

**E1 - SPATIAL DATABASES  
& LAND INFORMATION SYSTEMS**

**October 2015**

Although programmable calculators may be used, candidates must show all formulae used, the substitution of values into them, and any intermediate values to 2 more significant figures than warranted for the answer. Otherwise, full marks may not be awarded even though the answer is numerically correct.

**Note:** This examination consists of 10 questions on 4 pages.

Q. No

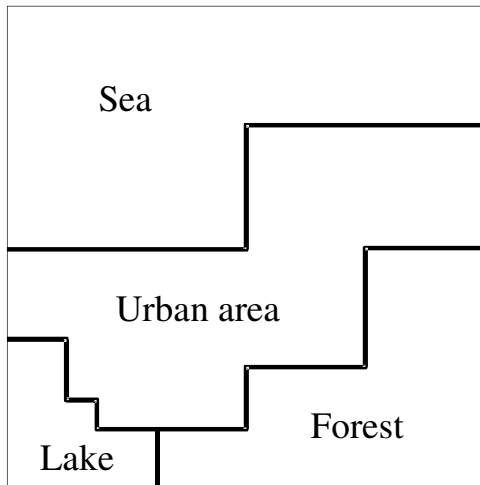
Time: 3 hours

Marks

Value   Earned

<p>1.</p>	<p>Database design is the process of producing a detailed data model of a database. The process of doing database design generally consists of a number of steps which will be carried out by the engineer. The steps are usually grouped in terms of the type of the database design at hand, i.e. Conceptual Design (CD), Logical Design (LD) and Physical Design (PD). Identify the type of the database design the following steps belong to:</p> <ol style="list-style-type: none"> <li>Decision about how real-world objects and relationships will be represented in a spatial database. For example, should a city be represented as an area or a point?</li> <li>Selection of spatial objects (points, lines, areas, raster cells).</li> <li>Determine what type of database management system should be used.</li> <li>Determine how files will be structured for access from the disk.</li> <li>Specify the types of information used by various functions.</li> <li>Specify accessing capabilities.</li> <li>Develop an ER model with integrity constraints.</li> <li>Specify the data elements, data types, and indexing options.</li> <li>Work interactively with users.</li> <li>Build the metadata.</li> </ol>	<p>10</p>	
<p>2.</p>	<p>The following UML class diagram conceptually describes the OGC Geometry Schema. In this diagram, three different types of relationships between classes have been used. Identify these relationships and explain their main functions.</p>	<p>2.5 2.5 2.5</p>	

Given the land use map below:



3.

Represent its raster image using a quadtree data indexing structure.

s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
s	s	s	s	s	s	s	s	s	s	s	s	s	s	s
s	s	s	s	s	s	s	s	u	u	u	u	u	u	u
s	s	s	s	s	s	s	s	u	u	u	u	u	u	u
s	s	s	s	s	s	s	s	u	u	u	u	u	u	u
s	s	s	s	s	s	s	s	u	u	u	u	u	u	u
u	u	u	u	u	u	u	u	u	u	u	f	f	f	f
u	u	u	u	u	u	u	u	u	u	u	f	f	f	f
u	u	u	u	u	u	u	u	u	u	u	f	f	f	f
l	l	u	u	u	u	u	u	u	u	u	f	f	f	f
l	l	u	u	u	u	u	u	f	f	f	f	f	f	f
l	l	l	u	u	u	u	u	f	f	f	f	f	f	f
l	l	l	l	l	f	f	f	f	f	f	f	f	f	f
l	l	l	l	l	f	f	f	f	f	f	f	f	f	f

10

4.	<p>Compare the various spatial database models for elevation data. Which ones would you expect to be best for:</p> <ul style="list-style-type: none"> <li>a) landscape dominated by fluvial erosion and dendritic drainage patterns;</li> <li>b) a glaciated landscape;</li> <li>c) a map of population density for Canada?</li> </ul>	5 5 5	
5.	<p>Explain how and what type of data (e.g. sensor data, cadastral data, etc.) can be stored in the following database types:</p> <ul style="list-style-type: none"> <li>a) Graph database</li> <li>b) Relational database</li> <li>c) Object oriented database</li> </ul> <p>Describe what are the main advantages and limitations of each one.</p>	2.5 2.5 2.5	
6.	<p>Compare and contrast the following pairs:</p> <ul style="list-style-type: none"> <li>a) object-oriented data model and relational data model</li> <li>b) Spatial functions and spatial constraints</li> <li>c) Spatial SQL and NoSQL</li> </ul>	2.5 2.5 2.5	
7.	<p>Layers or levels in a GIS cannot be used to (choose one):</p> <ul style="list-style-type: none"> <li>- Group related geographic features by function</li> <li>- Isolate point, line, and area features</li> <li>- Develop thematic maps</li> <li>- Combine non-spatial and attribute information</li> <li>- Highlight logical relationships among geographic features</li> </ul> <p>Explain why.</p>	10	
8.	<p>How is a spatial database different from a Land Information System? Give three functionalities of a spatial database and three functionalities of a Land Information System.</p>	10	

9.	Select the correct answers to the following questions:													
	a) How is the HAVING clause used?	2.5												
	b) What does the SQL BETWEEN operator specify?	2.5												
	c) What SQL statement selects the total number of parcels from the owner table below?	2.5												
	<table border="1"> <thead> <tr> <th>ParcelNumber</th> <th>Date</th> <th>OwnerID</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>12/12/2010</td> <td>13</td> </tr> <tr> <td>2</td> <td>13/12/1999</td> <td>17</td> </tr> <tr> <td>3</td> <td>27/05/1930</td> <td>21</td> </tr> </tbody> </table>	ParcelNumber	Date	OwnerID	1	12/12/2010	13	2	13/12/1999	17	3	27/05/1930	21	2.5
ParcelNumber	Date	OwnerID												
1	12/12/2010	13												
2	13/12/1999	17												
3	27/05/1930	21												
d) What follows after the SQL WHERE clause?	2.5													
e) What are primary - foreign key relations used for?	2.5													
10.	Give three reasons why "user" or "organizational" considerations may prove a factor in the success or failure of land information systems?	10												
	<b>TOTAL</b>	<b>100</b>												