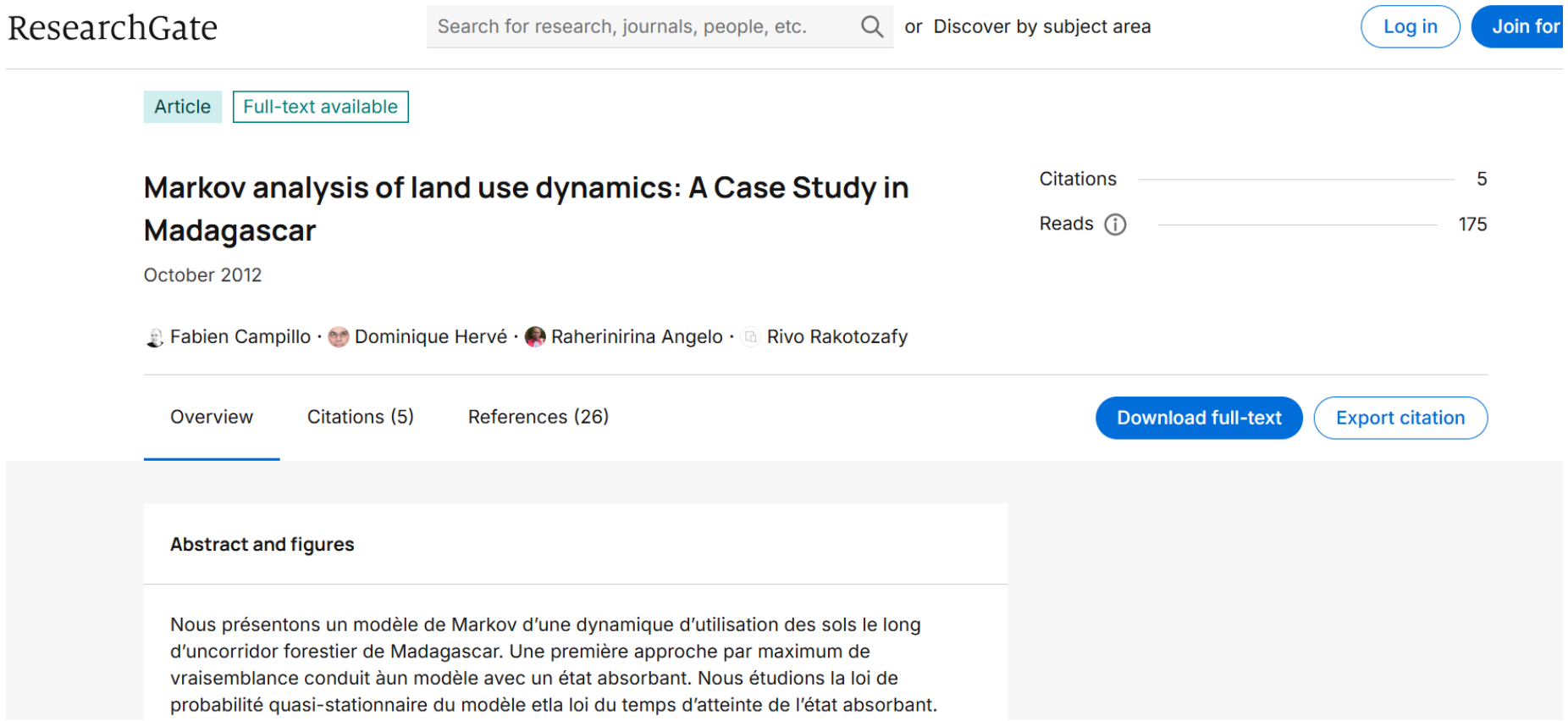
- ▸ Area of Study 1 sample application task: Data analysis
- ▸ Area of Study 1 sample application task: Data analysis
- ▸ Area of Study 1 sample application task: Data analysis – Live long and prosper?
- ▸ Area of Study 1 sample application task: Data analysis – Measles immunisation rates
- ▸ Area of Study 1 sample application task: Data analysis – The Stock Exchange
- ▸ Area of Study 2 sample modelling or problem-solving task: Investments
- ▸ Area of Study 2 sample modelling or problem-solving task: Recursion and financial modelling (superannuation)
- ▸ Area of Study 2 sample modelling or problem-solving task: Recursion and financial modelling (house loan)

Prompt

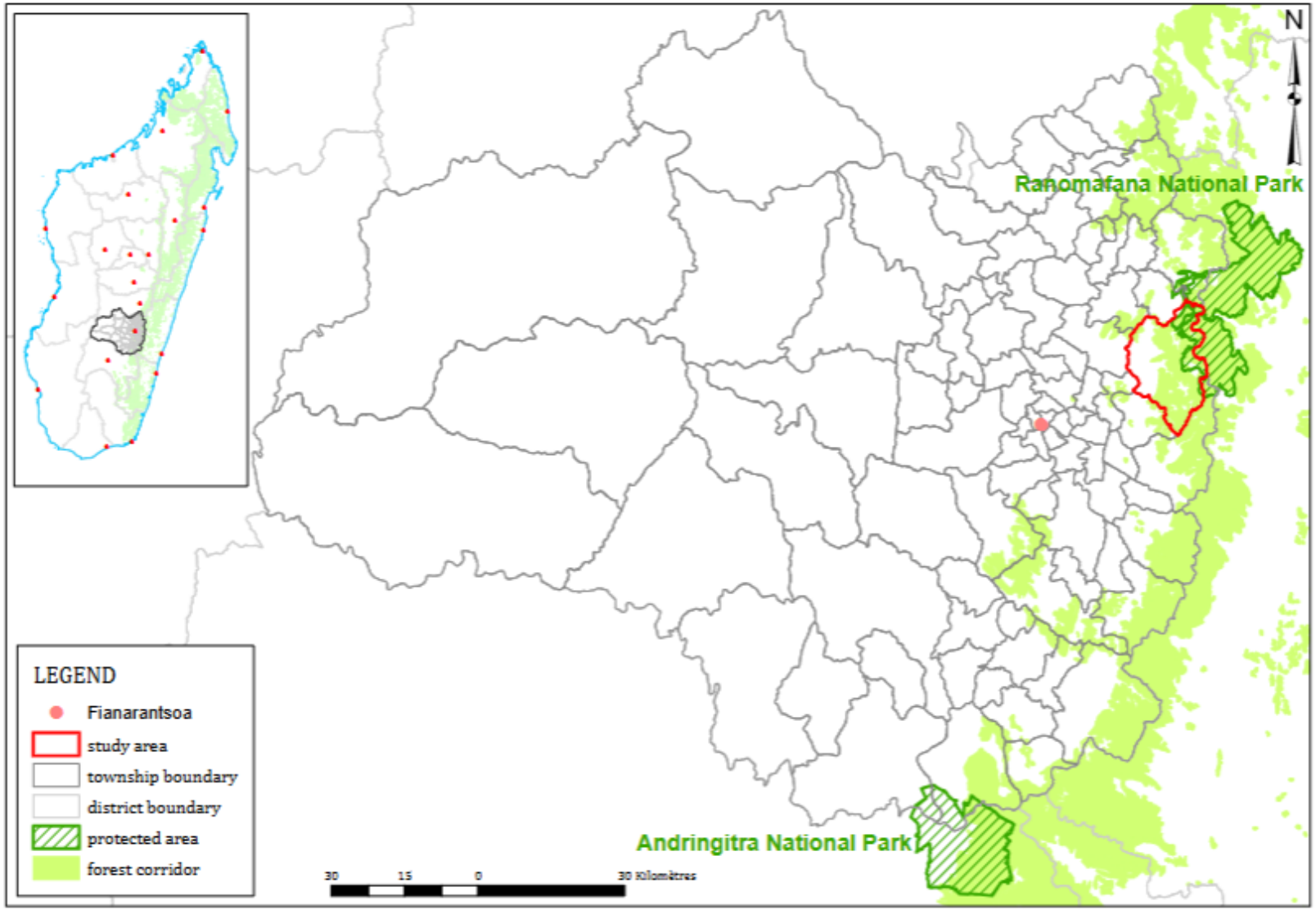

FOOD WEB
BYJU'S
The Learning App
Fox
Hawk
Snake
Owl
Frog
Bird
Rabbit
Mouse
Grasshopper
Grasses

Prompt

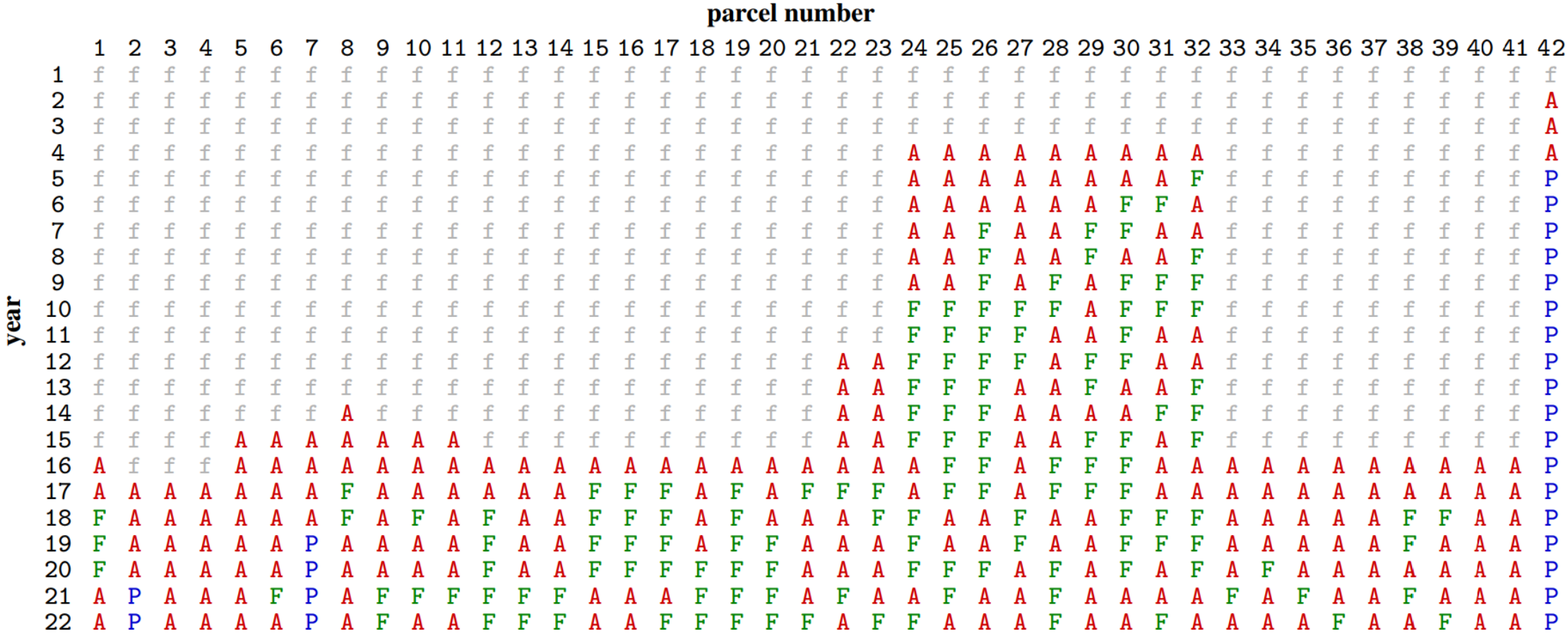
Research article



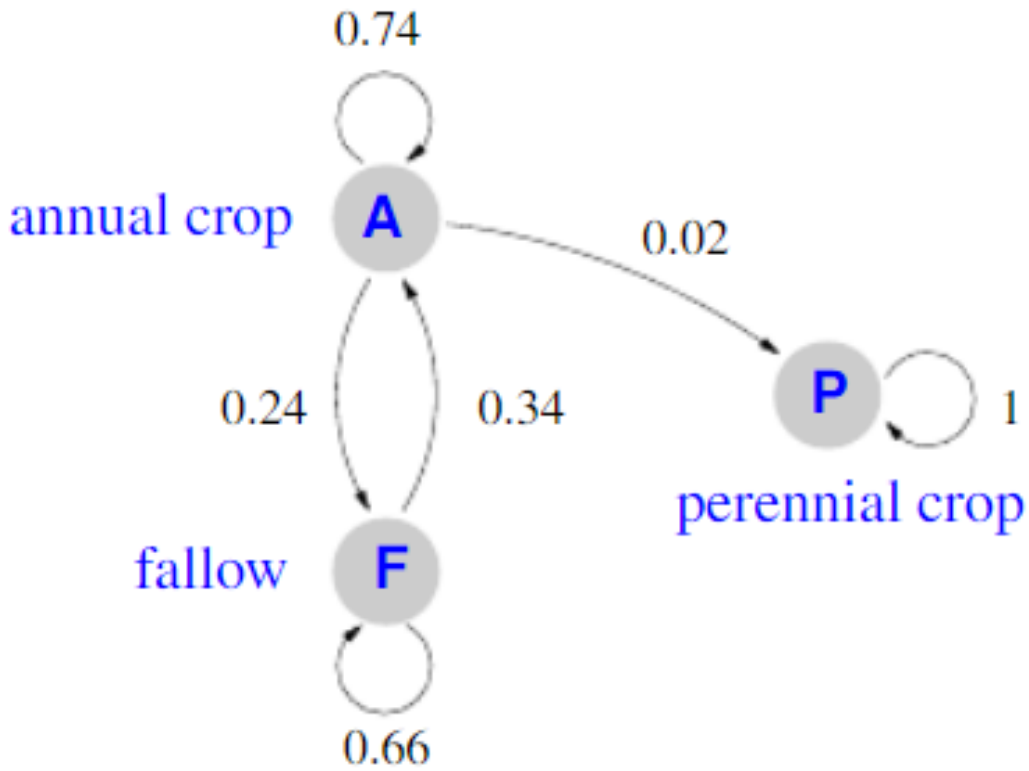
Madagascar Land



Madagascar land parcels



Madagascar Transition Diagram



SAC design

Questions to answer

Assume there are 42 parcels that need to be allocated to Annual (A), Fallow (F) or Perennial (P) crops.

a) Explain why Perennial crops to perennial crops from one year to the next is 1 in the Transition diagram.

b) Copy and complete the transition matrix below using the transition diagram given in Model 1 above.

$$T = \begin{array}{c} \text{This year} \\ \begin{array}{ccc} A & F & P \end{array} \\ \left[\begin{array}{ccc} & & \\ & & \\ & & \end{array}\right] \begin{array}{l} A \\ F \\ P \end{array} \end{array} \text{ Next year}$$

SAC Design

c) Choose a year from the raw data between **year 17 and 22** when the land has been deforested (no forest land remaining). Create an initial state matrix based on the allocation of the 42 parcels between the 3 options from your chosen year. Explore how these allocations change over time. Summarise your findings. For example, for the raw data for year 15 as shown below, **ignoring forest land** (f), and

15 f f f f A A A A A A A f f f f f f f f f f A A F F F A A F F A F f f f f f f f f f P

counting the number of parcels for A, F and P, the initial state matrix would be: $S_0 = \begin{bmatrix} 12 \\ 6 \\ 1 \end{bmatrix} \begin{matrix} \text{A} \\ \text{F} \\ \text{P} \end{matrix}$

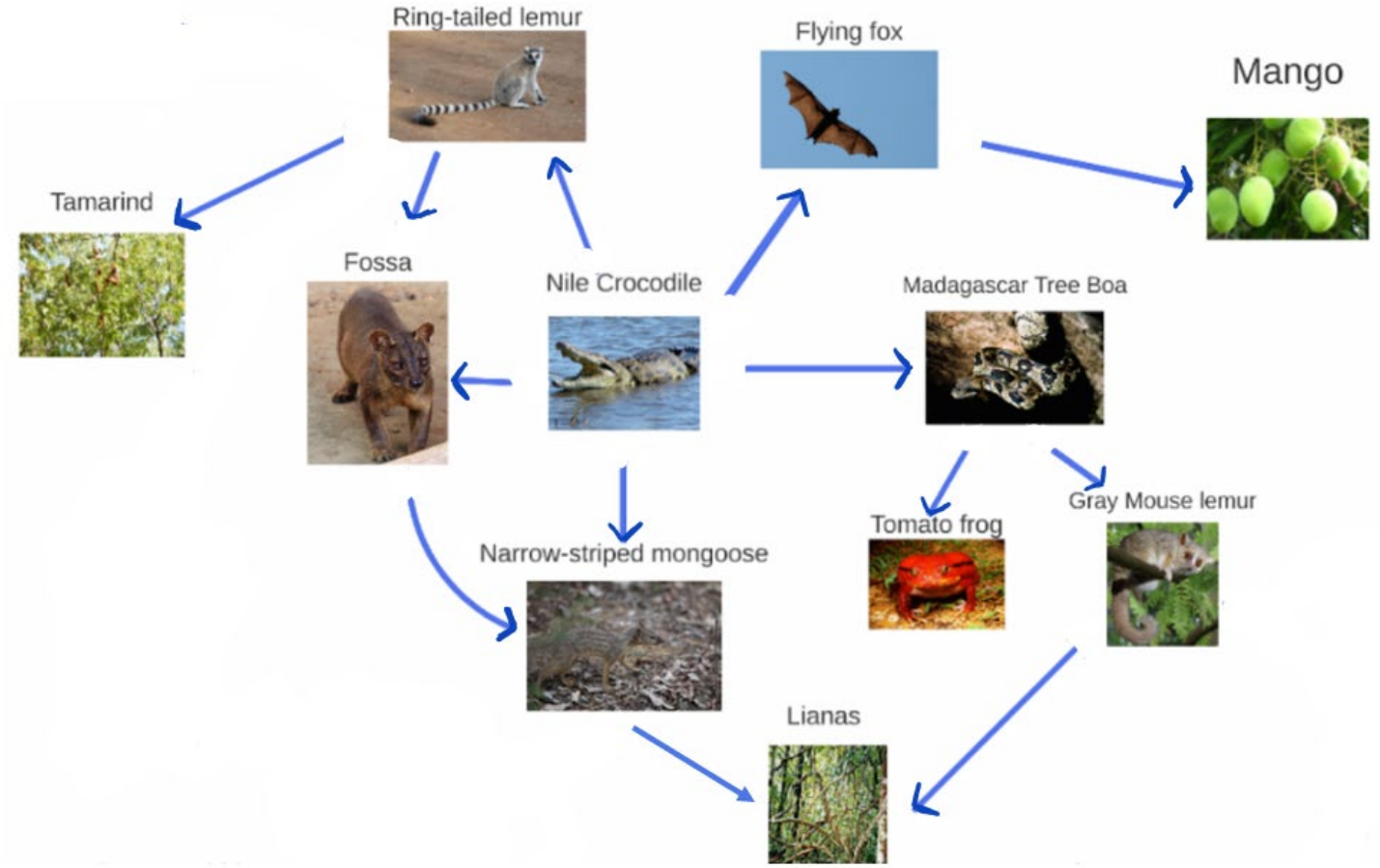
SAC Design

d) Using the transition matrix from b), explore what happens if you randomly reallocate the 42 parcels among the 3 options to create a new initial state matrix. Explore how these allocations change in the long term. Summarise your findings.

e) The researchers decide to extend the area of investigation to include a further 10 parcels of land that are **added at the end of each year**. Randomly allocate the 10 additional parcels to the 3 options and create a column matrix, to represent this. Use the same initial state matrix and transition matrix from previously in **parts b and c**. Set up a recurrence relation to model this and investigate the allocations over the first 5 years. Summarise your findings.

SAC Design

- Madagascar Food Chain



SAC Design

Questions to answer

a) Choose 8 animal and plants from the food chain above. You must include at least two plants, the Nile crocodile, and the Ring-tailed lemur in your selection. Circle your 8 selections on the diagram above. Complete the one-step dominance matrix below and **clearly label the matrix with your selections *using the key* above**. Provide a rank order for all listed animals and plants.

$D =$

$$\begin{bmatrix} \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \\ \square & \square & \square & \square & \square & \square & \square & \square \end{bmatrix}$$

b) Calculate a two-step dominance matrix. Choose two non-zero elements from this matrix and list the predator-prey sequence linked to the choices made. Complete the total dominance ranking to determine if one animal/plant is dominant over your other choices. Comment on your results.

SAC Design

The ring-tailed lemur

Table 2 contains the birthing and survival rates for age groupings of the ring-tailed lemur.

Age group (i)	1	2	3	4
Age range (years)	0-3	4-7	8-11	12-15
Initial population				
Birthing rate	0	0.8	0.7	0.4
Survival rate	0.6	0.8	0.7	0

SAC Design

c) It is estimated that there are 2200 lemurs currently living in Madagascar. Randomly allocate the **population of 1100** female lemurs to each age group and create the initial population state matrix. Create a Leslie matrix for the birthing and survival rates of the female lemur ring tailed lemurs.

d) Create a life cycle transition diagram for the ring-tailed lemur.

e) Investigate the population of ring-tailed lemur in both the short term and long term. Summarise your findings. Select two consecutive years and compare the population growth rate for each of the 4 age groups. Comment on your findings.

Mapping to rubric

Define and explain key concepts as specified in the content from the Matrices Area of Study and apply a range of mathematical routines and procedures.

Outcome 1 Criterion (5 marks)	**Marks**	**1**	**2**	**3**	**4**	**5**
Appropriate use of mathematical conventions, symbols, and terminology use of recursive matrix notation, initial state matrix (S_0),and recurrence matrices $S_{n+1,}, S_n$.						
Definition and explanation of key concepts Defining specific and numeric transition matrix to help model the movement of crops.						
Accurate use of mathematical skills and techniques Correctly calculate state matrices and steady state values, use matrix recurrence relations to model populations with restocking create correct Leslie matrix and life cycle transition diagram						
		Outcome 1 Total				

Mapping to rubric

Outcome 1 Criterion (5 marks)	**1**	**2**	**3**	**4**	**5**
Part 1 c) Use S_0 = Part 2 a) Label rows and columns of dominance matrix Part 2 c) label S_0 and L Part 2 c) labels and row and column of L					
Part 1 a) interpret 1 in T, **Part 1 b) correct elements in T** Part 2 b) Show $T = D + D^2$					
Part 1 c) State S_0 correctly (42), **Part 1 d) State S_0 correctly (42, reallocate),** **Part 1 e) Creating a new matrix which sums to 10,** Part 2 a) stating dominance sum, Part 2 b) showing numerical total dominance sum Part 2 c) Create S_0 that sums to 1100 lemurs Part 2 c) create correct L Part 2 d) correct life cycle diagram					
	Outcome 1 Total				

Marking to rubric

Outcome 1 Criterion (5 marks)	**1**	**2**	**3**	**4**	**5**
Part 1 c) Use S_0 = Part 2 a) Label rows and columns of dominance matrix Part 2 c) label S_0 and L Part 2 c) labels and row and column of L					
Part 1 a) interpret 1 in T, **Part 1 b) correct elements in T** Part 2 b) Show $T = D + D^2$					
Part 1 c) State S_0 correctly (42), **Part 1 d) State S_0 correctly (42, reallocate),** **Part 1 e) Creating a new matrix which sums to 10,** Part 2 a) stating dominance sum, Part 2 b) showing numerical total dominance sum Part 2 c) Create S_0 that sums to 1100 lemurs Part 2 c) create correct L Part 2 d) correct life cycle diagram					
	Outcome 1 Total				

Our continued journey…

2024 SACs

Q and A

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Event App

App Download Instructions

Step 1: Download the App 'Arinex One' from the App Store or Google Play

App Store

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Step 2: Enter Event Code: **mav**

Step 3: Enter the email you registered with

Step 4: Enter the Passcode you receive via email and click 'Verify'. Please be sure to check your Junk Mail for the email, or see the Registration Desk if you require further assistance.

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Be in it to WIN!