**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJ.)**

**CE F431**        **Principles of Geographical System**        Duration: 0900-1200 Hrs.
Date: 2.12.2017                Comprehensive Examination                MM: 45+75
**Close Book (1 hr)**

Q.1 Select the appropriate alternatives:   (1*15)

1.  Which is the image processing technique used to improve the quality of image for human viewing?
    a) compression b) enhancement c) restoration d) analysis
2.  Which technique is used for the images of the same scene are acquired from different viewpoints
    a) multi-view analysis b) multi-temporal analysis c) multi-sensor analysis d) image differencing
3.  Missing scan lines or stripes are the following type of noise
    a) Systematic   b) Random   c) Both   d) None
4.  Which kind of projection is suitable for given $\delta$ = 5.25° and Z = 7.25°
    a) Conical    b) Cylindrical   c) Azimuthal   d) None
5.  Basic steps for filtering in the frequency domain:
    a) Fourier transform  b) filter function  c) Inverse Fourier transform   d) all of these
6.  Gnomonic projection is a special class of:
    a) Azimuthal projection  b) Cylindrical projection  c) Conical projection  d) None of these
7.  CMYK stands as
    a) CMY + K where K stands for brown
    b) CMY + K where K stands for blue
    c) CMY + K where K stands for black
8.  Normal azimuthal projection is:
    a) Equal angle projection   b) Equal area projection   c) Conformal projection   d) All
9.  Seismic maps are the maps that preserve:
    a) area   b) shape   c) scale   d) All
10. Smoothening filters are used for:
    a) Blurring   b) Noise reduction   c) Edge detection   d) None of these
11. Image transformation such that all pixels get distributed equally in all the gray levels is:
    a) Histogram specification    b) Histogram matching    c) linear contrast stretching    d) Histogram equalization
12. The number of coefficients in a fourth order trend surface are:
    a) 10   b) 15   c) 18   d) 20
13. In a semivariogram $\gamma(h)$ the lag distance h from where there is a relation $d\gamma(h)/dh = 0$ is called
    a) range   b) sill   c) nugget    d) convergence
14. Which is the non parametric supervised image classification method
    a) Parallelepiped   b) Maximum likelihood   c) Linear discriminant   d) None of these
15. The number of color composites that can be formed using multispectral image of 7 bands
    a) 120  b) 180   c) 210   d) 110

Q.2 State whether the statements are true or false with reason: (1.5*10; carries 100% negative marking for wrong answer with wrong reason)

1. Frequency domain processing techniques are based on modifying the laplace transform of an image.
2. Restoration is an attempt to reconstruct or recover an image that has been degraded by using a priori knowledge of the degradation phenomenon.
3. Periodic noise in an image arises due to electrical or electromechanical interference during image compression.
4. Reclassification is the tool which requires effective percentage of the parameters.
5. The partial radiation due to scattered/diffused radiation entering the field of view of a remote sensor other than that from the required target increases the contrast of the image but reduces the sharpness.
6. Higher the relative variance, better the classification
7. Higher order polynomials trend surface with better fits may not be physically sensible
8. Theissen polygon method of interpolation is appropriate for gradually varying phenomenon
9. The lower left corner of the image is considered as the origin of the pixel coordinate system
10. Solar ephemeris provides the exact location of the sun at any given time of the day or year.

Q.3 Give the reasons/answer the following statements: (1*5)

1. An image after analog to digital conversion is not as clear as the original analog image.
2. Histogram of a brighter image has positive skewness.
3. Changing radiometric resolutions affect image interpretation.
4. What is spectral reflectance curve and what are its utilities in remote sensing?
5. Why a semivariogram is required in kriging method of interpolation

Q 4. Fill in the blanks: (10*1)

a) A small IFOV (instantaneous field of view) is desirable for high spatial detail.
b) Thermal Inertia is a measure of the response of a material to temperature changes.
c) Rayleigh scatter is one of the primary reason of haze in imagery.
d) Information from a set of classified rasters having certain weightage is obtained by weighted overlay.
e) There is no useful contribution to the interpolation if unvisited site from a data point is at a distance greater than the range
f) A rule of thumb suggests that possibly at least 50-100 data points are necessary to achieve a stable variogram
g) The trend surfaces are very susceptible to outliers in the data
h) Broad histograms reflect a scene with significant contrast
i) Clustering is a grouping of data with similar spectral characteristics

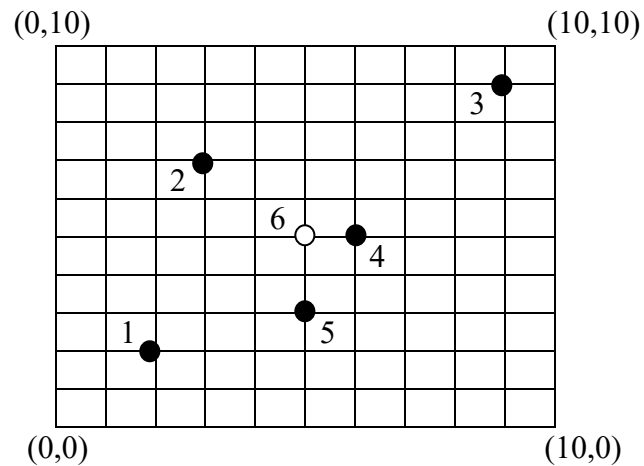**BIRLA INSTITUTE OF TECHNOLOGY & SCIENCE, PILANI (RAJ.)**

| **CE F431** | **Principles of Geographical System** | Duration: 0900-1200 Hrs. |
|---|---|---|
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**<u>Open Book (2 hrs)</u>**

1. Given a set of observed data (dark dots) and unknown data (empty dot) as tabulated and presented over a grid of 10*10.

| Points | (x,y) | Value |
|---|---|---|
| 1 | (2,2) | 3 |
| 2 | (3,7) | 4 |
| 3 | (9,9) | 2 |
| 4 | (6,5) | 4 |
| 5 | (5,3) | 6 |
| Unknown | (5,5) | ? |



Determine the interpolated value of the unknown point (blank circle) in the centre of the study area with respect to the known data values (dark circles) using:

a) IDW (inverse distance weighted) interpolation method. (assume r (exponent to distance) = 1)  (5)
b) Kriging interpolation method with respect to any **two most suitable** observed points in the above problem (exponential variogram with $c_0 = 2.5$, $c_1 = 7.5$ and a = 10.0)                    (10)

2. A person has to collect the samples of water from wells with the coordinates given in the following table. Presently he is at well A and his home is near well F. He is in a hurry to reach his home. So he thought to collect samples from the wells which will fall in the shortest route to his home. Identify the wells from where he would have collected the water samples. (assume radius of Earth =6371 Km)                    (15)

| Wells | Latitude | Longitude |
|---|---|---|
| A | 28.025 | 75.51 |
| B | 28.2 | 75.17778 |
| C | 27.875 | 75.63667 |
| D | 28.16389 | 75.25833 |
| E | 28.30278 | 75.625 |
| F | 28.04583 | 75.31667 |

3. It is required to transform a triangular object ABC placed in a cartesian coordinate system by rotating it by an angle of 30 degrees anticlockwise with respect to its leftmost corner and scaling it by double of its size. Its x,y coordinates are given as: A(2,0), B(5,1) and C(3,4). Derive the final coordinates for the corners of triangle.                    (5)

4. Rasterize the following vector given below mentioning the locations of pixels rasterized. Consider the bottom left cell as (0,0) and top right cell as (9,9). List the coordinates rasterized. Follow the incremental method. (5)
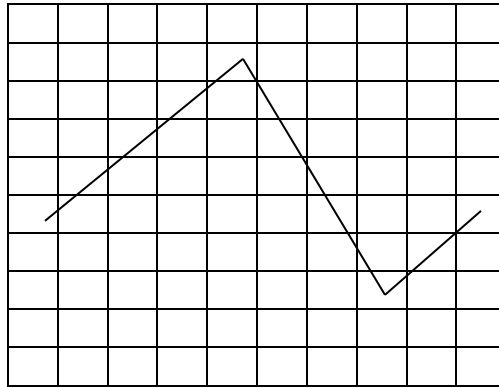


5. Convert the following raster image into vector. (10)
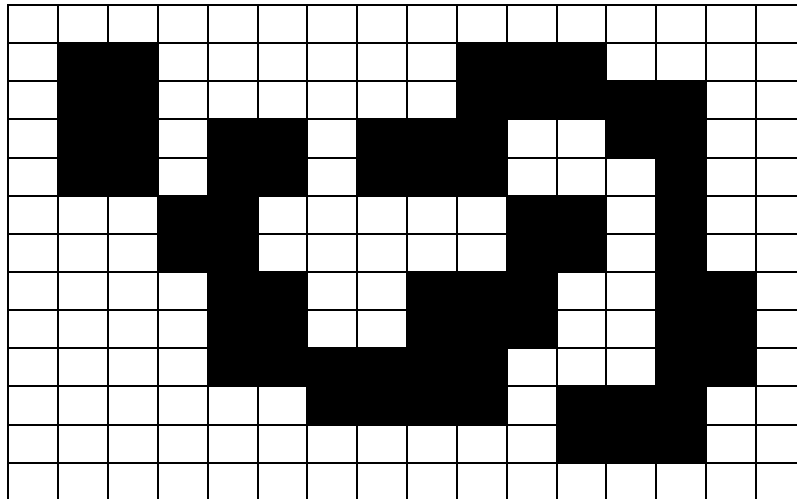


6. Using Douglas Pecker algorithm estimate the number of points in the curve to be connected by a polyline such that the threshold is not more than 2 cell as denoted in the following figure. You can use the graph paper where one block (1cmx1cm) can be taken as one cell. (10)
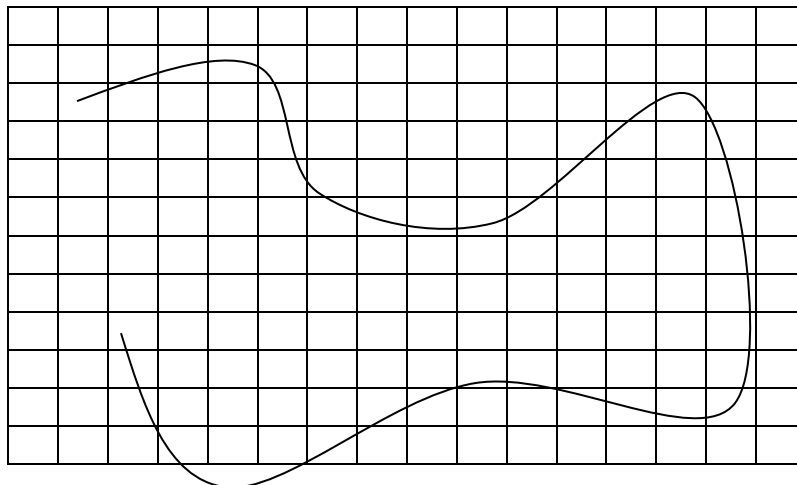
7. Obtain histogram equalization for the following image segment of size 5*5. Write the inference on image segment before and after equalization. (10)

| 20 | 20 | 20 | 18 | 16 |
|----|----|----|----|----|
| 15 | 15 | 16 | 18 | 15 |
| 15 | 15 | 19 | 15 | 17 |
| 16 | 17 | 19 | 18 | 16 |
| 20 | 18 | 17 | 20 | 15 |

8. Given the following confusion matrix:

| Category | A | B | C |
|----------|-----|-----|----|
| A | 125 | 12 | 8 |
| B | 21 | 210 | 9 |
| C | 16 | 11 | 95 |

Estimate the following quantities:
   a) The overall accuracy of the classification outcome
   b) The producer's accuracy for the three classes
   c) The user's accuracy for the three classes

(5)