Question No.(1) (10 Marks)

a) In a GIS project it is required to combine two raster data layers. The first layer is for landuse and the other one is for soil type. The following statement is executed by the software to create the output binary map \{newmap=iff((landuse="s") and (soil="c"), 1,0)}: What is the output data layer if the input data layers are as follows? What is the output data layer if we use the (or) operator instead of the (and) operator?

<table>
<thead>
<tr>
<th>Landuse</th>
<th>Soil</th>
</tr>
</thead>
<tbody>
<tr>
<td>s</td>
<td>c</td>
</tr>
<tr>
<td>a</td>
<td>f</td>
</tr>
<tr>
<td>a</td>
<td>f</td>
</tr>
</tbody>
</table>

(5 Marks)

b) Projection transformations from the globe to a plane introduce geometric distortions. Identify the different geometric distortions and their characteristics. (5 Marks)

Question No.(2) (15 Marks)

a) Discuss the relative strengths and weakness of raster and vector data structures in GIS. (5 Marks)

b) Outline the major features of a topological data structure and identify the advantages it provides relative to a ‘spaghetti’ data structure. (5 Marks)

c) In a GIS project, which has a certain working projection, you have a digital vector map with a plane coordinate system (X, Y). What are the required steps to convert the input vector map to the working projection? (5 Marks)

Question No.(3) (15 Marks)

Complete the following sentences

1- If the attribute value of the pixels for a 3-band image (band1, band 2, band 3), organized as Band Interleaved by Pixel (BIP) full raster data structure, is \(b, c, m, f, a, k, l, n, h, p, u, z\), then the pixels value for band 2 is..........................
2- ................. are mathematical expressions which transform the spherical earth to a flat map
3- A table represents a spatial object in the spaghetti vector data structure stores the following locational coordinates of vertices \{(5,8), (46,78), (90,80), (2,3)\}. This table represents............
4- A satellite image has an area of 100km²; the image has 1000 columns and 1000 rows. What is the resolution of the image? ............
5- To combine (overlay) two raster maps, both maps should have ............
6- If the attribute values of the pixels for a 2-band image (band1, band 2), organized as Band Interleaved by Line (BIL) full raster data structure, is \( (b, c, m, f, a, k, l, n, h, p, u, z) \), then the pixels value for band 2, assuming the number of columns of the image is two, is………………………………
7- In Spaghetti data structure, to answer this question (do polygon 1 share a common boundary line with polygon 2?) you should..........................
8- In the band interleaved by line (BIL) as a full raster structure, each row of pixels is repeated \( m \) times where \( m \) is ................. before moving to the next row.
9- In order to detect the details of the shape of a spatial object with an area of 400 m², the satellite image should have a resolution (pixel size) .................
10- ................. is a figure that is produced by rotating an ellipse about the minor axis
11- Depending on the shape of the developable surface, projections can be classified into ........................................ ..., ............
12- In the UTM coordinate system, the globe is divided into ........ UTM zones, numbered from west to east, starting from zone 1 at 180W.
13- The higher the resolution of an image, the ............... the size of the pixel.
14- Through ................. we calculate the parameters used in the equation to transform between a coordinate system and cell (pixel) location in the image
15- In the band interleaved by pixel (BIP) as a full raster structure, the band values for each pixel are stored together, so for a \( n \) band image the first \( n \) values refer to ...............