University of Pretoria
Department of Geography, Geoinformatics and Meteorology
GMA 320: Remote Sensing
Semester Test

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Answer all questions as concisely as possible.
You might find the following equations useful.

$$BV_{i,j,k} = \frac{1}{N} \sum_{i=1}^{N} BV_i \tag{1}$$

$$BV_{i,j,k} = \frac{1}{2} \left[BV_{i-1,j,k} + BV_{i+1,j,k} \right] \tag{2}$$

$$\mu_k = \frac{1}{n} \sum_{i=1}^{n} BV_{i,k} \tag{3}$$

$$var_k = \frac{1}{n} \sum_{i=1}^{n} (BV_{i,k} - \mu_k)^2 \tag{4}$$

$$\tag{5}$$

Question 1: 14 marks

1. Name four possible limitations of *in situ* measurements in remote sensing? [**4 marks**]

2. With examples, outline three important aspects/forms of data collection during remote sensing process. [**6 marks**]

3. Describe two broad generalised processes and elements involved in electromagnetic remote sensing of Earth resources [**4 marks**]

Question 2: 10 marks

Digital remotely sensed data are transformed to useful information, possibly via the conversion of an analog electrical signal data recorded by the remote sensing sensor to a digital value.

1. What is the importance of the preprocessing stage in the data-to-information conversion process in remote sensing? [**4 marks**]

2. By giving examples, distinguish between multi-spectral and hyperspectral remote sensing systems.[**4 marks**]

3. *Pushbroom* sensors are thought to yield accurate measurement of the reflected radiant flux from a specific portion of the terrain. Give two reasons for this? [**2 marks**]

Question 3: 7 marks

1. Name any two possible causes of low Signal-to-Noise ratio: S/N in the Brightens Values (BV) of a remotely sensed data? [**1 marks**]

2. How can a digital remote sensing analyst assess the quality and statistical characteristics of a remote sensed data? *any two ways*[**1 marks**]

3. Univariate statistics do not provide information on the covariance of spectral measurements. Table 4 shows the correlation matrix derived from a sample multi-spectral data set.

Table 1: Correlation matrix derived the multi-spectral data set recorded from vegetated terrain

Band	1	2	3	4
1	1			
2	0.38	1		
3	0.92	0.50	1	
4	0.96	0.20	0.84	1

- What do the high correlation between bands 1& 3 and 1& 4 signify? [**1 marks**]

- Which band provides unique information not found in the other bands? [**2 marks**]

- What is the proportion of total variation in the brightness values of band 4 that can be explained by a linear relationship with values of the random variation in band 1 ? [**2 marks**]

Question 4: 7 marks

- Enumerate any four important Digital Image Processing (DIP) system considerations. [**2 marks**]

- Name any three main features that an ideal remote sensing storage media should have. [**3 marks**]

- What are the attributes required of a good (remote scientist) digital image processing analyst? *state atleast two*[**2 marks**]

Question 5: 12 marks

The following is a sample pixel data record output from a remote sensing sensor.

50	96	108	84	97	95	112	105
55	106	118	104	107	145	152	145
-	-	-	-	-	-	-	-
57	102	106	105	103	134	144	137
54	116	108	114	97	115	102	125

1. Name the type of sensor mulfunction depicted above [**2 marks**].

2. Suggest one possible way of correcting this problem. Now use the methodology suggested to complete the above table [**10 marks**].