National Exams May 2015

04-Geom-A5, Remote Sensing and Image Analysis

3 hours duration

NOTES:

1. If doubt exists as to the interpretation of any question, the candidate is urged to submit with the answer paper, a clear statement of any assumptions made.

2. This is a CLOSED BOOK exam. Approved Casio or Sharp model calculator is permitted.

3. All five questions must be answered total 100 marks.

Front Page

04-Geom-A5 Remote Sensing and Image Analysis

Candidate ID:_____Name_____Signature_____

Question 1: [20 marks]

When we perform image-to-map rectification or image-to-image registration, we need to do spatial resampling and intensity (digital number) interpolation. Name three intensity interpolation methods. Describe their advantage and disadvantage. For a particular application, the digital numbers (brightness values) in the original image need to be kept during the interpolation process (such as classification). Which interpolation method is best for such an application?

Question 2 [20 Marks]

Identify 3 components of at-sensor radiance of a surface object, show the photon paths using a diagram, and identify the component contains surface bi-directional reflectance information.

Question 3 [20 Marks]

What is supervised classification? What is unsupervised classification? Describe the advantages and disadvantages of supervised and unsupervised classification.

Question 4 [20 marks]

What are the major steps to process a raw satellite image (top-of-atmosphere, digital number) to an at-surface reflectance image? Explain the reasons for converting digital numbers in satellite images to reflectance before they are used for retrieving the physical/biophysical parameters of surface objects.

Question 5 [20 Marks]

At a conference research group A and research group B both presented papers on the value of the principal components analysis (PCA) for reducing the number of features required to represent image data. Group A described very good results that they had obtained with the method whereas Group B indicated that they felt it was a little use. Both groups were using image data with only two spectral bands. The covariance matrices for their respective images are as follows. Explain the points of view of both groups.

$$\Sigma_A = \begin{bmatrix} 5.4 & 4.5 \\ 4.5 & 6.1 \end{bmatrix} \qquad \Sigma_B = \begin{bmatrix} 28.0 & 4.2 \\ 4.2 & 16.4 \end{bmatrix}$$