Midterm #1: Version A
ENGR 180, Fall 2022
Your Name:_____
Section (circle one:Thurs, Fri

This exam is to be Completed in class or equivalent please skim through the full exam prior to the 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 guidance you are welcome to use a calculator (NOT phones)

The exam will end at 4:15 p.m.

There are 22 mixed variety questions and one extra credit question. Points per question noted at the end of each question/prompt.

Section 1 multiple choice
Circle the letter that responds to the correct response.

1. These two polygons are digitized in the exact same area but at different times. This resulted in them not lining up perfectly. When the GISer overlaid the two layers, they ended up with errors as indicated in the composite. What are the errors called?

   A. PacMan Gaps
   B. Sliver Gaps
   C. Filter Gaps
   D. Slice Gaps

2. A conception model expressed in a data structure (e.g. ascii, Excel) is a...
   a. Conceptual Model
   b. Mathematical Model
   c. Data Model
   d. Geographic Data Model
3. Surfaces represented by grids (rasters) have several disadvantages including:
   a. Large data challenges, and loss of representation of surface complexity
   b. Lack of floating-point precision
   c. Challenges associated with data manipulation, combination, and display
   d. All Of the above
   e. None of the above

4. You are interested in creating a map of the distribution of poultry farms and their distance to the interstate highway network to help optimize transportation efficiency for exports from Southern California to Oregon, Washington, Idaho, and Nevada? Which map projection would you choose?

   a. Lambert Conformal Conic
   b. California Teale Albers
   c. Transverse Mercator
   d. State Plane

5. MC: Which of the following are not allowable geographic coordinates for Disneyland in CA?
   Select any/all that apply.
   a. 117.9190°W
   b. -117.9190°
   c. 117°55' 8.3136" W
   d. 117.9190 N

6. A topographically derived wetness index is an inverse function of which paired attributes?
   a. Contributing Area and Slope
   b. Slope and Aspect
   c. Slope and Ground Cover
   d. Contributing Area and Hillshade

7. MC: What kind of cell-choice operation is a least-cost distance raster analysis

   a. Local
   b. Nearest Neighbor
   c. Mr. Rogers Neighborhood
   d. Extended Neighborhood

Section 2: True or False?

Circle the letter corresponding to the correct response

8. Lower resolution rasters have slower processing times due to larger arid cells
   a, True
   b. False

9. True or False? Cones, squares, and planes are the most common developable surface onto which the Earth surface is projected to create a flat map
   a. True
   b. False

Section 3: Fill in the Blanks

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

10. Tobler's first law of Geography states "all things are related, but nearby things are more related than distant things. This concept is also known as Spatial Autocorrelation (2 words).

11. FIB: Acronymania! in the following section, use representative words to indicate the proper meaning of each abbreviation or acronym.

    a. DSM: Digital Surface model
    b. SQL: Structured Query Language
    c. CHM: Canopy Height Model
    d. UTM: Universal Transverse Mercator
    e. ETL: Extract Transform Load
    f. DEM: Digital Elevation Model
    g. USGS: United States Geological Survey

Section 4: Define and Design receive points.

Respond to the following question in complete sentences. Illegible responses will not receive points

12. What does the acronym MAUP stand for, and why is it a problem? Design draw a two-part visualization of the concept below in the two boxes.

    MAUP - Modifiable Areal Unit Problem

Section 5: Matching

13. Match the following terms with their correct definitions. Put the letter of the definition in the blank cell in the middle.

Term	Your Answer	Definition Bank
Geodesy	D	A. The elevation as defined as the distance above a geoid
Map Projection	F	B. a 3d model of the earth that has a smooth surface and is wider than it is tall.
Datum	E	C. the three dimensional equipotential surface, along which the pull of gravity is a specified constant
Orthometric Height	A	D. the science of measuring the shape of the Earth.
Ellipsoid	B	E. a specific, defined version of the 3D system where there is a singular reference point aligning the map projection with a location on the earth's surface.
Geoid	C	F. the transformation of coordinate locations from the Earth's curved surface onto flat maps.

Section 6: 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.

14. Calculate the representative fraction for comparing the earth (40,000,000m circumference) to a beach ball (1.25m circumference). Be sure to express the result using the proper representative fraction format for full points.

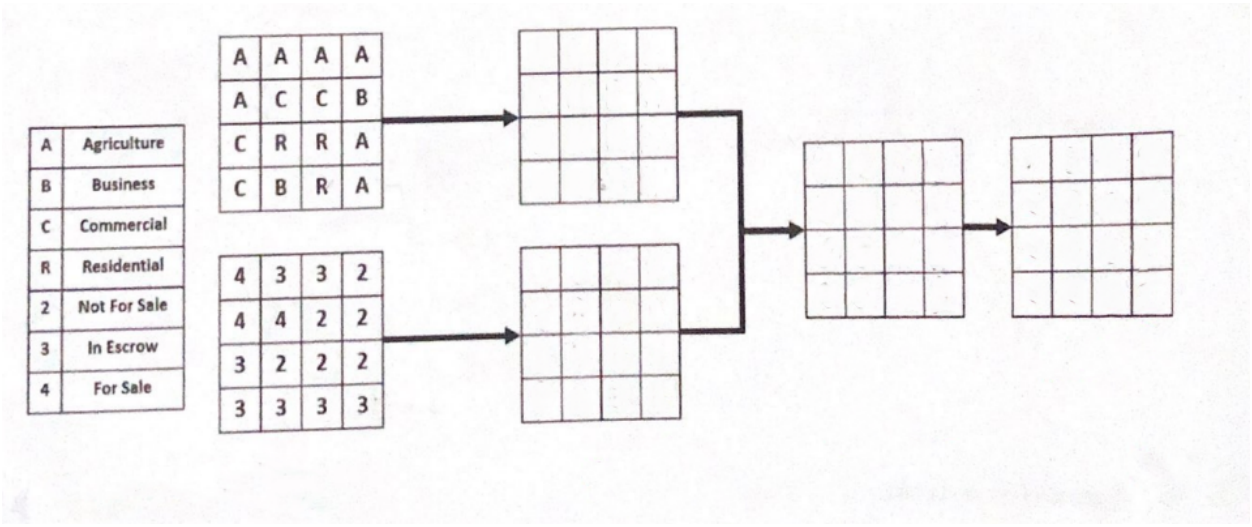
15. Calculate the distance between Point A and Point B, as shown in the following coordinate pairs. Round your answer to the nearest whole number.

    Point A (1000.00, 500.00) and Point B (2000.00, 5000.00)

16. Convert the following coordinate pair from DMS To DD. Show your work
    Lat 38° 8' 59.9676'' N
    Long: 84° 31' 14 3999" Ww

17. Calculate the geodesic “great-circle” distance in kilometers between the COB1 building at UC Merced (37°22'00.9"N, 120°25'25.5"W) and the Aquatic Ecology Lab at Kathmandu University (27°37'06.7"N, 85°32'22.7"E). Show your work.

18. Perform reclassification and logical overlay analysis on the rasters below to identify where there are agriculture lots for sale using the empty raster grids below.



Section 7: Written Answers

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

19. Explain the data integration concept of extract, transform and load, and how it relates to spatial analysis and modeling.

20. Write a query statement that determines if a point falls into two (overlapping) rectangles.

21. You are going on an off-roading adventure on the Rubicon Trail near Tahoe this winter break to celebrate your A+ in Engineering 180. The Rubicon trail runs generally East-West across a section of the Sierra Nevada in California. What Projected Coordinate System would you choose to map your route? Justify your choice.

22. Are tangent or secant Projections typically more accurate? Justify your answer using complete sentences.

Extra Credit

Describe one news article that you read or video that you watched related to this class. What did you learn from it?

Toolbox

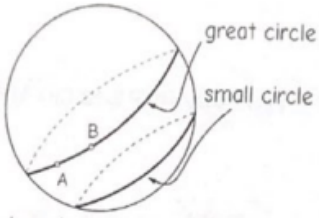
Great Circle Distance

Spherical approximation

Consider two points on the Earth's surface,

A with latitude, longitude of (ϕ_A, λ_A), and

B, with latitude, longitude of (ϕ_B, λ_B)



The great circle distance between points on a sphere is given by the formula:

$d = r \cdot \cos^{-1}[(\sin(\phi_A) \cdot \sin(\phi_B) + \cos(\phi_A)\cos(\phi_B) \cdot \cos(\lambda_A - \lambda_B)]$,

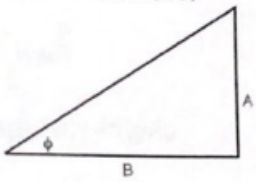
where d is the shortest distance on the surface of the Earth from A to B,
and r is the Earth's radius, approximately 6378 km.

Slope as percent = $\frac{\text{rise}}{\text{run}} * 100$

= A/B * 100

Slope as degrees = ϕ

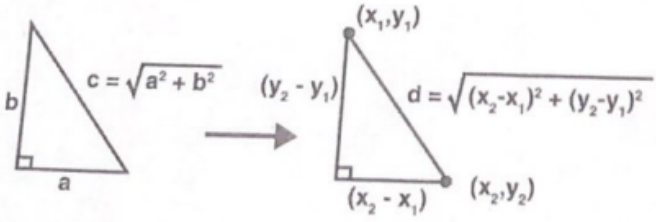
= $\tan^{-1}(A/B)$



$$\alpha = 180 - \arctan\left(\frac{\left(\frac{dZ}{dy}\right)}{\left(\frac{dZ}{dx}\right)}\right) + 90\left(\frac{\left(\frac{dZ}{dx}\right)}{\left|\frac{dZ}{dx}\right|}\right)$$

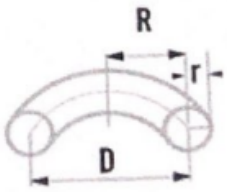
$$s = a\tan\sqrt{\left(\frac{dZ}{dx}\right)^2 + \left(\frac{dZ}{dy}\right)^2}$$

$$S = \frac{\text{arc AB} \times R}{2} = \frac{\pi R^2}{360}\alpha$$



$$S = 4\pi^2 Rr$$

$$V = 2\pi^2 r^2 R$$



THE END. Great work