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**CS/B.TECH (CSE)/SEM-8/CS-802C/2011**

# 2011
# GIS & REMOTE SENSING

*Time Allotted* : 3 Hours *Full Marks* : 70

*The figures in the margin indicate full marks.*
*Candidates are required to give their answers in their own words as far as practicable.*

## GROUP – A
## ( Multiple Choice Type Questions )

1. Choose the correct alternatives for the following : $10 \times 1 = 10$

i) If the earth is approximated by a ellipsoid generated from an ellipse with major and minor semi-axes $a$ and $\lambda a$ respectively, how much is the polar flattening ?

a) $\lambda$ b) $1 - \lambda$

c) $\sqrt{(1-\lambda)}$ d) $\sqrt{(1-\lambda^2)}$

ii) Which of the following projections is used for mapping areas with long North-South extent ?

a) Mercator b) Lambert Conformal

c) Transverse Mercator d) Robinson's

iii) Which of the following is FALSE about region quadtrees ?

a) Every non-leaf node has 4 children

b) If the quadtree has a root, $t$ leaves and $m$ other internal nodes, then $t = 3m + 4$

c) All nodes at the same height represent regions of equal area.

d) The height of the tree is $log\ n$, where $n$ is the number of nodes.

iv) Which of the following is a vector data format ?

a) Geo TIFF b) TIGER

c) MrSID d) JPEG.

v) Which of the following is not a basic element in topological relationships ?

a) Adjacency b) Containment

c) Connectivity d) None of these.

vi) Which of the following is an example of a neighborhood operation in rester-based GIS data processing ?

a) Reclassification b) Rrecoding

c) Slope determination d) Overlay.

vii) Which of the following is an example of a topological function in vector-based GIS data processing ?

a) Address geocoding b) Surface interpolation

c) Area computation d) Overlay analysis.

viii) Which of the following involves in reducing the number of categories of attribute data on a layer ?

a) Line simplification b) Reclassification

c) Sliver removal d) Address geocoding

ix) Which of the following best approximates the visible range of the electromagnetic spectrum ?

a) 0.4 to 0.7 microns b) 0.7 to 1.2 microns

c) 0.1 to 0.4 microns d) 1.2 to 1.6 microns.

x) Which of the following is NOT a format for storing multiband remote sensing images ?

a) DOQ b) BIL

c) BIP d) BSQ.

## GROUP – B

### ( Short Answer Type Questions )

Answer any *three* of the following. $3 \times 5 = 15$

2. What are the five elements defining a geodetic datum ? 5

3. a) If the equatorial radius of the earth is *R*, what is the approximate ratio of the equatorial circumference and the length of the 45° N parallel ? 1

   b) Why are secant map projections useful ? 1

   c) Why are the Transverse and Oblique variants of the Mercator projection sometimes used ? 1

   d) If the scale is doubled for the parallels and halved for the meridians, hos is projection property of direction affected ? 1

   e) How does the Mercator's projection affect directions ? 1

4. Answer the following with respect to UTM coordinates :

   a) What is the projection system on which UTM coordinates are based ? 1

   b) How many degrees of longitude is each projection zone wide ? 1

   c) What is the first zone and what is its central meridian ? 1

   d) What is the span of a typical UTM zone band (other than the northernmost band) in terms of degrees of latitude ? 1

   e) How are eastings measured ? 1

5. a) What are the problems associated with UTM boundaries ? 2

   b) What are the approaches used to deal with these problems ? 3

6. What are nominal, ordinal, interval and ratio attributes ? Explain with examples from the GIS domain. 5

## GROUP – C

### ( Long Answer Type Questions )

Answer any *three* of the following. $3 \times 15 = 45$

7. a) What are the relative merits and demerits of raster and vector methods for spatial data structures ? 5

   b) What are the main characteristics of the different types of raster file formats ? 5

   c) What are the different topological overlay operators involved in vector-based GIS data processing ? 5

8. a) i) Give an algorithm to determine whether a point is inside a polygon. 3

      ii) What improvements can you suggest if it is known in advance that the polygon is convex ? 2

b) i) Explain how Freeman Chain Coding (FCC) and Run Length Encoding (RLE) are used to compress raster data. 3

ii) Convert [2, 2, 2, 2, 2, 2, 2, 2, 2, 2, 4, 4, 4, 6, 4, 4, 4, 4, 4, 4, 4, 2, 2, 4, 4, 4, 6, 6, 6, 6, 6, 6, 6, 6, 6, 0, 0, 0, 0, 0, 0, 0, 6, 6, 0, 0, 0, 0, 0, 0] from FCC to RLE, assuming that the directions are numbered clockwise starting with North as 0. 2

c) i) What are the minimum and maximum number of nodes for a region quadtree of height $h$ ? 2

ii) Construct a region quadtree for the following rester data :

00000011
00000011
11000000
11000000
11110000
11110000
11110000
11110001 3

9. a) Explain *the image-to-map* method of georeferencing for raster based geographic data processing. 5

b) i) Given an ellipsoid representing the earth. What angle does the latitude of a point $x$ on the ellipsoid surface exactly represent ? Explain with a simple diagram. 3

ii) What are the different types of perspective projections classified based on the viewpoint ? 2

c) In georeferencing what is the geoid and what is it used for ? 5

10. a) Explain the role of the following digital analysis techniques in mosaicking raster images :

i) Histogram Matching 2

ii) Feathering 3

b) Explain how overlay analysis using logical and arithmetic operators is performed in rester-based geographic data processing. 5

c) How are the following neighbourhood operations are performed in raster-based GIS processing ?

i) Spatial Aggregation. 3

ii) Filtering. 2

11. a) Give the conditions that may necessitate cartographic generalization. 5

b) Explain the basic principles of Electromagnetic Remote Sensing. 5

c) Describe briefly the processes involved in digitization of existing maps. 5