

UNIVERSITY OF FORT HARE

GIS DATABASE DESIGN & MANAGEMENT  
**GIS 314**

DEGREE EXAMINATIONS

JUNE

2018

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Time: 3 HOURS  
Subject: Subject Code  
Marks: 100

This paper consists of 5 pages including the cover page

Internal Examiners

Ms KR Marembo

External Examiners

Dr T Dube

INSTRUCTIONS

Read questions carefully.  
Answers should be legible and grammatically correct.  
Answer ALL questions.

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**QUESTION 1****25**

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Give **ONE** example of each of the following:

- 1.1 List four components of a database. (2)
- 1.2 State whether the following statements are true or false: (5)
  - 1.2.1 Some of the database components are database entity, entity diagram, and attribute.
  - 1.2.2 A spatial pattern is the arrangement of objects on Earth excluding the space in between them.
  - 1.2.3 An entity is a phenomenon of interest in real world that cannot further subdivided into phenomena of the same kind.
  - 1.2.4 A flat file database is part of a relational database.
  - 1.2.5 A database index is a special representation of information about attributes that improves searching.
- 1.3 List three methods of indexing geographic objects. (3)
- 1.4 List four disadvantages of a hierarchical database. (2)
- 1.5 Explain what an attribute field represent in a database taking notes of all its properties. (3)
- 1.6 Explain how the B-tree indexing method work. (5)
- 1.7 Explain how GIS databases can be used to analyze trends and location. (5)

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**QUESTION 2****25**

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- 2.1 Discuss in details the R-tree geographic indexing method. Include a real world example where it can be applied. (5)
- 2.2 Explain three rules for identifying E-R diagrams components. (3)
- 2.3 Explain what procedure you would follow to break a flat file into a relational database system. (5)
- 2.4 Explain in details how you would determine suitability of data sources. (6)
- 2.5 Define a network database. (1)
- 2.6 Explain how errors such as undershoot and overshoot occur, how they can affect a database and how they can be fixed. (5)

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**QUESTION 3****25**

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- 3.1 Explain the completeness and validity quality parameters to follow during data editing. (5)
- 3.2 What is a database query? (1)
- 3.3 The table below contains information about theft in Seattle. You are approached by the Government because they can no longer keep up with their data because of the multiple duplication and the size of the database that keeps increasing. They want you to create a better database management system.

Event Code	Description	EC SubGroup	EC Group	District	Zone	Census Tract
65	THEFT - M	THEFT	OTHER PROPERTY	Q	Q1	5700.1012
65	THEFT - M	THEFT	OTHER PROPERTY	S	S2	11101.3001
64	SHOPLIFT	THEFT	SHOPLIFTING	K	K1	8200.1004
65	THEFT - M	THEFT	OTHER PROPERTY	M	M2	7200.1063
62	BICYCLE THEFT	THEFT	BIKE	S	S1	11000.5008
64	SHOPLIFT	THEFT	SHOPLIFTING	L	L3	3900.4004
65	THEFT - M	THEFT	OTHER PROPERTY	M	M1	8100.3007
64	SHOPLIFT	THEFT	SHOPLIFTING	M	M3	8100.1027
65	THEFT - M	THEFT	OTHER PROPERTY	D	D3	8200.1005
65	THEFT - M	THEFT	OTHER PROPERTY	F	F1	10700.1001

- 3.3.1 Which database model do you think will be more appropriate? (2)
- 3.3.2 Give reason why you chose the database you think is appropriate. (2)
- 3.4 Draw a complete UML diagram for the database you are provided. (5)
- 3.5 Draw a complete ER diagram for the database you are given above. (5)
- 3.6 Draw a relational database, and populate it using the information in the table you are given highlighting primary and foreign keys where possible. (5)

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**QUESTION 4****25**

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You are contacted by the government on a project they want to initiate. They want to monitor how drought occurrences affect crop production so that they may be able to assist farmers from low-income class. At the same time be able to monitor how people are affected by drought. You are given the relevant information in a relational database and they employ you as their data analyst (See next page).

Municipality						
Town Name	Ward number	BLACK	COLOURED	INDIAN	WHITE	TOTAL
Adelaide:	2	772	13771	6	1476	16026
Alice	3	14187	48617	60	39	62903
Balfour	1	180172	1004	432	9405	191013
Bedford	2	723	5003	3	803	6532
Fort Beaufort	3	147547	80	12	10926	158566
HealdTown	4	184569	309	252	2809	187939
Hermanuskop	5	134729	1581	28	2705	139043
Hogsback	7	119951	351	92	10699	131093
Katberg	6	984761	37839	30078	474342	1527021
Katrive Dam	6	99727	201	1732	1118	102778
KwaPita	4	49654	257	102	6193	56206
Melani	3	2242	1847	0	422	4511
Middle Drift	8	114629	1855	188	12256	128929
Seymour	1	21573	11626	42	2526	35766

Yield					
Town Name	SYMBOL	WHEAT	OATS	HAYDRY	HAYWET
Adelaide:	JmC	31	35	1.4	4.3
Alice	JmD	29	32	1.2	4
Balfour	KaB	38	44	2	5
Bedford	KaD	34	41	1.8	4.6
Fort Beaufort	KaD2	32	35	1.6	4.4
HealdTown	KeB	38	44	2	5
Hermanuskop	KeD	34	41	1.8	4.6
Hogsback	KfD	32	35	1.7	4.4
Katberg	KoB	34	39	1.5	4.4
Katrive Dam	KpD	28	30	1.3	4
KwaPita	NrB	26	34	1.2	4.2
Melani	NrD	24	32	1.1	3.9
Middle Drift	Mt	35	42	2.2	5.4
Seymour	MtD	30	33	1.8	4.4

Drought		
Town Name	2017	1999
Adelaide:	-0.84	-1.82
Alice	-1.01	-1.08
Balfour	-0.003	-2.00
Bedford	0.43	-1.87
Fort Beaufort	-1.29	1.81
HealdTown	-1.29	1.60
Hermanuskop	-2.015	-1.99
Hogsback	0.29	1.71
Katberg	2.07	-1.39
Katrive Dam	1.14	-1.88
KwaPita	2.06	1.50
Melani	-0.241	1.95
Middle Drift	-2.035	-1.21
Seymour	1.12	-1.88

- TABLE 1 is the Municipality table that contains the towns, and population per race.
- TABLE 2 is the Yield table that contains the yield potential for wheat, oats, dry and wet hay, and the symbol for the soil type.
- TABLE 3 is the Drought table that contains drought information between 1999 and 2017. Drought is more intensive when it is negative. Above zero means there is actually sufficient rainfall.

- 4.1 Write down a query to derive total population of Ward 3 **using SQL statements.** (2)
- 4.2 What is the average drought intensity in Ward 3 in 2017? **Correct to three decimal places.** (1)
- 4.3 Write down the query to identify the town with the highest drought intensity that occurred in 1999. (2)
- 4.4 Given the following query:  
**“Municipality.TOTAL” == 6532**
- 4.4.1 What is the Ward number with that population size? (1)
- 4.4.2 What is the Oats yield capacity of that Ward? (1)
- 4.4.3 What is the soil Symbol related to the Ward? (1)
- 4.5 Given the following query:  
**“Yield.Symbol” == “KoB” and “Municipality.Black” < 5000**
- 4.5.1 List the names of the towns selected. (3)
- 4.5.2 Give their respective Haydry and Haywet scores. (3)
- 4.6 Write down the query statement to find out the total population exposed to a highest drought intensity in 2017. (3)
- 4.7 Solve the following:
- 4.7.1 What record will be selected, given the following statement? (2)

```
SELECT Town_Name FROM Drought
WHERE 2017 BETWEEN -2 AND -1.2
```

4.7.2 What is the total white population corresponding to this selection? (2)

4.7.3 Write down in a table format outputs corresponding to the query below.

**Including:** Town Name, Total population, Symbol, Wheat, and Oats. (4)

```
SELECT Drought.Town_Name, Municipality.Total, Yield.Town_Name, Yield.Wheat,
Yield.Oats FROM Drought
FULL JOIN Yield ON Drought.Town_Name = Yield.Town_name
FULL JOIN Municipality ON Drought.Town_Name = Municipality.Town_Name
WHERE 2017 > -1.5 OR WHERE 1999 = -1.88
```