Supplementary Guidelines for ENVSOCTY 3GI3

Exercise 1

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Key Knowledge before working on E1

Slide 02:

1. Integer vs Floating Point Rasters
2. Multidimensional Raster

Slide 03:

1. 4 Resampling Methods
2. Raster Georeferencing
   - Control Points
   - Geometric Transformation
3. "Updating" vs "Rectifying"

E1 Video + E1 Overview Notes:

1. Geoprocessing Environment Settings
   - cell resolution
   - masks
   - snap raster

Slide 04:

1. Raster Provisioning vs Raster Geodatabases
2. Deriving Rasters
   - Interpolation from Sample Points
   - Remote sensing-based approaches
   - Conversion of vector data (Rasterization)

Slide 05:

1. ModelBuilder
2. How to create ModelBuilder in ArcGIS Pro

Specifications for Creating the Database

- 1000 m cell size

- using *Asia North Albers Equal Area Conic* as Projected Coordinate System (PCS)

Other Tips

- adhere to File Naming Conventions

- check Environment Settings before every move

- check Coordinate Systems (GCS/PCS) for feature layers or map layers constantly

0. Boundary of Philippine Sea

- Think about whether using dissolving tools (such as *Dissolve/Pairwise Dissolve*) first or selecting tools (such as *Select Layer By Attribute*) first, which is more convenient?

- How to change/assign coordinate systems? What's the different between *Define Projection* and *Project*?

1. Bathymetry

- What tool to use to import an ASCII file into a floating-point raster dataset in ArcGIS Pro?
    - When you are using the tools, what are the differences between pixel types (such as, *16 bit unsigned* and *32 bit float*)?
- What tool to use to Extract a raster By the Philippine Sea layer as a Mask?
- In what tool can you Project Raster to another coordinate system while you can:
    - Choose a Resampling Technique out of 4
    - Set the Output Cell Size to 1000
- How can you alter the values (depths) of the Philippine Sea to start at 0 m and decrease?
    - Except for the example (*Greater Than → Reclassify → Multiply*) during lab time, are there any other ways? *Con* tool?

2. Sea Surface Temperature

- How to locate the Multidimension Tools in Toolboxes and which one should be used to import a multidimension raster dataset?
    - In the tool, check *Variables*
- How do you change the values in Celsius to Kelvin? Any *Math* tools in *Spatial Analyst Tools*?
- Similar to Map 1, you have to Extract the raster dataset By a Mask and Project the Raster. But this time you need to change the Environments Settings:
    - Cell Size?
    - Mask?
    - Snap Raster?
    - ❑ Why are we doing this?

3. Salinity

- Before adding any coordinate systems to this dataset, you should Export Features to get the "File Geodatabase Feature Class".

- Add a GCS and then get a PCS.

- Check its Attribute Table and then you would find the Surface field for interpolation. But before that,
    - how to Select Layer and then Delete Rows for those "-999.999" (indicated as NA) values By Attributes ?
    - how to Select Layer for those points within 1000,000 meters of Philippine Sea By Location?

- What is interpolation? When using **_Natural Neighbor_** tool:
    - Check the Cell Size
    - Check the Environment Settings

- Do you still need to _Extract by Mask_ and _Project Raster_?

4. Ocean Surface Currents

- How do you import datasets from *Living Atlas*?

- Remember to change "*show layer at all scales*" in Properties if you found the datasets missing when zooming in or out.

- What's next? You can figure out this on your own!

5. Primary Production

- Review lecture slide 03 and course video to learn how to georeference an image.

- Think about different types for *Geometric Transformation* and experiment with the number of *Control Points*.

- How do you *Rectify* your georeferenced product?

- After getting the Extracted final feature layer, how do you Reclassify this into five groupings based on quintiles?

A. Maps

- 5 Maps: *Bathymetry, Sea Surface Temperature, Salinity, Ocean Surface Currents and Primary Productivity* (each 15 mark).

- Map elements:

  - clear and informative title

  - a comprehensive legend

  - some form of orientation (north arrow? graticule? measured grids?) Is the north arrow directing the true north and is the scale bar displaying the precise distances in Conic projections?

  - a scale indicator (scale bar? texted scale ratio?)

  - credits (your name, McMaster University, data sources, creation of the map, etc.)

  - specific to these maps: descriptive statistics (except for the primary productivity map (since this is displaying quintiles) → check the required things in *Instructions*

- Tips to make your map better-looking:

  - Display Philippine Sea layer (also set the fill color to no fill) to show a boundary line

  - Think about what kind of color schemes to use to better represent the themes of maps

# B. Cartographic Models

- 5 cartographic models in *ModelBuilder* (each 5 mark).

- Review lecture slide 05 and course video to learn how to use ModelBuilder.

- Must:

    - Renaming the input data and output data

    - Add Labels to briefly interpret what you are doing

- With respect to the model for primary productivity:

    - *"The model for primary productivity will start with the raster that you exported from the georeferencing exercise, and you will include text on the model, before the first model element that indicates that the data was georeferenced, and include how many control points were used and the transformation that you chose to apply." - Instruction*

- For E1, it's ok to perform individual tools step by step to get the final product then create the models (you may find the models may not connect consistently or displayed grey). However, you are highly suggested trying firstly building the models then *Validate* then *Run* the models to get the final product, as instructed in course for slide 05.

C. Questions

- 5 questions, the first four each as 5 marks, the fifth one is needed to answer but not marked.

- Do not only write a sentence or two hoping to get full marks. More aspects the better (as long as they make sense)!

- Be cautious when using generative AI to assist in knowledge learning. Check guidelines for Generative AI for Students drafted by McMaster.

- Copying and pasting AI answers are not allowed and very unrespectful for the reviewers!

C. Questions

- The answer to the fifth question could look something like this:
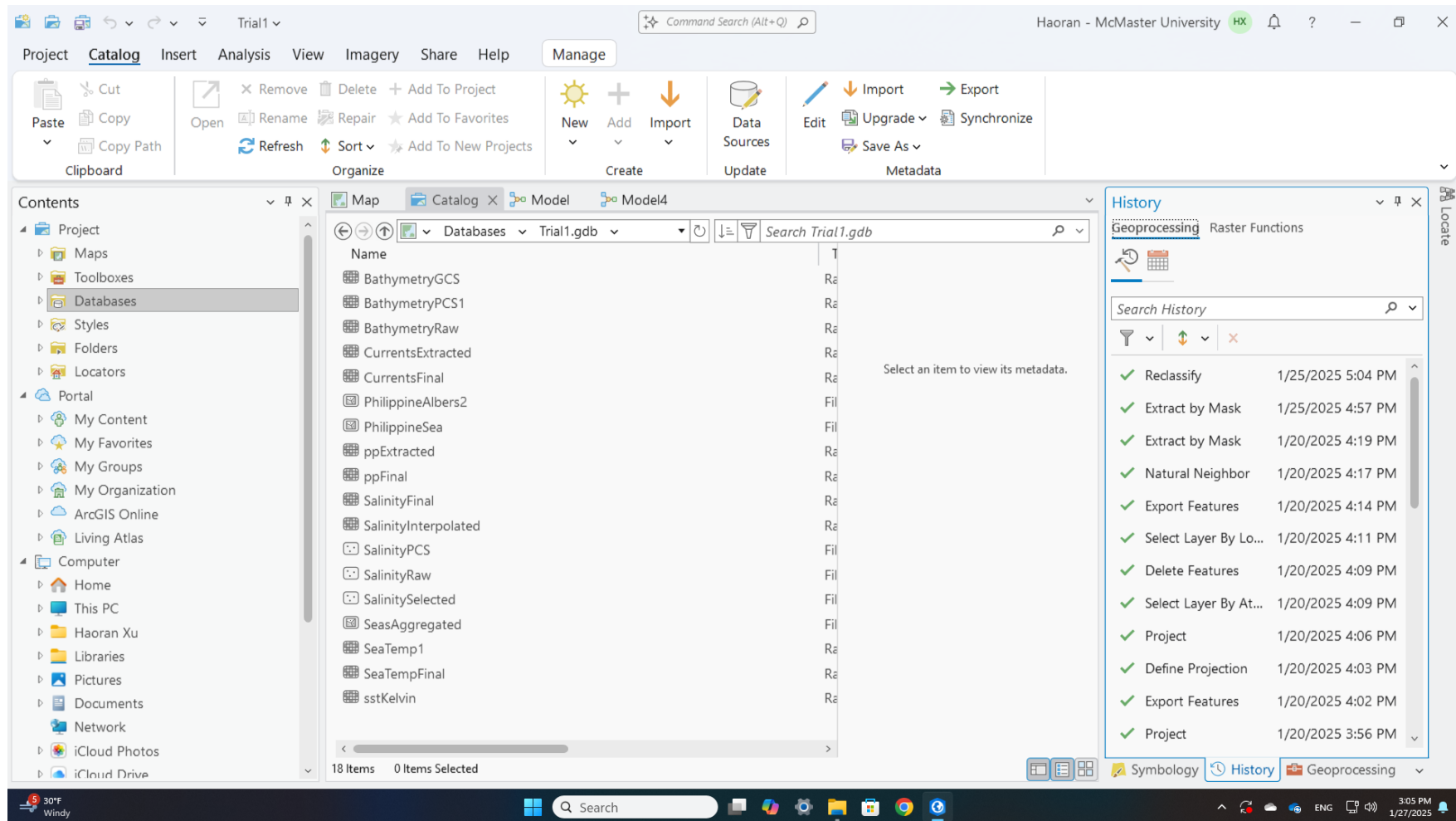
D. Final Submission

- 1 single PDF Document
  - My personal way is putting everything (maps, models, answers) all in Word doc, then converting the file into a PDF. But Word is a commercialized software that may not be supportive to everyone. It is very ok to find your own way to produce one single PDF (try coding in *R* language).
  - *Cover page contains: the exercise number and name (Exercise 1: Raster Fundamentals), your name, submission date, and your TA's name (which is me).*
  - *Use 12-point font, 1.5 spacing between lines and 1-inch borders*
  - *Correct all spelling and grammatical mistakes/issues*
- Due date: please submit to the Avenue Drop Box by Monday, February 3, 2025 at 8:00AM.