

# 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. Also, please make sure that your handwriting is **LEGIBLE**. 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. Suppose a group of student was asked to measure the length of the coastline of the state of Texas. Which one of the following would you think best approximate their measurements (4 points)
  - (a) 600km
  - (b) 6000km
  - (c) 9000km
  - (d) None of the above; the length really depends on the scale used to conduct the measurement.
4. Which of the following types of geographic data is least suited to an object-based 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
5. 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) Overlay/spatial join
  - (d) Multiplicity
6. When coverage is digitized, all boundaries are first captured as polylines or “spaghetti”. These are then analyzed by the computer, to close gaps, remove overshoots, form closed polygons and build the spatial adjacency. This operation is termed: (4 points)
- (a) Cooking the noodles
  - (b) Pancaking
  - (c) Building topology
  - (d) Dumpling
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 also 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 coordinate of the epicenter and its damage radius, and have access to the locations of land cover (e.g. water body) of Sichuan. Which of the following GIS operations could be involved to help identify the possibly affected dams? (4 points; multiple correct answers)
- (a) Buffer
  - (b) Geocoding
  - (c) Point in polygon
  - (d) Convex hull
8. The following table (see 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)

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

- (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 1), 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 1: 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. (20 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. (20 points)

13. 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)? (20 points)