UNIVERSITEIT VAN PRETORIA
UNIVERSITY OF PRETORIA
Departement Geografie, Geoinformatika
en Meteorologie
Department of Geography, Geoinformatics
and Meteorology

GIS 310

***Eksamen* / Examination**
ADVANCED GIS

***Interne Eksaminator*/Internal Examiner**
G. D. BREETZKE

***Eksterne Eksaminator*/External Examiner**
MR J.G. VAN WYK

TYD / TIME:	DATUM / DATE:	PUNTE / MARKS
180 MIN	10 *JUNIE*/JUNE 2004	160

INSTRUKSIES / INLIGTING
INSTRUCTIONS / INFORMATION

Answer all the questions.

Beantwoord al die vrae.

Multiple-choice section: [20]

1. _____ are examples of data structures used in GIS (2)
   a) Topological and spaghetti
   b) Points, lines and polygons
   c) Vector and raster
   d) Epsilon and Monte Carlo

2. Which of the following could NOT be derived from a DEM? (2)
   a.) slope map
   b.) aspect map
   c.) histogram
   d.) contour map
   e.) soils map

3. A _____ is similar to a _____, but a _____ is closed, meaning that the first node and the final node are the same node on the network (2)
   a) tour, path, tour
   b) centre, stop, centre

c) stop, centre, stop
d) path, tour, path

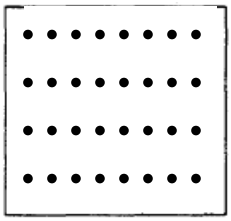
4. _____ is the process for building a relationship between locational data in a database and street address data that are normally in a tabular format (2)
   a) Geocoding
   b) Location-allocation
   c) Path-finding
   d) Tracing
   e) Routing

5. The following is NOT an advantage of an Object Orientated Database Management System. (2)
   a) Designer can specify the structure of objects and their behavior
   b) Better interaction with object-oriented languages such as Java and C++
   c) Definition of complex and user-defined types
   e) Each field in a table can be the key to locating data in another table
   e) None of the above

6. Which statement/s is true? (2)

   I. Small scale maps (e.g. 1:1000 000) = large area BUT no detail
   II. Large scale maps (e.g. 1:25 000) = smaller area BUT greater detail
   III. Small scale maps (e.g. 1:25 000) = large area BUT no detail
   IV. Large scale maps (e.g. 1:1000 000) = large area BUT greater detail
   V. Small scale maps (e.g. 1:000 000) = smaller area BUT no detail

   a) I
   b) I and II
   c) V
   d) II and IV
   e) III and IV
   f) None of the above combinations



7. The above diagram is an example of a _____ cover of data observations (2)

   a) Patchy
   b) Random
   c) Stratified
   d) Clustered
   e) Regular

8. Trend surface analysis is an example of a global, deterministic, exact interpolator (2)

a) True
b) False

9. Kriging is an example of a _____ interpolator (2)

a) stochastic, global, inexact
b) deterministic, global, exact
c) stochastic, local, exact
d) deterministic, local, inexact
e) difficult

10. _____ is commonly used to convert interval and ratio scale data into an ordinal ranking for landuse suitability modelling using map algebra. (2)

a) Buffering
b) Proximity analysis
c) Network analysis
d) Classification
e) Reclassification

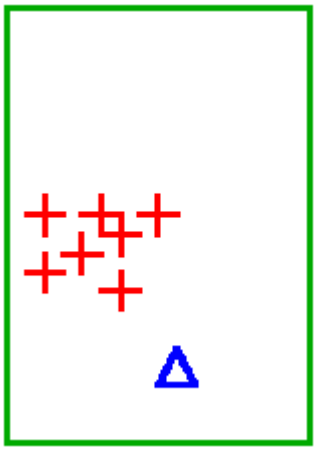
Long questions [90]

1. With reference to the diagram below, answer the following questions:

Arc number	Starting node	Ending node	Arc length
1	1	2	4
2	1	3	5
3	2	4	8
4	2	5	3
5	3	1	6
6	3	4	7
7	3	6	6
8	4	5	2
9	4	1	9
10	5	2	5
11	6	3	8

a) What network representation is illustrated? (1)
b) Give three advantages of this type of network representation (6)
c) Complete the pointer table for the network representation (7)

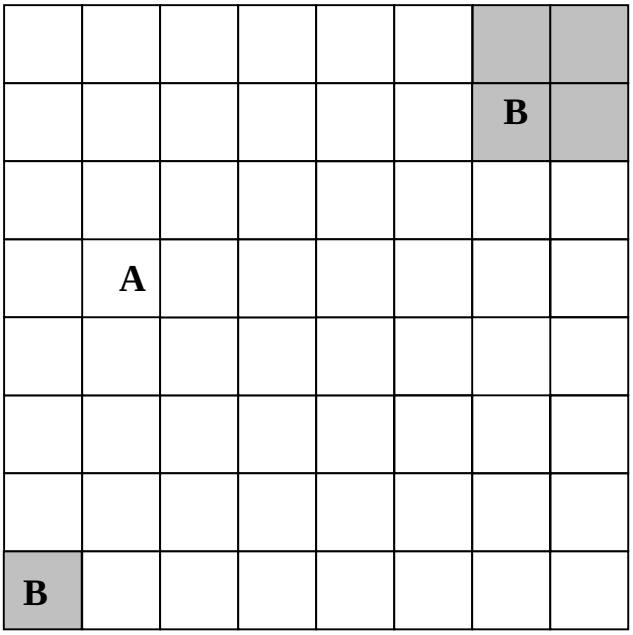
2. With reference to the diagram below, answer the following questions:



a) What Global Positioning Systems (GPS) errors are represented graphically above? (4)
b) Explain each GPS error representation and indicate the amount of positional error that will occur (6)

3. Differentiate between the Monte Carlo and the Epsilon methods of modelling error in GIS (8)

4. Calculate the area of the quadtree polygon (A) below (10)



NOTE: *Dimension of pixel = 1km* 1km*

HINT: Structure your answer according to the following table.

Leaf	Level	Area Weight

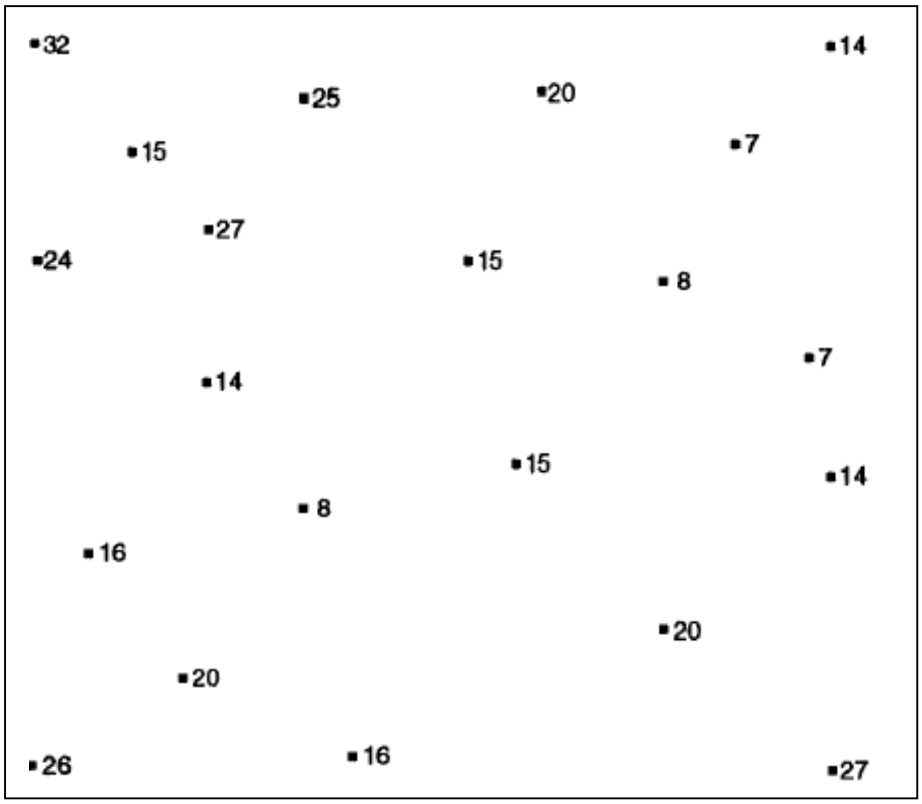
5. What are the requirements for network analysis? Structure your answer according to the following table. (8)

System Requirements/	Data Requirements/

6. Discuss the different raster data compression techniques and how they work. (10)

7. Reproduce the following points and interpolate the surface at 10 metre intervals using:

   i) The line threading interpolator (5)
   ii) The Theissen interpolator (5)



   iii) Contrast the two interpolation methods by referring to your interpolated surfaces (4)

8. *(Answer 4 of the following):* (16)
   a. Explain the differences between the volume preserving and non-volume preserving area interpolation methods
   b. Discuss the 4 levels of measurements and give examples of each type
   c. Differentiate between the topology and spaghetti data vector models
   d. Indicate different ways that quantitative data can be classified in a GIS and indicate when each of the methods should be used.
   e. Discuss the 3 steps involved in edge matching in GIS
   f. Name the 4 modes of GIS data input, and provide a brief description of each mode
   g. Name the 4 network classification types and provide an example of each

Essay section [50]

Discuss data error in GIS. In your discussion, include aspects that cover errors and accuracy, uncertainty and how problems relating to data quality are overcome. (Assuming there are problems).

End of Exam

TOTAL: 160 marks

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Answer all the questions.

Beantwoord al die vrae.

Meervoudige keusevrae afdeling: [20]

1. _____ is voorbeelde van data-strukture in GIS (2)

f) *Topological* en *spaghetti*
g) Punte, lyne en poligone
h) Vector en raster
i) Epsilon en Monte Carlo

2. Watter van die volgende kan NIE afgelei word van ‘n DEM nie? (2)
(1)

f.) hellingskaart / *slope map*
g.) aspekkaart / *aspect map*
h.) histogram
i.) kontoerkaart
j.) grondekaart / *soils map*

3. ‘n _____ is soortgelyk aan ‘n _____, maar ‘n _____ is geslote, sodat die eerste node en die finale node op die netwerk dieselfde is. (2)

a) toer, pad, toer
b) middelpunt, stop, middelpunt
c) stop, middelpunt, stop
d) pad, toer, pad

4. _____ is die proses waarvolgens ‘n verhouding tussen liggingsdata in ‘n databasis en straatadresdata wat normaalweg in tabulêre format is, geskep word. (2)

f) Geocoding
g) Location-allocation
h) Path-finding
i) Tracing
j) Routing

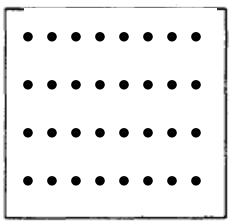
5. Die volgende is NIE ‘n voordeel van ‘n Voorwerp Georiënteerde Databasis Bestuurstelse nie. (2)

a. Die struktuur van voorwerpe en hul gedrag kan gespesifiseer word.
b. Beter interaksie met voorwerp-georiënteerde tale soos Java and C++
c. Definisie van komplekse en gebruiker-gedefinieerde tipes
d. Elke veld in‘n tabel kan as sleutel dien om data in ‘n ander tabel te vind.
e. Nie een van bogenoemde nie

6. Watter stelling(s) is korrek? (2)

I. Klein skaal kaarte (e.g. 1:1000 000) = groot area MAAR geen detail
II. Groot skaal kaarte (e.g. 1:25 000) = kleiner area MAAR groter detail
III. Klein skaal kaarte (e.g. 1:25 000) = groot area MAAR geen detail
IV. Groot skaal kaarte (e.g. 1:1000 000) = groot area MAAR groter detail
V. Klein skaal kaarte e.g. 1:000 000) = kleiner area MAAR geen detail

g) I
h) I en II
i) V
j) II en IV
k) III en IV
l) Nie een van bogenoemde kombinasies nie



7. Die bostaande diagram is ‘n voorbeeld van ‘n _____ dekking van data observasies. (2)

f) Laslap / *Patchy*
g) Willekeurige / *Random*
h) Gestratifiseerde / *Stratified*
i) Gegroepeerde / *Clustered*
j) Reelmatige / *Regular*

8. Trend oppervlak-analise is ‘n voorbeeld van ‘n globale, deterministiese, eksakte interpolator. (2)

c) Waar
d) Vals

9. Kriging is ‘n voorbeeld van ‘n _____ interpolator. (2)

f) *stochastic*, globale, nie-eksakte
g) deterministiese, globale, eksakte
h) *stochastic*, lokale, eksakte
i) deterministiese, lokale, nie-eksakte
j) moeilike

10. _____ word algemeen gebruik om interval- en verhoudingskaaldata te verwerk tot ‘n ordinale rangorde vir grondgebruik-geskiktheidsmodellering met behulp van kaartalgebra. (2)

f) Bufferwerking / *Buffering*
g) Nabyheidsanalise / *Proximity analysis*
h) Netwerk analise / *Network analysis*
i) Klassifikasie / *Classification*
j) Her-klassifikasie / *Reclassification*

Lang vrae [90]

1. Met verwysing na die onderstaande diagram, beantwoord die volgende vrae:

Arc number	Starting node	Ending node	Arc length
1	1	2	4
2	1	3	5
3	2	4	8
4	2	5	3
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7	3	6	6
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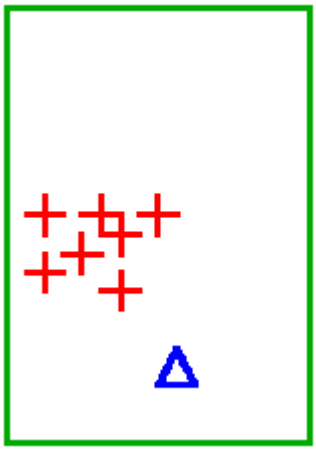
a) Watter netwerkvoorstelling is geïllustreer? (1)
b) Gee drie voordele van hierdie tipe netwerkvoorstelling (6)
c) Voltooi die *'pointer'* tabel vir die netwerkvoorstelling (7)

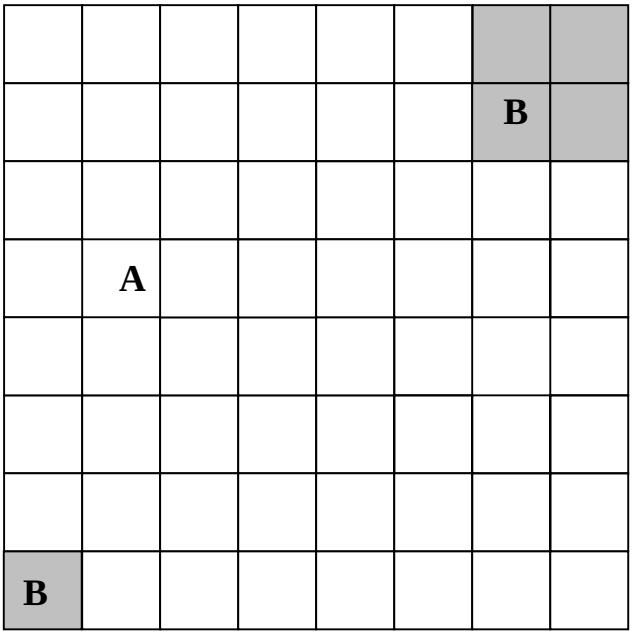
2. Met verwysing na die onderstaande diagram, beantwoord die volgende vrae:



c) Watter Globale Posisionering Stelsel (GPS) foute word in die bostaande grafiek voorgestel? (4)
d) Verduidelik elke GPS fout in die voorstelling en dui die grootte van die posisionele fout wat sal voorkom aan. (6)

3. Onderskei tussen die Monte Carlo en die Epsilon metodes van foutmodellering in GIS (8)

4. Bereken die oppervlak van die "quadtree" poligoon (A) hieronder (10)



NOTE: *Dimension of pixel = 1km* 1km*

WENK: Gebruik onderstaande tabel om jou antwoord te struktureer.

Blaar	***Vlak***	***Gebiedsgewig***

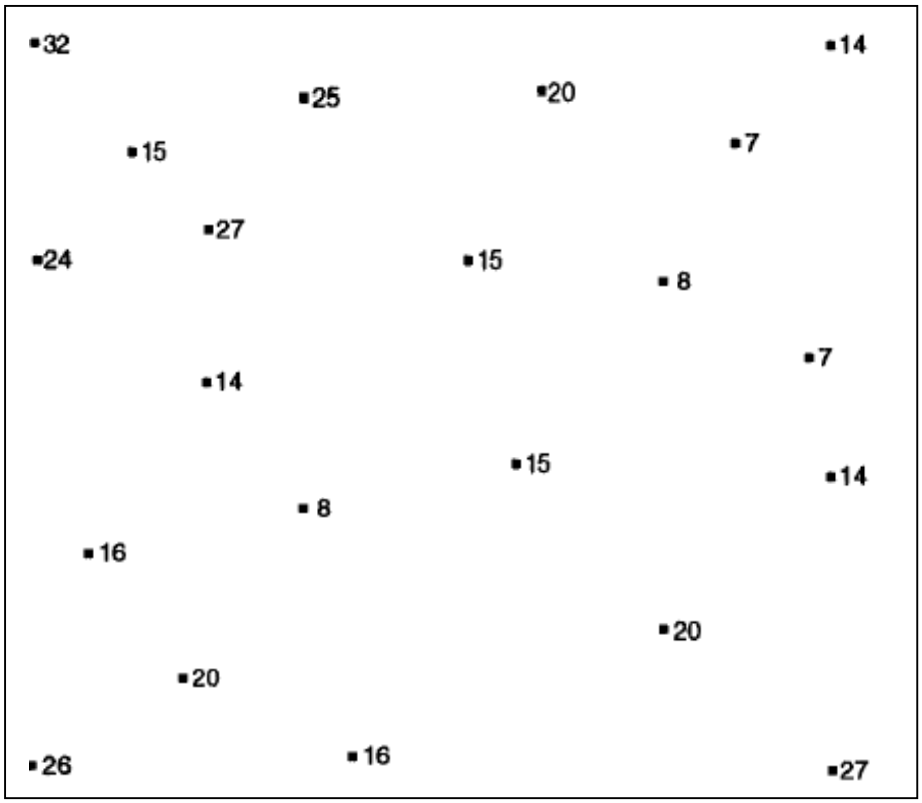
5. Wat is die vereistes vir netwerk analise? Struktureer jou antwoord volgens die onderstaande tabel. (8)

System Requirements/	**Data Requirements/**

6. Bespreek die verskillende raster data saampersing tegnieke en verduidelik hoe hulle werk. (10)

7. Herhaal / *Reproduce* die volgende punte en interpoleer die oppervlakte met 10 meter intervalle deur gebruik te maak van:

   j) Die *line threading* interpolator (5)
   ii) Die *Theissen* interpolator (5)



   iii) Kontrasteer die twee interpolasie metodes deur te verwys na jou interpolasie oppervlaktes (4)

8. *(Beantwoord 4 van die volgende):* (16)
   a. Verduidelik die verskille tussen die volume behoudende en nie-volume behoudende area-interpolasie metodes
   b. Bespreek die vier vlakke van opmeting en gee voorbeelde van elke tipe
   c. Onderskei tussen die topologie en spaghetti data vector modelle
   d. Toon verskillende maniere aan waarop kwantitatiewe data ‘n GIS geklassifiseer kan word en dui ook aan onder watter omstandighede elk van die metodes gebruik behoort te word.
   e. Bespreek die 3 stappe betrokke by *edge matching* in GIS
   f. Noem die 4 GIS data invoer metodes, en voorsien elke metode van ‘n kort beskrywing
   g. Noem die 4 netwerk klassifikasie tipes en gee ‘n voorbeeld by elk

Opstel afdeling [50]

Bespreek datakwaliteit in GIS. Sluit die volgende in die bespreking in: foute, akkuraatheid, onsekerheid/twyfelagtigheid en hoe probleme rondom datakwaliteit opgelos kan word (as die aanname gemaak word dat daar wel probleme is).

Einde van eksamen

TOTAAL: 160 punte