07.01.20

14.00 - 16.00pm

CMPU 4032 Geographical Info Systems

Courtyard, Aungier Street

Programme Code: TU060
Module Code: CMPU 4032
CRN: 24057

TECHNOLOGICAL UNIVERSITY DUBLIN

KEVIN STREET CAMPUS

MSc. in Computing (Part-Time)

Year 2

SEMESTER 1 EXAMINATIONS 2019/20

Geographic Information Systems

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Dr. Deirdre Lillis

Two Hours

Answer ***three*** questions.
All questions carry equal marks.
One complimentary mark shall be awarded for a maximum of 100.

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1. (a) The *geographic coordinate system* is the reference system, defined by latitude and longitude, for locating features on the Earth's surface. Comment on the practical difficulties with using a single geographic coordinate system as a global reference.

(9 marks)

(b) What problem or problems do *projected* coordinate reference systems attempt to solve? Describe, in general terms, how projected coordinate systems work and the compromises inherent in their use.

(9 marks)

(c) What is the relationship, if any, between *geographic* coordinate systems and *projected* coordinate systems?

(5 marks)

(d) When considering a projected coordinate system such as *Irish Grid* or *Irish Transverse Mercator*, what do the following terms describe?

- scale factor
- central meridian
- longitude of central meridian
- latitude of origin (or central parallel)
- false easting & false northing

(5 marks)

(e) If I have a spatial dataset in the *ESRI Shapefile* format, where might I find the coordinate reference information? How will this be described?

(5 marks)

2. (a) Briefly describe the OGC *Simple Feature for SQL (SFS)* Model.

(5 marks)

(b) Explain, with examples, the significance of the *Dimensionally Extended 9-Intersection Model* (DE9IM) in spatial analysis.

(8 marks)

(c) Explain the concepts of *dimensionality*, *interior*, *boundary* and *exterior* in the context of the DE9-IM. How might this apply to geometries of different dimensions?

(8 marks)

(d) For each of the PostGIS queries below, interpret the result and describe what it means using a DE9-IM matrix.

```
SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'),
ST_Buffer(ST_GeometryFromText('POINT(1 2)'),2));
st_relate
-----------
0FFFFF212

SELECT ST_Relate(ST_GeometryFromText('LINESTRING(1 2, 3 4)'),
ST_GeometryFromText('LINESTRING(5 6, 7 8)'));
st_relate
-----------
FF1FF0102


SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'),
ST_Buffer(ST_GeometryFromText('POINT(1 2)'),2), '0FFFFF212');
st_relate
-----------
t

SELECT ST_Relate(ST_GeometryFromText('POINT(1 2)'),
ST_Buffer(ST_GeometryFromText('POINT(1 2)'),2), '*FF*FF212');
st_relate
-----------
t
```

(12 marks)

3. (a) Explain the notion of *Spatial Interpolation*. Discuss *Inverse Distance Weighting* (IDW) as a method of spatial interpolation. Your answer should highlight the pros and cons of this method.

(8 marks)

(b) Describe the usefulness of *slope* and *aspect* measures from a *Digital Elevation Model* (DEM). How are these calculated?

(8 marks)

(c) What is meant by *Viewshed Analysis*? Under what circumstances would this be useful? How is it calculated?

(7 marks)

(d) Briefly describe the following types of spatial analysis:

(i) Queries and reasoning
(ii) Measurements
(iii) Transformations
(iv) Descriptive summaries
(v) Optimization techniques

(10 marks)

4. (a) When we conceptualize geographic data we talk of *discrete objects* and *continuous fields*. Describe what these terms mean and discuss their implications for representing spatial data in a computer.

(11 marks)

(b) Describe the **Open Geospatial Consortium** (OGC) *Simple Features for SQL* (SFS) Model.

(11 marks)

(c) Describe the importance of *topology* in GIS. What are the advantages and disadvantages of topologically structured data as opposed to simple features data?

(11 marks)