UNIVERSITY OF SWAZILAND
Faculty of Health Sciences
Department of Environmental Health Science

B.Sc. DEGREE IN ENVIRONMENTAL MANAGEMENT AND
WATER RESOURCES

MAIN EXAMINATION PAPER 2019

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TITLE OF PAPER	INTRODUCTION TO GIS AND REMOTE SENSING
COURSE CODE	EHS 452
DURATION	2 HOURS
MARKS	100
INSTRUCTIONS	READ THE QUESTIONS & INSTRUCTIONS CAREFULLY
	ANSWER **ANY FOUR** QUESTIONS
	EACH QUESTION **CARRIES 25** MARKS.
	WRITE NEATLY & CLEARLY
	NO PAPER SHOULD BE BROUGHT INTO THE EXAMINATION ROOM.
	BEGIN EACH QUESTION ON A SEPARATE SHEET OF PAPER.

DO NOT OPEN THIS QUESTION PAPER UNTIL PERMISSION IS GRANTED BY
THE INVIGILATOR.

QUESTION ONE (5 Marks each)

1A. For the raster image shown in the figure below prepare raster encoding using the quad tree raster encoding method.
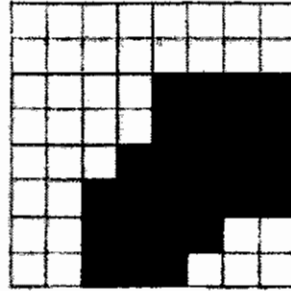
1B. Prepare the left-right topology data structure for the network of polygons shown in the figure below.
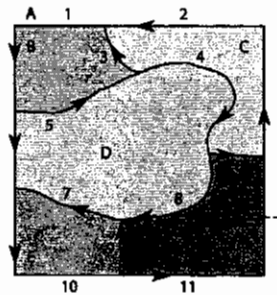
1C. State the advantages of vector data models.

1D. Differentiate among the following four types of resolutions:

      i.   Spatial resolution
     ii.   Spectral resolution
   iii.   Temporal resolution
   iv.   Radiometric resolution

1E. State the maximum and minimum range of numbers that can be stored in a computer with the following number representation: Short integer

QUESTION TWO (5 marks each)

2A. For the student, course and instructor data shown below generate the following data models:

      i. Flat data base model
     ii. Hierarchical data base model
   iii. Network database model

Student	Course taken		Instructor	Course taught
A	N1, N2, N3		D	N1, N5
B	N1, N4, N5		E	N4, N2
C	N1, N3, N6		F	N3, N6

2B. List and define the five keys of a relational data base system.

2C. State how and in what way the second normal form is violated in the following relational data base design

Table name: Class
Primary key Class_Code
Foreign key: Course_code

Class_code	Class_room	Class_time	Course_code	Lect_code

2D. What is the difference between JPEG (Joint Photographic Expert Groups) and TIFF (Tagged file image format) file formats in terms of file compression characteristics.

2E. List and describe the three methods of querying attribute data in a GIS.

QUESTION THREE (5 marks each)

3A. The table below shows an attribute table with the name Exam_Table. Show the output of a QUERY statement having the following clause:

SELECT	LastName, FirstName, StreetNumber
FROM	Exam_Table
WHERE	StreetNumber >= 10000 AND StreetNumber < 100
ORDERED BY	LastName

| Last Name	First Name	Street Number	Street Name	City	State
Squires	Edwin	4589	Shamar Rd.	Upland	IN
Rothrock	Paul	91657	Carex Ave.	Upland	IN
Hess	Douglas	123	Fake St.	Springfield	IN
Peterson	Chris	4687	Windthrow Way	Kane	PA
Gibson	David	354	Bluestem St.	Carbondale	IL
Smith	Dan	267	Wetland Rd.	Vicksburg	MS
Lichvar	Bobby	888	Badboy Lane	Vicksburg	MS
Orme	Tony	6576	Lakebed Ave.	Los Angeles	CA
Gillespie	Tom	94	Longboard Pl.	Los Angeles	CA
McDonald	Glen	13	Pilestbeeiiesr3	Los Angeles	CA
Tanner	Dave	6969	Goldenrod Ave.	Newport Beach	CA
Ramirez	Ruben	987	Summer St.	Oceanside	CA
Zackey	Justin	1982	Bonroe Mill	Bryn Athyn	PA
Shuey	Jamie	45683	Wrong Way	Eugene	OR
Goncharenko	Eric	23846	Oso Avenida	Los Angeles	CA
Buckley	Chris	745	Hambone Ave.	Miami	FL
Brody	Richard	54	Sugarplum St.	Topanga	CA

3B. Define the following type of buffers:

     i. Multiple ring buffers
    ii. Doughnut buffer
   iii. Bidirectional buffer
   iv. Setback buffer
    v. Dissolved buffer

3C. State the type of vector processing operated on the two features shown in the figure below.
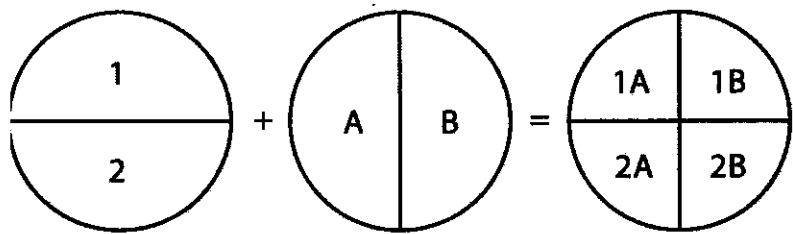
3D. Draw the output cell grid values of the clip operation carried out on the raster data set shown in the figure below.
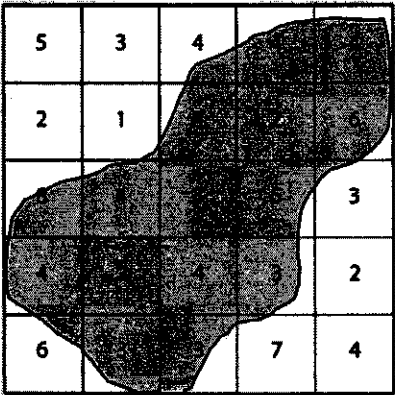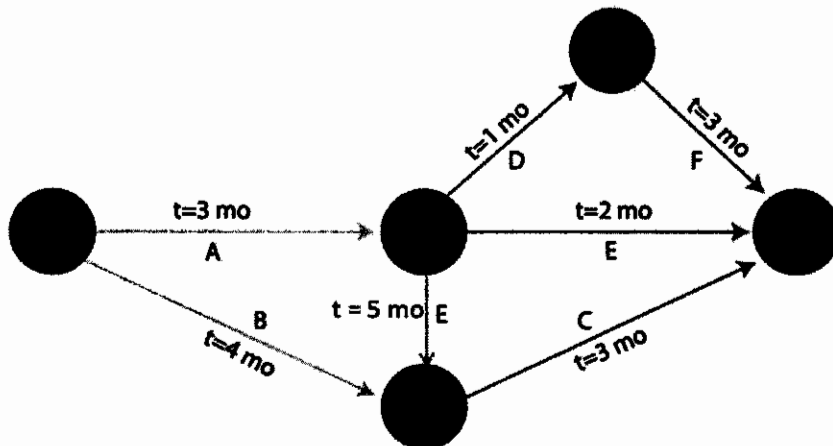

3E. Carry out a nearest neighbor analysis to the raster cell data shown in the table below by means of averaging among the cell values of the nearest neighbors.

1	2	3	5
8	4	5	1
15	7	9	11

QUESTION FOUR (5 marks each)

4A. For the GIS based project network activities shown in the figure below, determine the critical path of the network.

4B. A GIS analyst opted to use a mathematical transformation (addition) to combine two raster data sets: one showing the location of tress in a given region and the other the location of urban areas lying within that region. The objective of the analyst was to produce a raster data set that shows location of trees located in urban areas, urban areas that do not contain trees, etc. The input raster values are 0 and 1. Discuss if the choice of the mathematical operation (addition) will always produce the correct result.

4C. Given the elevation values of four cells taken from a digital elevation model of a raster surface, determine the slope (in %) and aspect values. Assume that the raster cell sizes are 10 km by 10 km.

500	650
225	350

4D. For the digital elevation raster data shown in the table below, determine the single stream line to which flows will accumulate.

28	30	30	40	40	50	50
27	25	25	30	30	30	40
27	23	20	25	25	25	30
27	22	18	20	20	20	30
27	22	19	15	15	20	30
27	22	19	17	14	18	30
27	22	19	17	10	18	30
27	22	19	17	5	18	30

4E. Describe with the help of a diagram the _Ebbinghaus illusion_ in relation to proportional symbolization.

QUESTION FIVE (5 marks each)

5A. Give examples of i) active sensors and ii) passive sensors used for remote sensing

5B. Using thermal infrared radiation detection by a remote sensor which feature appear brighter i) ground or ii) water or iii) reflecting metal surface such as aircraft? State the reason for your answer.

5C. Suppose you have a remotely sensed image using the false colour combinations involving the following three colour bands: infrared (shown as false red), near infrared (shown as false green) and green (shown as false blue). State the appearance of the following features on the satellite image:

      i. Atmospheric water droplet
      ii. Atmospheric ice
      iii. Sediment laden water in flooded zone
      iv. Saturated soil
      v. Vegetation

5D. What is the relationship between the spatial resolution of images obtained for aerial photogrammetry and each of the following factors:

      i. Focal length of cameras
      ii. The height of flight of the airplane?

5E. Describe the effect of dielectric constant and its influence on the appearance of remotely sensed image using RADAR for dry soil versus saturated soil.