UNAM
UNIVERSITY OF NAMIBIA

FACULTY	AGRICULTURE, ENGINEERING AND NATURAL SCIENCE		
DEPARTMENT	ENVIRONMENTAL SCIENCE		
SUBJECT	SPATIAL MODELLING & SIMULATION		
SUBJECT CODE	GSM3712		
DATE	NOVEMBER 2022		
DURATION	3 HOURS	MARKS	100

SPECIAL/SUPPLEMENTARY EXAMINATION

Examiner: Eliakim Hamunyela, PhD
Internal Moderator: Martin Hipondoka, PhD

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. This paper consists of ONE (1) page (excluding this front page).
5. Answer all questions

1. Differentiate between the following terms:
   a. Temporal grain and temporal extent [4]
   b. Process and pattern [4]
   c. Cross-level and ecological fallacy [4]
   d. Agent-based modelling and mathematical modelling [4]
2. Motivate why the definition of a "model" as a "simplified representation of reality" should still be considered relevant despite technological advancement. [4]
3. In some contexts, aggregation and segregation as spatial processes can be viewed as mutually re-enforcing processes. Explain, by giving two examples, why this view is plausible (reasonable). [6]
4. Mention and discuss three types of variable in system dynamic models. [6]
5. Explain how the choice of spatial scale may influence the patterns we see [2]
6. Discuss three ways how spatial simulation models may be used. [6]
7. Suppose you developed a model, but your model output does not produce the patterns you have observed in real-world. As a modeller, mention and discuss the steps you would follow to improve your model. Provide a justification for your answer. [10]
8. Using the stock-flow model, do the follow:

   a. Create a conceptual model for a global hydrological model. [10]
   b. List all the state variables in your global hydrological model created in (a) above. [5]
   c. List all processes in your global hydrological model created in (a) above [5]
   d. State what would be the appropriate grains and extents of your global hydrological model if you want to use it to understand the impact of increased greenhouse gases emission on global water cycle. Motivate your answer. [8]
9. Justify why tackling a simulation problem using a simple random walk model sometimes is a good choice. [8]
10. State three examples whereby the use of "Levy flight" model would be appropriate. Motivate your answer. [6]
11. Motivate the necessity for model evaluation. [4]
12. Critique over reliance on simulation models to address real world problems. [4]

---END---