UNAM

UNIVERSITY OF NAMIBIA

FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCES		
DEPARTMENT	ENVIRONMENTAL SCIENCE		
SUBJECT	SPATIAL MODELLING & SIMULATION		
SUBJECT CODE	GSM3712		
DATE	OCTOBER 2021		
DURATION	3 hours	MARKS	100

NORMAL EXAMINATION

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Moderator: Martin Hipondoka (PhD)

This Question Paper consists of **1 pages** excluding this cover page.

INSTRUCTIONS

1. Work in an orderly manner and present your work as neatly as possible.
2. While most of the marks will be awarded for content, candidates must bear in mind the importance of presentation, i.e. insight and critical thinking.
3. Number your questions correctly and clearly.
4. Answer **all** the questions.
5. Please be reminded that cheating in the examination will result **in a failing grade.**

Question 1

    (a) **Differentiate** between mathematical and empirical models.   [4]
    (b) **Giving** four examples, **justify** why spatial simulation models are useful.   [8]
    (c) **Discuss** the concept of **equifinality** in the context of inferential traps   [6]
    (d) **Discuss** how cross-level fallacy could occur.   [4]

Question 2

    (a) **Explain** what the concept of "random walks" means in the context of spatial simulation.   [4]
    (b) **Justify** why tackling a simulation problem using a simple random walk model *sometimes* is a good choice.   [4]
    (c) From the list below, **choose the** modeling problem you would simulate using a Levy flights model. **Justify** why.   [10]
            i.   *Foraging behaviour of cows*
           ii. *Flooding*
          iii. *Movement of the wind*
    (d) Giving two examples, **explain** how segregation could lead to unintended aggregation.   [6]
    (e) **Discuss** two types of feedbacks that can occur in a system.   [4]
    (f) **Give two** practical examples for each feedback using real-world scenarios.   [8]

Question 3

    (a) **Discuss** the dependence between:
            i.   Process and spatial scale   [4]
           ii. Pattern and spatial scale   [4]
         iii. Process and temporal scale   [4]
    (b) Explain how the model *"grain"* can influence the performance of a model.   [4]
    (c) Suppose you developed a model, but your model output does not produce the patterns you have observed in real-world. As a modeler, **explain** what you would do next to improve your model. **Provide** a justification for your answer.   [6]

Question 4

Oil spill in the ocean can have huge effects on marine life, and subsequently on the economy. Suppose, as part of a proactive measure, the Ministry of Environment and Tourism in Namibia wants to understand how the oil would spread in an event of oil spill in the Namibian ocean. So the Ministry decided to appoint you as a Consultant to develop a spatial model for simulating the spread of oil in the Namibian ocean.

    (a) Mention, chronologically, the steps you would follow to develop the model. Motivate why each step would be necessary.   [14]
    (b) Explain how you would account for *spatial* and *temporal* scales in your model.   [6]

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