

Midterm #2: Version A

ENGR 180, Fall 2022

Your Name: _____ Your Section (circle one): Thurs/Fri

This exam is to be completed in class or equivalent. Please skim through the full exam prior to beginning. Please raise your hand and remain seated if you have any questions. Your TA will be available to respond to general questions but will not be able to help/offer specific guidance. You are welcome to use a calculator (NOT phones).

The exam will end at 4:15pm.

There are 25 mixed-variety questions and one extra credit question. Points per question are noted at the end of each question/prompt. 120 points total.

Section 1: Multiple Choice

Circle the letter which corresponds to the correct response. 3 points per correct response, 15 points total.

1. Digital remote sensing data are stored in various file formats as a...
 - a. BLOB
 - b. Matrix
 - c. Vector
 - d. Hyperspectral
2. In object-based image analysis (OBIA), you can classify features based on...Circle all that apply.
 - a. Shape
 - b. Engineering Firm
 - c. Color
 - d. Texture
 - e. Year Built
3. Spatial Resolution...
 - a. Is the size of wavelength recorded on a sensor
 - b. Measures the smallest discernible detail detected in an image
 - c. Measures of a sensor's ability to distinguish between two objects of similar reflectance
 - d. Is consistent across all remote sensing platforms
4. You Are planning field data collection. What sampling patterns could you use? Select any/all that apply.

- a. Random
 - b. Systematic
 - c. Tobler
 - d. Cluster
 - e. Adaptive
5. Which of the following Remote Sensing Systems categorizations has the highest number of bands?
- a. Ultraspectral
 - b. Multispectral
 - c. Hyperspectral
 - d. Gigaspectral

Section 2: True or False?

Circle the letter corresponding to the correct response. **3 points per correct response, 12 points total**

6. T/ F: Supervised data classification requires a priori knowledge of classes present in imagery
7. T/ F: Laser used in LIDAR remote sensing is multichromatic
8. T/ F: NDVI is calculated using red and far infrared bands.
9. T/ F: Cringing is a valid way to convert point data to a raster surface.

Section 3: Fill in the Blanks

Write-in the correct response into the blank, underlined spaces. illegible responses will not receive points

10. The brightness values of an 8-bit image ranges from its lowest 0 ; black (number corresponding color) to its highest at 255 ; white (number; corresponding color).

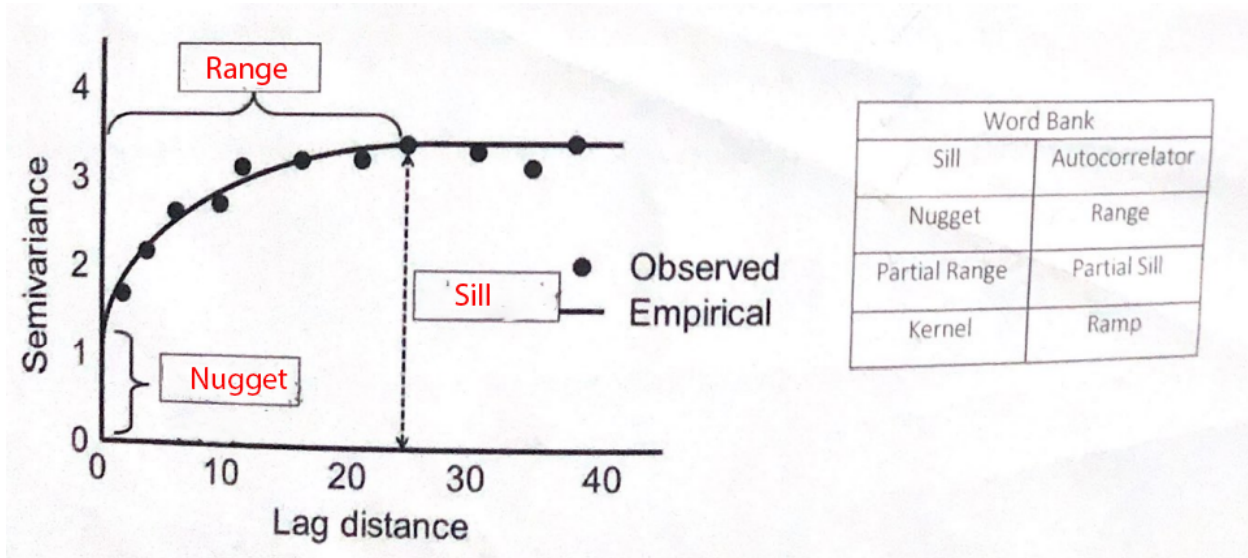
2 points per pair, 4 points total

11. In order to utilize structure from motion successfully, you need ae values for your inertial measurement unit's (IMU) orientation; roll , pitch and yaw .

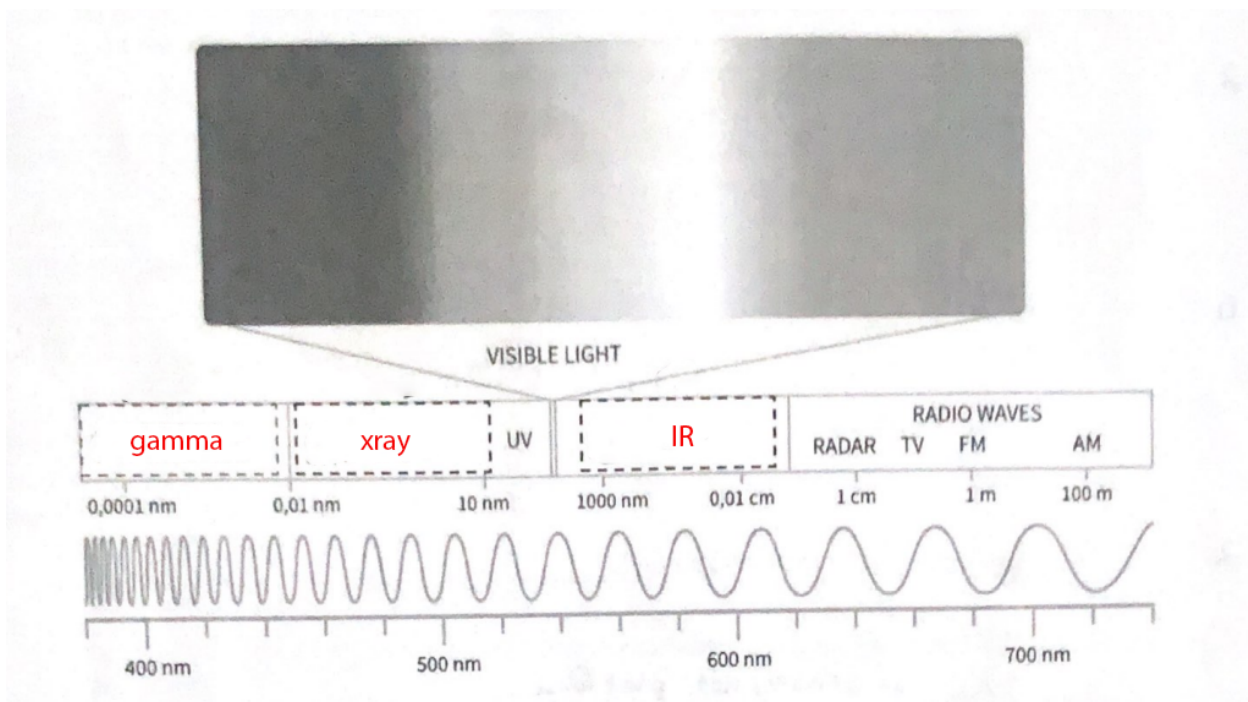
1 point per correct word, 3 points total

12. Using the word bank on the right, label the parts of the semivariogram, which is the plot telling up the amount of spatial autocorrelation of sampled points.



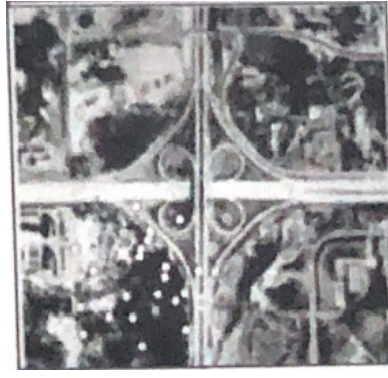
1 point per correct response, 3 points total.



13. Fill in the blanks on the electromagnetic spectrum chart below (white boxes with dashed black outline). **1 point each, 3 points total.**



14. The dots in the map below indicate GNSS positions taken at the center of the freeway intersection. Fill in the blanks regarding relative values of high or low for measured accuracy and precision for each of the three images. **2 points per pair, 6 points total.**

Accuracy: Low	Accuracy : High	Accuracy: Low
Precision: High	Precision : Low	Precision: Low
		

Section 4: We Love Lists

Respond to each prompt with G corresponding bullet point list. Complete sentences are NOT required.

1 point per correct item in lists, 8 points total.

15. Name two common active remote sensing methods
16. Name three types of resolution in remote sensing
17. Name three remote sensing platforms.
18. Acronymia! Spell out the full terms for each acronym. **1 point for each correct acronym, 10 points total.**

GNSS: Global Navigation Satellite System

SRTM: Shuttle Radar Topography Mission

NIR: Near InfraRed

NBR: Normalized Burn Ratio

GCP: Ground Control Points

NDVI: Normalized Difference Vegetation Index

EMR: Elastic Map Reduce

NASA: [National Aeronautics and Space Administration](#)

SAR: [Synthetic aperture radar](#)

CDFW: California Department of Fish and Wildlife

Section 4: Matching

19. Write the letter for the corresponding definition in the Center Column for Spectral Information. **1 point per correct response. 6 points total.**

Term	Your Answer	Definition
Quantification	B	A. Determines variability of identified material
Characterization	A	B. Determines the abundance of materials
Identification	C	C. Determines the unique identity of the foregoing generic categories
Discrimination	E	D. Separates materials into spectrally similar groups.
Detection	F	E. Determines generic categories of the foregoing classes
Classification	D	F. Determines the presence of materials, objects, activities, or events

Section 5: Calculate

Calculate the correct answer based on each of the four following prompts. Show your math for full points. illegible responses will not receive points.

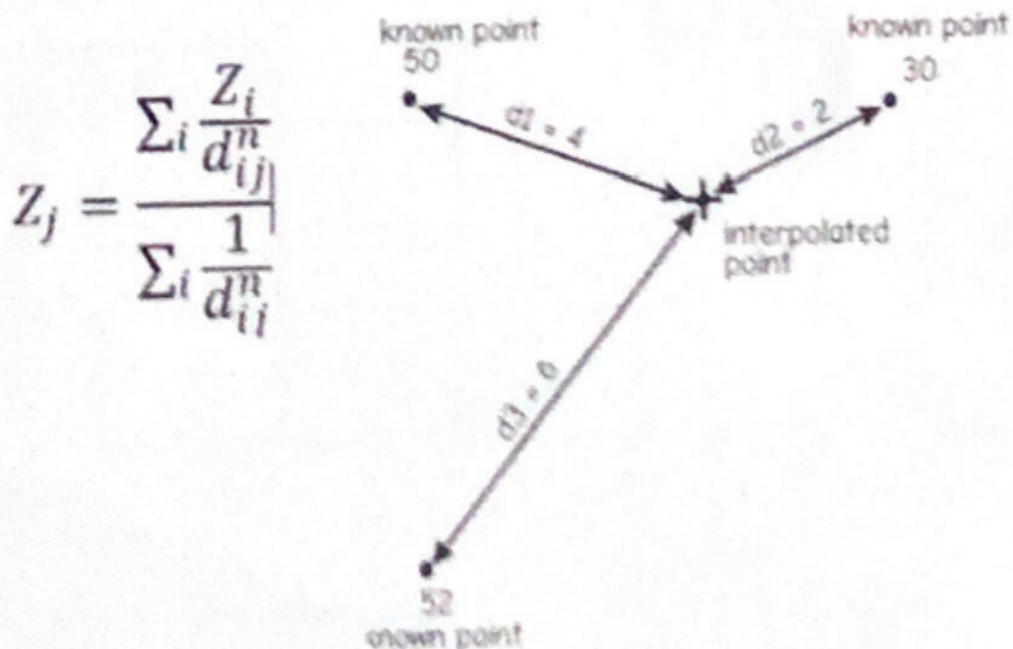
20. The remote server went down, oh no! You were in the process of calculating NDVI and must finish by hand calculating the 3 empty cells in the output raster below. After calculating, circle the cell that has the least vegetation in it. **2 points per calculation, 2 points for correct least veg. 8 points total.**

Red Band				NIR Band				Output NDVI Ratio		
1	4	1		2	14	4		0.33	0.56	
2	3	2		3	12	10		0.20	0.60	
4	4	1		6	8	2		0.20		0.33

21. Calculate the user's, producer's, and overall accuracy of the image classification given the confusion matrix. Show your work, **12 points total**.

		Field Verified Pixel Class					
		Asphalt	Corn Field	Grass	Rooftop	Water	
Classified Image Pixels	Asphalt	17			5	1	
	Corn Field		15	5			
	Grass		5	15			
	Rooftop	1			12	1	
	Water	2			3	18	

22. Calculate the z_j value of the "interpolated point" using IDW from the three known points. Show your work. **8 points total**.



Section 6: Written Answers

In complete sentences, respond to each of the three following prompts. Illegible responses will not receive points.

23. During wildfires, smoke can cause very red sunsets. Explain this phenomenon's basis; it relates to the concept of Rayleigh Scattering. **8 points.**
24. Describe the primary purpose of interpolation and provide one engineering example in which it would be used. **6 points**
25. You need to analyze vegetation health in a 10 km long, 2 km wide area of the Merced River corridor on a quarterly basis (every 3 months) after a chemical spill. What remote sensing data platform will provide the best option for analysis from the options in the table below? Justify your decision. **8 points.**

Sensor	Satellite	Spectral bands	Characteristics
SMMR	Nimbus-7	Passive microwave	Daily data at 25 km spatial resolution
AMSR-E	AQUA	Passive microwave	Daily data at 12.5 km spatial resolution
Landsat TM	Landsat	VIS, NIR	30 m spatial resolution, revisit period is 16 days
AVHRR	NOAA	VIS, NIR	Daily data at 1 km spatial resolution
MODIS	Terra	VIS, NIR	Daily data at 250 m spatial resolution
SAR and Polarimetric SAR	ERS-1 and 2, Radarsat	Active microwave	8–100 m spatial resolution Repeat cycle is 24 days

Acronyms

AMSR-E: Advanced Microwave Scanning Radiometer-Earth Observing System

AVHRR: Advanced Very High Resolution Radiometer

ERS: European Remote Sensing Satellite

MODIS: Moderate Resolution Imaging Spectroradiometer

SAR: Synthetic Aperture Radar

SMMR: Scanning Multichannel Microwave Radiometer

Extra Credit

Choose one of the 4 guest lecturers. Name one geoprocessing tool in ArcGIS Pro they could use for their research and describe how they could use it with examples they provided regarding their respective research questions. Use complete sentences. **2 points.**

Topic Reminders:

- Dr. Paul Zhang. Synthetic Aperture Radar (SAR) in Florida
- Britne (Beth) Clifton: Geomorphology/Floodplain Restoration
- Gustavo Facincani-Dourade: Watershed Management
- Dr. Kelley Moyers. Ag/Water Usage