Quiz

CSC222 Geographic Information Systems

05 November 2014

1. Where is the Near East? the Middle East? the Far East? Do these terms make sense?

2. Limited access to the open ocean or a position on a crossroads are among the geographic circumstances that can shape the history and help determine the wealth of a nation.

   Give an example. Identify a nation. Describe its geographic circumstances.

3. In the following formula...

   - The *diameter* denotes the size of the mirror, lens, or antenna on an imaging instrument.

   - The *wavelength* is the wavelength of the electromagnetic radiation that the mirror, lens, or antenna focuses. Visible light, infrared light, ultraviolet light, and microwaves are all forms of electromagnetic radiation. The wavelength of microwaves is greater than the wavelength of infrared light, which is in turn greater than the wavelength of red light, which in turn is greater than the wavelength of blue light.

   - The *distance* is the distance from the instrument to the subject—for example, it could be the distance from a camera on a satellite to the earth below.

   - The *size* is the size of the smallest feature that can the imaging instrument can register—for example, this might be the size of the smallest crater that can be seen through a camera on a satellite that orbits the moon.

$$1.22 \cdot \frac{wavelength}{diameter} \cdot distance = size$$

   (a) How does increasing the diameter of the antenna, lens, or mirror affect size of the smallest object that can be seen?

(b) How does a choice to swap a camera that forms an image with visible light (short wavelength) for a radar that forms an image with microwaves (long wavelength) affect the size of the smallest object that can be seen?

4. Your retina is the part of your eye on which the lens focuses an image. It contains three kinds of cone cells. One kind is most sensitive to red light, one is most sensitive to green light, and the third kind of cone cell is most sensitive to blue light. Each kind of cone is sensitive to light in a range of wavelengths. The cones that are most sensitive to red, for example, respond not to a single kind of red but to a band of reds. Your eye and brain perceive color by combining measurements of the brightness in the three bands (red, green, and blue).

Some remote sensing instruments can register that brightness of light in each of dozens or even hundreds of bands. By combining information about the brightness from these many bands, the instrument can provide information about the health of crops and forests and the chemical composition of soils and rocks.

The number of bands on which the instrument measures brightness is a measure of what kind of resolution?

5. Suppose that a satellite passes over the same point on the earth every n days. The number n is a measure of what kind of resolution?

6. Imagine a book that contains one thousand pages, but only a single sentence in a single paragraph in a single chapter that runs from page 1 to page 1000. Certainly such a book would be much harder to read than a book that is divided into chapters, paragraphs, and sentences. It would also be harder to write!

Software engineers have learned the importance of dividing their programs into sections. The prevailing discipline requires programmers to bundle together related data with methods for operating on that data. It furthermore asks them to define relationships among these objects.

- Simple, small classes can be assembled to make larger and more complex class. This is called "aggregation." In this way, a programmer can reuse work.

- More general units can be refined to make more specialized ones. This is called "inheritance." The programmer only has to write the parts of the specialized class that distinguishes it from the more general class.

- The software that runs the program can automatically determine an object's type and execute the appropriate version of a method. This is called "polymorphism." The programmer can store objects that belong to related class in a list and let the software keep track of

the objects' types. This automation of the bookkeeping increases the productivity of programmers and reduces the opportunities for error.

What is the name for this programming discipline?

7. For thirty years, the most common way of organizing, storing, and retrieving data has put that data into tables. Our geographic information systems uses a database of this type.

- Each row in a table is a record—it contains information about a single object such as a hospital in California.
- Each column contains attributes of a single kind—for example, one column, might contain the names of the hospitals in a California.

To retrieve information from such a database, we used the Structured Query Language (SQL). For example, we can SELECT specified attributes FROM specified tables WHERE those attributes have specified values.

What is the name of this kind of database?

8. Advances in technology have it possible and practical to collect huge amounts of data. This has prompted the invention of new kinds of databases and database management systems. People now speak of NoSQL databases. The new systems allow enormous sets of divided to be divided among many machines. They allow queries to be divided and run in parallel on the many machines. Each machine produces a partial result. The system then collects the partial results to construct and format a final result. This process is called Map/Reduce. The division the problem into pieces and the distribution of those pieces is the "Map" part of Map/Reduce. The gathering together of partial results is the "Reduce" part of Map/Reduce.

All of this is part of a development called "Big Data" that is getting a lot of attention. The characteristics of Big Data are volume, variety, and velocity.

(a) What is volume?
(b) What is variety?
(c) What is velocity?