

# Final Examination

## 2002

**Time Allowed:** 2 hours + 10 minutes reading time

**Beginning:** 9.00 am

The paper contains two sections – A and B (6 pages in total)

Section A and Section B are each worth 50% of the total mark for the examination

Students should answer **ALL questions from Section A** and **2 questions from Section B**

Use the space provided in the examination paper to answer Section A

Use the Examination Booklets provided to answer Section B

**Use diagrams and actual GIS procedures wherever possible  
to help explain your answer**

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**Section A: Short Answer – Answer ALL Questions (50 Marks)**

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1. Methods for creating GIS spatial data?

4 marks

2. What is map algebra? give an example

4 marks

3. Describe these map algebra functions?

a) local

b) Neighbourhood

c) Zonal

d) Global

4 marks

4. What is meant by the term “null”?

2 marks

5. The raster data model is the major alternative to vector GIS. Both raster and vector have advantages and disadvantages.

(a). Briefly describe the raster data model.

(3 marks)

(b). Describe the properties of, and difference between, discrete and continuous rasters. Give an example of each.

(3 marks)

(c). What issues would you consider in choosing an appropriate *resolution* for a raster database?

(2 marks)

6. Describe as many types of network analysis as you can think of (e.g. geocoding, shortest path analysis, travelling salesman etc.) and suggest a plausible real-world application for each.

(6 marks)

7. Below left is a raster digital elevation model (DEM) of a typical upper catchment area. The grid cell values for the DEM represent the height of the land above sea level. This question has 3 tasks:

(a). **Mark on the DEM on the left** the FLOWDIRECTION of each cell by drawing arrows connecting cell centres.

(b). On the blank grid marked Flow Accumulation enter cell values of FLOWACCUMULATION which as you no doubt remember is the number of cells flowing into each cell.

(c). Circle the POURPOINT on the Flow Accumulation grid.

DEM

|    |    |    |    |    |
|----|----|----|----|----|
| 14 | 14 | 15 | 18 | 20 |
| 13 | 12 | 14 | 17 | 19 |
| 14 | 12 | 11 | 15 | 18 |
| 11 | 10 | 7  | 8  | 12 |
| 9  | 6  | 1  | 7  | 8  |

Flow Accumulation

|  |  |  |  |  |
|--|--|--|--|--|
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |
|  |  |  |  |  |

(8 marks)

8. The 3 rasters below all have a cell resolution of 100 metres and the same origin point. Complete the following raster operations:

Grid1

|   |   |         |    |
|---|---|---------|----|
| 1 | 0 | 2       | 1  |
| 6 | 9 | 5       | 4  |
| 3 | 5 | NO DATA | 10 |
| 1 | 1 | 0       | 2  |

Grid2

|     |     |   |         |
|-----|-----|---|---------|
| 7   | 2   | 8 | 14      |
| 6   | 2   | 1 | 12      |
| 0   | -7  | 0 | NO DATA |
| -12 | -10 | 1 | NO DATA |

Grid3

|   |   |   |   |
|---|---|---|---|
| 2 | 2 | 1 | 2 |
| 2 | 2 | 1 | 3 |
| 1 | 1 | 3 | 1 |
| 1 | 3 | 3 | 1 |

Grid1 + Grid2 = 

|  |  |  |  |
|--|--|--|--|
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|  |  |  |  |
|  |  |  |  |
|  |  |  |  |

 (2 marks)

Con(Grid1 > 3, Grid1, 3) = 

|  |  |  |  |
|--|--|--|--|
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|  |  |  |  |

 (4 marks)

Focalmean(Grid2) = 

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|  |  |  |  |

 (4 marks)

Zonalarea(Grid3) / 10000 = 

|  |  |  |  |
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|  |  |  |  |
|  |  |  |  |

(14 marks)

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**Section B: Essay Answer - Answer 2 of the 5 Questions Provided (50 Marks)**

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1. The raster data model allows us to develop models of environmental and social processes in space and time. Discuss the usage of raster data in detecting spatio-temporal patterns in crime. Use examples from what you know about motor vehicle theft. Discuss the relative importance of GIS-based spatial analysis in the process of exploratory spatial data analysis compared to other, more common types of analysis such as graphing trends and elementary statistical analyses. What extra intelligence does the spatial component provide?  
(25 marks)
2. Compare and contrast the range of analytical capabilities of the raster data model versus the vector data model. What issues might you consider in choosing a data model for a particular spatial database or analysis? Use examples of the analysis of social and environmental phenomena to illustrate your answer.  
(25 marks)
3. Particular types of real world entities (e.g. lakes, rivers, landuse types, population density etc.) on the Earth's surface are usually suited to a particular spatial data type (e.g. vector line theme, polygon theme, discrete or continuous raster). For example streams are naturally suited to a linear network data model. Discuss the issues involved in modelling real-world entities as spatial data layers.  
(25 marks)
4. Describe the benefits and limitations of integrating vector and raster data in spatial analyses. What are some of the issues you must deal with, what are some of the problems to watch out for? Use examples from your experience in working on the Willunga landuse planning exercise.  
(25 Marks)
5. List and describe the steps involved in digitising from paper maps.  
(25 Marks)

END OF EXAM

Marks out of 100