



TECHNICAL UNIVERSITY OF MOMBASA
FACULTY OF APPLIED AND HEALTH SCIENCES
DEPARTMENT OF ENVIRONMENT & HEALTH SCIENCES
UNIVERSITY EXAMINATION FOR:
BACHELOR OF SCIENCE IN MARINE RESOURCE MANAGEMENT
BSMR 15S/YEAR 3/ SEMESTER 1

AES 4305: APPLICATIONS GIS AND REMOTE SENSING
PRACTICAL EXAMINATION

SPECIAL/ SUPPLEMENTARY EXAMINATIONS
SERIES: SEPTEMBER 2018
TIME: 2 HOURS

Instructions to Candidates

This paper consists of TWO questions

Answer ALL questions.

This paper consists of four printed pages.

Mobile phones are NOT allowed in the examination room

SECTION A. (35 MARKS)

QUESTION 1

- a) Use the Africa map shapefile, Kenya boundary shapefile which contains the Kenya boundary outline and the xpls file containing geographic coordinates of major towns in Kenya, among other information. Upload the Kenya boundary shapefile onto ArcMap platform and show the towns in their respective spatial position. Have them labelled and prepare a map conforming to standard cartographic rules. On your layout, include an inset to show the spatial position of Kenya in Africa. Print the map onto an A4 size PDF format sheet. The map must contain a Title, a Legend with well labelled features, North arrow, Neatline and any other necessary marginal information. Include your student name and registration number. (10 marks)
- b) You have been provided with a data package labelled B. It represents various constituency shapefiles with its metadata and xpls files. You are then required to analyze spatial population by comparing their different placement and time.

- i. Generate a Thematic maps of Kenya showing population trends for both 1999 and 2009 censuses. Represent on a map, the changes in population in 2009 taking 1999 as its respective base year. Identify the spatial aspects of the extremes and give possible explanations for the above results with reference to these. Print this map in A4 size PDF format indicating your names and student registration number. **(10 marks)**
- ii. Generate population hotspot and coldspot analysis maps for the respective densities for Kenya for both and 2009 censuses. (use The Global Morans I Tool for radial estimations). Give a short comparative analysis (in not more than 50 words) for this spatial pattern and trend in comparison to those in b) i. above. Print this map in A4 size PDF format indicating your names and student registration number.
(15 marks)

SECTION B (35 MARKS)

Regression analysis – a case study

In this practical, we will perform some analysis within ArcMap to determine spatial solutions to a longtime national problem using regression analysis: Spatial visualization and prediction using regression analysis is a powerful use of GIS. This practical serves as a thorough introduction to your project – you will need to apply and expand on the methods used in this session.

The first stage in any GIS analysis is to determine the criteria to be addressed. In this case, we want to define a set of criteria assessed using the GIS, and then finally all criteria are combined to produce a final output map. Obviously the criteria used could be highly complex. Here, we will just look at some simple criteria – but you should refine and certainly expand on these for your project

There are two types of criteria: (i) Regression analysis using Ordinary Least Squares (OLS), which is normally considered a statistical approach to analysis with global reference even though can be localized and (ii) Regression analysis using Geographic Weighted Regression, which is still an analytic approach with statistical techniques but with localized references.

The criteria used in this practical are given below:

Criteria for Ordinary Least Squares (OLS) and Geographically Weighted Regression (GWR) analysis

Before starting off any regression analysis, there must be spatial definition of the problem statement. For our case its poverty. Depending on the available data, dimensions of poverty can be spatially divergent. This definition will lay a platform form for a measure of dispersion from the average poverty dimension. With this, a hotspot analysis can be created thus forming a concrete basis for regression analysis.

There has to be a relationship defined between spatial poverty dimension as defined and the possible causes, for which data is provided i.e spatial income level, spatial levels of education, GINI coefficient, proximity to major towns, spatial distribution of productive population (i.e youth who can work) and accessibility to health care. Note that with every produced maps, plans and analysis, you are expected to attach your references i.e your names, registration numbers and unit name and codes.

1. Prepare your data

Before you start, you will need to make sure you have all necessary data in the same folder. To do so, looking at the criteria above, create a table with the list of the necessary files (and their lineage), that you will include in the write up. Make sure all your datasets have a defined projection and are projected in the same projection.

QUESTION 2

You have been provided with the following datasets;

- Map showing the national boundary of Kenya
- Map showing population distribution in Kenya and the density of population per constituency.
- GINI coefficient data.
- Spatial locations of major towns in Kenya which are regarded as economically active.
- Spatial data showing approximate percentages of potential economically active adults per constituency/county.
- Spatial data for location of medical centers in Kenya.
- Spatial data for schools and high level education centres.

- a) Using the data provided, perform the following;
- i. Formulate a spatial poverty dimension description and generate its respective hotspot analysis representation. Print this on A4 size sheet with its respective description of parameters. **(5 marks)**
 - ii. Create a scatterplot matrix graph for the variables and generate working relationships between them. Print the graphs and write down a regression function for analysis of the problem statement (assume coefficients are still unknown. Define all the parameters in the equation). Test the analysis with OLS and determine from its execution results whether its viable. **(5 marks)**
 - iii. Perform a spatial autocorrelation using Moran I tools to normalize any extreme predictions. Print the report and explain the results in not more than 20 words. **(5 marks)**

- iv. Rewrite the equation in (ii) above with its respective defined coefficients. Explain the relationship as defined by the coefficients and justify the portrayed statistical significance of each independent variable with the dependent variable.

(5 marks)

b) Using the data provided, perform the following;

- i. Perform a GWR for the above analysis (i.e the analysis done in (a) above) using the same variables and print a definitive spatial output for each variable.

Formulate the GWR prediction model and print.

(8 marks)

- ii. Run the model created in b) i. above and print the resulting analysis. Point out any 3 places (either towns or constituencies) that are expected to experience extreme poverty in the near future. Give possible explanation of your answers with reference to your analysis and the data used. Give possible mitigations too.

(7 marks)