# Arizona State University (ASU) GIS205 Geographic Information Science I Final Practice Exam (Sample)

Study Guide

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# Questions

1. Which technology uses laser beams to create elevation models?

   A. RADAR

   B. Photogrammetry

   C. LIDAR (Light Detection and Ranging)

   D. GIS

2. What type of composition does a true color composite image seek to depict?

   A. The exact colors perceived by the human eye

   B. A grayscale representation of components

   C. Colors that represent thermal data

   D. A standard pattern of bands

3. What notable features does the WorldView-3 satellite have?

   A. Multispectral and panchromatic sensors

   B. Shortwave infrared and panchromatic sensors

   C. Multispectral, shortwave infrared, and CAVIS bands

   D. Only a panchromatic sensor

4. What differentiates a vertical photo from an oblique photo?

   A. A vertical photo is taken from a greater altitude

   B. A vertical photo has the camera looking directly down

   C. Vertical photos are always in color

   D. Oblique photos capture less detail

5. Which term describes the measurement unit that is one billionth of a meter?

   A. Millimeter

   B. Micrometer

   C. Picometer

   D. Nanometer

6. In geospatial modeling, what does a 2.5D model refer to?

A. A model that allows multiple z-values at each coordinate

B. A terrain model with a single z-value assigned to each x/y coordinate

C. A two-dimensional graphical representation of elevation

D. A model solely representing vertical features

7. How is spectral reflectance defined?

A. The amount of energy absorbed by a surface

B. The total incident energy reflected from a surface

C. The percentage of the total incident energy reflected from that surface

D. The energy emitted from a surface in infrared

8. Which GNSS technology is developed for civil aviation?

A. NDGPS

B. WAAS

C. EGNOS

D. MSAS

9. Which scanning method is characterized by transferring data along the spacecraft's trajectory?

A. Multispectral scanning

B. Along-track scanning

C. Across-track scanning

D. Hyperspectral scanning

10. What is a color composite in image processing?

A. An image in black and white

B. An image formed by combining the red, green, and blue bands

C. An image with only one color band

D. A measure of image resolution

# Answers

1. C
2. A
3. C
4. B
5. D
6. B
7. C
8. B
9. B
10. B

# Explanations

1. Which technology uses laser beams to create elevation models?

A. RADAR

B. Photogrammetry

C. LIDAR (Light Detection and Ranging)

D. GIS

LIDAR (Light Detection and Ranging) is a remote sensing technology that uses laser pulses to measure distances and generate detailed elevation models of the Earth's surface. The process involves emitting laser beams from an aircraft or ground-based system, which then bounce off objects and return to the sensor. By calculating the time it takes for the laser light to return, LIDAR can accurately determine the distance to the objects, allowing for the creation of high-resolution 3D models of topography and features like vegetation and buildings. This ability to provide precise elevation data makes LIDAR particularly useful in various applications, including mapping, forestry, urban planning, and environmental monitoring. The technology excels in penetrating vegetation to reveal the ground surface, creating digital elevation models that are much more detailed than those obtained through traditional surveying methods. In contrast, RADAR uses radio waves and is better suited for different applications such as weather observation or aircraft navigation, while photogrammetry relies on photographs to create measurements and models rather than direct distance measurements. Geographic Information Systems (GIS) is a framework for managing and analyzing spatial data but does not, itself, collect elevation information directly. LIDAR stands out for its specialized capability in generating detailed and accurate elevation models.

2. What type of composition does a true color composite image seek to depict?

A. The exact colors perceived by the human eye

B. A grayscale representation of components

C. Colors that represent thermal data

D. A standard pattern of bands

A true color composite image is designed to reflect the exact colors that an observer would perceive with the naked eye when looking at a scene. This type of image typically uses data from three specific bands of the electromagnetic spectrum: red, green, and blue. These bands correspond closely to the colors that humans see and are combined in a way that produces a natural-looking representation of the environment. For example, in satellite imagery or aerial photography, true color composites help in visualizing landscapes, vegetation, urban areas, and water bodies in colors that are familiar to us, enhancing the interpretability of the imagery for analysis or presentation. Other options describe different types of imagery or data representations that do not aim to replicate human visual perception. Grayscale representations would depict intensity values rather than color. Colors representing thermal data refer to images that use different wavelengths related to thermal infrared, which are not visible to the human eye. Similarly, a standard pattern of bands is more about the organization of spectral data than about recreating the visual experience.

3. What notable features does the WorldView-3 satellite have?

A. Multispectral and panchromatic sensors

B. Shortwave infrared and panchromatic sensors

C. Multispectral, shortwave infrared, and CAVIS bands

D. Only a panchromatic sensor

The WorldView-3 satellite is equipped with advanced sensors that enhance its capabilities for various applications in remote sensing and geospatial analysis. The correct answer highlights that it contains multispectral, shortwave infrared, and CAVIS bands, which significantly contribute to its functionality. Multispectral sensors can capture data at different wavelengths across the electromagnetic spectrum, allowing for detailed analysis of land cover, vegetation health, and soil properties. The addition of shortwave infrared bands enables the satellite to provide insights into water content in vegetation, soil, and rocks, which is crucial for environmental monitoring and resource management. Furthermore, the inclusion of the CAVIS (Clouds, Aerosols, Vapor, Ice, and Snow) bands allows for enhanced atmospheric correction and the provision of more accurate surface reflectance data, helping researchers and policymakers make well-informed decisions based on the satellite's observations. In summary, the combination of these diverse sensors makes WorldView-3 a powerful tool in satellite imaging, capable of providing a comprehensive view of Earth's surface under varying conditions, which is essential for a wide range of scientific and practical applications.

4. What differentiates a vertical photo from an oblique photo?

A. A vertical photo is taken from a greater altitude

B. A vertical photo has the camera looking directly down

C. Vertical photos are always in color

D. Oblique photos capture less detail

A vertical photo is characterized by the camera being positioned directly above the subject, looking straight down towards the ground. This perspective provides a true representation of the area's layout and features, making it particularly useful for mapping and analysis in geographic information systems (GIS). Because the camera is oriented vertically, it captures a perspective that minimizes distortion of the landscape, helping in the accurate measurement of distance and area. This direct overhead view contrasts with oblique photos, which are taken at an angle, either from the side or above but not directly over the subject. The oblique perspective can introduce distortion, making features appear larger or smaller depending on their distance from the camera. It is useful for visual representation and aesthetic appeal but complicates tasks that require precise measurements. In terms of color, vertical photos are not inherently required to be in color; they can be grayscale or monochrome as well, making the choice about color irrelevant in differentiating between vertical and oblique photos. Additionally, the altitude at which a photo is taken does not determine its classification as vertical or oblique; vertical photos can be taken from various altitudes. The amount of detail captured in oblique photos does not inherently make them less effective for analysis but instead presents the features from a different viewpoint.

5. Which term describes the measurement unit that is one billionth of a meter?

A. Millimeter

B. Micrometer

C. Picometer

D. Nanometer

The term that describes the measurement unit that is one billionth of a meter is a nanometer. The nanometer is commonly used in scientific fields, particularly in nanotechnology, to measure things at an atomic or molecular scale. To put it in context, one nanometer equals $10^{-9}$ meters, making it extremely useful for characterizing the size of nanoparticles, biomolecules, and other structures that are not visible to the naked eye. In contrast, a millimeter is $10^{-3}$ meters, a micrometer is $10^{-6}$ meters, and a picometer is $10^{-12}$ meters. Each of these units represents a different scale of measurement, and understanding their differences is crucial in various scientific and technical applications. The distinction helps clarify why the nanometer is specifically defined as one billionth of a meter.

6. In geospatial modeling, what does a 2.5D model refer to?

A. A model that allows multiple z-values at each coordinate

B. A terrain model with a single z-value assigned to each x/y coordinate

C. A two-dimensional graphical representation of elevation

D. A model solely representing vertical features

In geospatial modeling, a 2.5D model specifically refers to a terrain model where each x/y coordinate is associated with a single z-value. This means that while the model represents a surface in three-dimensional space, it does not allow for vertical complexity at each point; rather, it maintains a single elevation value for each horizontal location. This approach effectively simplifies the representation of terrain, such as in digital elevation models, where the focus is on the height above a reference plane (like sea level) without accommodating features like overhanging cliffs or multi-level structures. The other options suggest different interpretations of 2.5D. One mentions multiple z-values, which would imply a more complex, true 3D model, while another describes a purely two-dimensional representation that does not capture elevation at all. The mention of vertical features only addresses a specific type of data representation and does not align with the standard definition of a 2.5D model, which is fundamentally concerned with a unidimensional elevation format integrated into a 2D spatial framework.

7. How is spectral reflectance defined?

A. The amount of energy absorbed by a surface

B. The total incident energy reflected from a surface

C. The percentage of the total incident energy reflected from that surface

D. The energy emitted from a surface in infrared

Spectral reflectance is defined as the percentage of the total incident energy reflected from a surface at specific wavelengths. This measure is crucial in remote sensing and environmental science, as it helps characterize how different materials interact with light. By understanding spectral reflectance, scientists and researchers can analyze various surfaces, such as vegetation, soil, or water, to determine their properties, health, and even identify different materials. In this context, the concept of spectral reflectance is specifically tied to the ratio of reflected energy to incident energy, expressed as a percentage. This means if a surface reflects a certain amount of light that falls on it, spectral reflectance enables us to quantify that proportion relative to the total light available. Accurately knowing this percentage is vital for tasks such as creating accurate land cover classifications or monitoring environmental changes over time.

8. Which GNSS technology is developed for civil aviation?

A. NDGPS

B. WAAS

C. EGNOS

D. MSAS

The correct choice is WAAS, which stands for Wide Area Augmentation System. This technology was specifically developed to enhance the accuracy, integrity, and availability of GPS signals for civil aviation in North America. WAAS uses a network of ground reference stations that monitor GPS signals, correct for errors, and send this information to satellites, which then broadcast the augmented signals back to users. This is crucial for improving the precision of aircraft navigation, particularly for approaches and landings at airports, thereby increasing safety in aviation operations. WAAS is part of a larger effort to improve GPS reliability for aviation purposes and has been instrumental in allowing for precision approaches in locations where traditional ground-based navigation aids may not be available. While other technologies like NDGPS (National Differential GPS), EGNOS (European Geostationary Navigation Overlay Service), and MSAS (Multi-functional Satellite Augmentation System) also support various applications, WAAS specifically focuses on meeting the stringent standards required for civil aviation in the U.S. and has been integrated into various navigation systems utilized by pilots.

9. Which scanning method is characterized by transferring data along the spacecraft's trajectory?

A. Multispectral scanning

B. Along-track scanning

C. Across-track scanning

D. Hyperspectral scanning

The scanning method that is characterized by transferring data along the spacecraft's trajectory is along-track scanning. This approach involves sensors collecting data in a direction parallel to the movement of the sensor, which allows for continuous coverage of the area being observed as the spacecraft travels. In this method, the data collection occurs in strips that follow the path of the satellite, enabling efficient mapping of large areas. It contrasts with other scanning techniques, such as across-track scanning, which collects data perpendicular to the direction of movement and may involve moving the sensor or mirror to cover different areas. By focusing on the trajectory, along-track scanning can achieve high data return rates and is favorable for applications that require monitoring changes over time, such as environmental studies or agriculture. Overall, along-track scanning is essential for producing detailed images and mappings aligned with the spacecraft's trajectory, making it a critical method in remote sensing.

10. What is a color composite in image processing?

A. An image in black and white

B. An image formed by combining the red, green, and blue bands

C. An image with only one color band

D. A measure of image resolution

A color composite in image processing refers to an image created by merging the red, green, and blue (RGB) bands of a digital image. Each of these bands corresponds to a specific range of wavelengths in the visible spectrum. By combining these three color bands appropriately, one can produce a full-color image that represents a scene in a way that is similar to how the human eye perceives color. This process involves assigning each color band to its respective channel in the image: the red band contributes to the red hues, the green band contributes to the green hues, and the blue band contributes to the blue hues. Through varying the intensity of these colors, a comprehensive image can be obtained that maintains the nuances of colors found in the original scene. In contrast, an image in black and white lacks the dimensionality of color and would not be classified as a color composite. Similarly, an image with only one color band does not provide a full representation of color and thus does not meet the definition of a color composite. A measure of image resolution relates to the detail and clarity of an image rather than its color composition, and therefore it does not pertain to the definition of a color composite image.