Geographic phenomena	Type of Phenomena (Field, Object)	Only for field phenomena (continuous or discrete)	Layer (or layers) name
Elevation	field	continuous	DEM_PVK
Transportation network	Object		roads - PVK
Administrative boundaries	Object	D	PVK
Spectral Radiance	Object field	continuous	~~Qb kigali pansharp rac~~
Health Facility	object	D	Hospitals - PVK
Land use	Object	D	PVK - landcover PVK - land cover 2
Hillshade	field	continuous	Hillshade - PVK

2

	Computer representation				
	Vector			Tessellation	
Layer name	Point	Line	Area/polygon	Regular	Irregular
Hopistals_PVK	✓				
Roads_PVK		✓			
PVK			✓		✓
PVK_LandCover			✓		✓
PVK_LandCover_2			✓		✓
Qb_kigali_pansharp_rac			✓	✓	
DEM_PVK			✓		✓
Hillshade_PVK			✓		✓

1,5

7,5
12

File Data Properties	Value
Number of rows	7688
Number of Columns	7991
Number of bands	4
Source type	Generic
Cell size (Resolution)	0.612257, 0.612257
Pixel type	Unsigned integer
File size	234.36 MB
File format	IMAGINE Image
Georeference Origin	0

4

UNIVERSITY of RWANDA

COLLEGE OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF CIVIL, ENVIRONEMTAL AND GEOMATICS ENGINEERING

CAT I **Date: 25/02/2025** **Time: 1h**

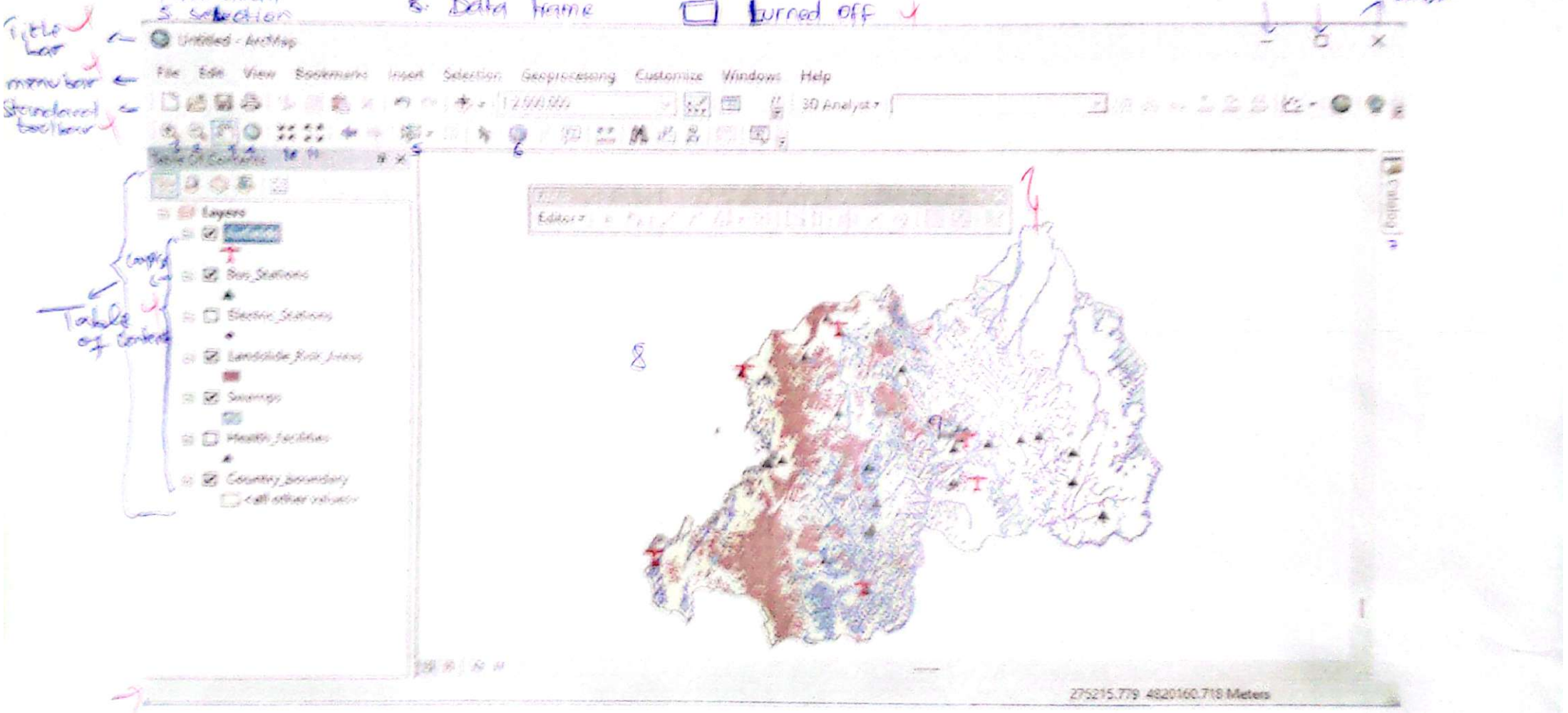
SGE2267 GIS and Remote Sensing

Instructions: Answer all questions

1. **Write a short note on the following as used in GIS & RS:** **[2]**
   a. ArcCatalog
   b. Remote Sensing
   c. Attribute data
   d. Data frame
2. What are the different types of folders and data sources do you find in the Catalog tree? **[2]**
3. Explain why you have to use GIS, and describe its key components and functionalities. **[5]**
4. Describe the two main types of data used in GIS. Provide examples of each and explain their differences. **[5]**
5. From the image below list the main components of the ArcMap interface and what you can identify in the image. **[6]**

Good Luck!!!!!

1. Pan
2. Zoom out
3. Zoom in
4. full extent
5. selection
6. Identification mark
7. Catalog table
8. Data frame
9. Map (unfinished)
turned on
turned off



In this image there is a map which includes Airfields, Bust_stations, electric stations (turned off), landslide-risk areas, swamps, health facilities which is also turned off and country boundary and each is represented by different colour for easier to differentiate one from another.

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SCHOOL OF ENGINEERING

DEPARTMENT OF

CIVIL, ENVIRONMENTAL AND GEOMATIC ENGINEERING

END OF SEMESTER II EXAMINATION -ACADEMIC YEAR 2024-2025

YEAR: 2 SEMESTER: II PROGRAMME(S): SGE

MODULE CODE & TITLE: SGE2267 Geographical Information System I

DATE: 12 /06/2025 **TIME: 2hours**

MAXIMUM MARKS = 50

INSTRUCTIONS

1. This paper contains **FOUR (4)** questions.
2. **Answer THREE (3) Questions only:**
   Question ONE (1) from Section "A" is Compulsory and Answer any TWO (2) from Section "B"
3. Any written materials and Programmable calculators are NOT allowed.
4. Do not forget to write your Registration Number.
5. Write all your answers in the booklet provided
6. Do not write any answers on this questions paper.
7. **Start each question in a NEW page**

SECTION: A

Question: 1 **[20]**

a) Mention 4 examples of spatial data sources. **[4]**

b) Match the most suitable computer representation for each of the following phenomena. **[3]**

Match	Question Items / phenomena
	Parcel in a cadastral system
	Area affected by a fire
	River
	Concentration of soil pollution
	Soil sample locations
	Sea surface temperature

Answers Items
A. Raster
B.TIN
C. Polygon
B. Line
E. Point

c) Select all the statements from the list below that are true. **[2]**

i. Both "Union" and "Intersect" compute the intersection of the geometry of the input layers.

ii. The number of attributes in the output attribute table of a "Clip" operation is the same as for an "Intersect" operation when performed on the same input layers.

iii. When a "Clip" and an "Erase" operation are performed on the same two input layers, the geometry of the two output layers are complementary. If you put the two output layers together (Union) you will get the geometry of the complete input layer (After postprocessing).

d) In the vector model, the point is the basic building block from which other spatial entities are constructed. Explain this statement. **[2]**

e) In the table below, indicate the correct type of data value. Select nominal, ordinal, interval or ratio. **[4]**

Items	Data Type
100,500,1000	
Low, Medium, High	
Rubavu, Kigali, Nyagatare, Kayonza	
10°C, 20°C, 30°C	

f) Write the correct result in the output raster C (T=True, F=False) according to the following condition: C = (A>20) AND (B = "A") **[2]**

A

10	12	15	20
11	14	16	21
21	34	31	34
25	36	37	41

B

A	B	B	B
A	A	B	B
A	A	B	B
B	B	B	B

g) Select all the statements from the list below that are true.

i. What is a sliver polygon? **[1]**

A. The resulting polygons when overlaying polygons on polygons
B. Small error polygons sometimes created when overlaying polygons on polygons
C. Small River polygons created when overlaying polygons on polygon

ii. Why do we use simplification? **[1]**

A. To minimize the map data and show only the essential information
B. To make straight lines
C. To remove redundancy

iii. Which of the following is true about the vector data model? **[1]**

A. The model uses x-, y-coordinates to store the geometry of spatial features.
B. The model uses points, lines, and polygons to represent simple spatial features.
C. The representation of spatial features using the vector data model depends on map scale.
D. All of the above
E. Only A and B

SECTION: B

Question: 2 **[15]**

a) Name the three types of simple features used in GIS and their geometric properties. **[3]**

b) Below are the input raster layers A, B and C. Combinations of these layers will be used to perform two raster overlay operations. Fill the results of the operations in the empty output layer. The result should have the format: T (=True) or F (=False).

i. Write the result of the overlay operation: **D = (A and B) or C** in output raster layer **D.** **[2]**

ii. Write the result of the overlay operation: **E = A xor C** in output raster layer **E.** **[2]**

A

T	T	T	F
T	T	F	F
T	F	F	F
F	F	F	F

B

T	T	F	F
T	T	F	F
F	F	F	F
F	F	F	F

C

F	F	F	F
F	T	T	F
F	T	T	F
F	F	F	F

c) List two (2) digitizing methods. Give an example of when you would use the methods. **[4]**

d) What elements of a map can be omitted during the map design process without affecting the overall quality of the map? Explain your answer. **[4]**

Question: 3 **[15]**

Bugesera District has developed a plan to protect its land against erosion. It aims to plant trees on non-forest land located on steeply sloping areas. The slope classes are defined as follows:

- Class 1: 6% – 40%
- Class 2: > 40%

Assume that you are a technical advisor and/or GIS consultant for the district.

a) What vector (3 types), and raster (3 types) data will be required for this task? **[6]**

b) Using a table, list all possible GIS tools you would use to generate all spatial outputs for this project, along with their utilization. **[9]**

Question: 4 **[15]**

a) In a project, you aim to reduce wastewater pollution from informal settlements (slums) entering nearby rivers and drainage channels. Wastewater from households often carries contaminants such as pathogens, organic waste, and nutrients, which degrade water quality. One effective way to reduce this pollution is by establishing vegetated buffer zones along rivers and drainage channels. These zones filter runoff before it enters the water and are off-limits to construction or waste dumping.

The cost of establishing these buffer zones is 10,000 RWF per square meter, and they can only be created on open or undeveloped land.

Describe how, using a vector GIS approach, you can calculate the total cost for a municipality to create 5-meter buffer zones around all rivers and drainage channels. The available digital data includes economic vector maps containing land use (polygons) and watercourses/drainage lines (lines). **[9]**

b) You are the district construction engineer, and you are designing a map that will be used as a basemap for a city sewage water treatment plant, intended to serve all houses in the city. Due to a limited budget, you are unable to collect all the required spatial data, so you request the Ministry of Infrastructure to share any spatial data they may have. In response, they send you the following data, which is 25 years old: roads, rivers, residential houses, digital elevation model, water pipes, electricity lines, schools, and hospitals.

i. Which data from the above list is most likely to be outdated? **[3]**

ii. Explain why. **[3]**