GIST 4302/5302 Exam I

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Name:_____ **R#:**_____

Note: This exam is **OPEN BOOK/NOTES**, but does not allow electronic devices (computer/smartphone/tablet) access. The exam allows you to use **60 minutes**, within which you are required to answer the following set of questions. The total maximum score of this exam is **100**. Please read the questions **CAREFULLY** before you start to write your answers. Please make sure that your handwriting is **LEGIBLE**, and use the back if you more space for writing. Good luck! ♣

1. Given two locations, A and B, on a map with Mercator project, the straight line connecting A and B on this map will always represent the shortest path between these two points in practice. Is it true? (4 points)

   (a) True
   (b) False

2. What is the approximate accuracy on the ground of a latitude expressed to 3 decimal places, e.g. 100.589°? (4 points)

   (a) 100km
   (b) 10km
   (c) 1km
   (d) 100m

3. Which of the following types of geographic data is <u>least</u> suited to an object-based (or vector) representation? (4 points)

   (a) The locations of automobiles in Lubbock, TX
   (b) The locations of Texas Road House stores in Lubbock, TX
   (c) A topography (elevation) map of Lubbock, TX
   (d) A map showing the locations of major US cities

4. A public-health study is looking at possible relationships between obesity and access to fast food in a large city. Two maps are created in a relational model. The first describes a sample of 20,000 individuals, with attributes of name, residence lat/long, and body-mass index. The second describes each of the city's census tracts, and includes attributes of the tract population and the number of fast-food outlets in the tract. To carry out the analysis it is necessary to combine the two tables into one, giving for each census tract the average body-mass index of sampled residents of that tract, and the number of fast-food outlets per capita. The task of combining the two tables is known as: (4 points)

   (a) Inheritance
   (b) Encapsulation

(c) Multiplicity

(d) Overlay/spatial join

5. In the preceding question (question 4), the conclusion on the relationships between the obesity and access to fast food in the city will depend on the boundary of the census tracks. In other words, if we change the boundary of the census tracks, the conclusion on the relationships between the obesity and access to fast food might be different. Is it true? (4 points)

   (a) True

   (b) False

6. Figure 6 shows the locations of bear sightings in Alaska with each cross indicating the location of an bear sighting. Which of the following GIS tools can be used to describe the minimum polygon that covers all the locations? (4 points)

   (a) Voronoi digram

   (b) Convex hull

   (c) Point in polygon

   (d) None of the above

Figure 1: Locations of bear sightings in Alaska; each cross indicates the location of an bear sighting.

7. At 08:02 AM on April 20, 2013 (Beijing time), a deadly earthquake (magnitude 7.0) hit Ya'An in Sichuan province, a southern west area of China, and has resulted in 186 people dead, 24 missing, at least 11,826 injured with more than 968 seriously injured as of 5pm on April 20 (Beijing time). It has been reported that the earthquake has caused cracks on dams of some reservoirs in that area, which, if not fixed timely, could lead to another potential disasters. Suppose we know the geographic coordinates of the epicenter and its damage radius, and have access to the locations of water body of Sichuan. Which of the following GIS operations could helpful to identify the possibly affected dams? (4 points)

   (a) Convex hull

   (b) Voronoi digram

   (c) Spatial query

   (d) None of the above

Arc ID	Right Area	Left Area	Start Node	End Node
1	A	X	1	2
2	C	X	2	4
3	X	B	1	4
4	A	C	2	3
5	A	B	3	1
6	B	C	3	4

Table 1: A table of topological relations in a spatial dataset

8. Table 1 describes topological relations (NAA representations) of a vector dataset. In what order do the arcs occur in a clockwise direction around Polygon A? (4 points)

   (a) 5,1,4

   (b) 5,4,1

   (c) 1,2,3

   (d) 1,3,2

9. Which of the following can be used to represent a phenomenon conceptualized as a continuous field (e.g., elevation, precipitation)? (4 points; multiple correct answers)

   (a) A collection of contours digitized as polylines

   (b) A raster

   (c) A triangulated irregular network

   (d) A collection of points with height values

10. John Snow produced a famous map in 1854 showing the deaths caused by a cholera outbreak in London (see Figure 2 in the next page), and the locations of water pumps in the area. He suspected that the cholera deaths might be related to the drinking water from the pumps, since there is a significant clustering of death around a certain pump. Which of the following could be used to help further verify his conjecture? (4 points)

    (a) Triangulation of the pumps

    (b) Voronoi diagram of the pumps

    (c) Convex hull of the pumps

    (d) None of the above

Figure 2: John Snow's cholera map; gray dots represent the deaths and black stars represent the water pumps.

11. Please explain what Tobler's first law of geography is about and its possible implications in the context of GIS and spatial analysis. (15 points)

12. Given a gridded elevation dataset, please describe the steps taken to extract the possible stream networks, and also please explain the possible factors that affecting the stream network results. (15 points)

13. Please explain what *geocoding* is and explain the possible factors that affect the accuracy of the geocoding results. (15 points)

14. Suppose our class are invited to an elementary school of Lubbock to introduce the students about GIS, and you are assigned to talk about the concept of *Voronoi diagram* (a.k.a. Thiessen polygons). How would you plan to explain this Voronoi diagram to your audience (please note that most of the students are $\sim$ 10 years old kids)? (15 points)