

**UNIVERSITY OF SOUTH AUSTRALIA**  
**School of Geoinformatics, Planning & Building**

**Spatial Information Systems 4**  
**And**  
**Spatial Systems 3N**

**EXAMINATION**

**Semester 2, 2001**

Time Allowed: 3 hours + 10 minutes reading time

**General Instructions to Candidates**

**Total Marks = 100.**

**Calculators are not required.**

**Question 1, 2 and 3 are compulsory.**

**Attempt any two questions out of questions 4, 5, and 6.**

**Marks for questions are indicated in brackets.**

**This is a closed book examination.**

**Please ensure that the front of answer book is completed with your student name, student I.D. number and course.**

### Question 1

- a) Explain all of the terms on the right hand side of the bivariate kernel density formula and gaussian weight function (formula provided below). Including diagrams where required. (15)
- b) How does the gaussian kernel density estimator improve upon the naive density estimator? (5)
- c) Detail the operation of the adaptive kernel. (10)

$$\hat{f}(X_j) = 1/nh^2 \sum_{i=1}^n K\left[\frac{x_i - X_j}{h}\right]$$

Where  $K\left[\frac{x_i - X_j}{h}\right] = \frac{e^{-\frac{(x_i - X_j)^2}{2h^2}}}{2\pi}$

## Question 2

- (a) Explain the terms in the following two formulae. Relate your explanations to a diagram and example data (*eg matrices where required*).

$$z(x) = m(x) + \varepsilon'(x) + \varepsilon''$$

$$b = w A + \varphi \quad (10)$$

- (b) Describe the operation of co-kriging. (5)
- (c) Outline the advantages of kriging over deterministic interpolative approaches. (5)
- (d) Distinguish between universal & ordinary kriging. Use a diagram. (10)

### Question 3

- (a) Provide a brief overview of the common spatial inference modelling techniques. (5)
- (b) Discuss the assumptions that underpin the Ordinary Least Squares (OLS) regression approach to linear parametric modelling. (5)
- (c) How does the Geographically Weighted Regression (GWR) technique improve upon OLS. Describe the GWR technique. (10)
- (d) Describe the maximum likelihood approach to the classification of presence/absence data. Use a 2 dimensional example. When would this technique be employed? How does the kernel classification approach sometimes improve upon this approach? (10)
- (e) Describe the operation of Artificial Neural Network (ANN) modelling. What are the disadvantages of this approach. When would this technique be employed? (10)

\*\*\*\*\* END OF EXAMINATION \*\*\*\*\*