FYS207 LAB EXERCISE - INTRODUCTION TO TOPOGRAPHIC MAPS

(updated Feb. 2016, AGI Lab Manual 10th Edition)

Part 1 - Refer to the lab manual for the following questions.

1-1. Using internet search tools (google, Wikipedia), the lab manual and referring to **Figure 9.3 on p. 232-233**, complete the following tasks / answer the following questions related to topographic maps.

A. What is a USGS 7.5-minute quadrangle map? List the types of information that it contains (refer to p. 229-230)?

_____B. What year was the map in Figure 9.3 first published?

_____C. What year was the map in Figure 9.3 revised?

D. What is longitude and latitude used for? What units are positions of longitude and latitude measured in? (refer to p. 229-230)

_____ E. How many angular degrees are contained in a circle (refer to conversion sheets)?
_____ F. How many angular degrees are contained in a semi-circle (refer to conversion sheets)?
_____ G. How many angular degrees are contained in a right angle (refer to conversion sheets)?
_____ H. How many angular degrees are contained in a straight line (refer to conversion sheets)?
_____ I. How many angular minutes are contained in 1 degree of angular measurement?
_____ J. How many angular seconds are contained in 1 minute of angular measurement?
_____K. How many angular seconds are contained in 1 degree of angular measurement

_____ L. What is the geographic location of the quadrangle map show on Figure 9.3?

_____ M. What is the longitude of the western edge of the map in Figure 9.3?

_____ N. What is the longitude of the eastern edge of the map in Figure 9.3?

_____ O. What is the latitude of the southern edge of the map in Figure 9.3?

_____ P. What is the latitude of the northern edge of the map in Figure 9.3?

_____Q. Define magnetic declination. What is the magnetic declination of the map in Figure 9.3 (refer to p. 231)?

_____R. What does "UTM" stand for and how is it used (refer to p. 236).

_____S. What coordinate units are UTM positions measured in (refer to p. 236)?

_____T. Define "ratio scale" (refer to p. 230). What is the ratio scale of the map in Figure 9.3?

_____U. What are contour lines? What do they represent (refer to p. 239)?

_____V. What is the contour interval for the map in Figure 9.3?

_____W. How much elevation change is recorded between Index Contours in Fig. 9.3?

1-2. What are the latitude and longitude coordinates of points A and B in Figure 9.2, p. 230?

1-3. Using a protractor, what is the azimuth compass bearing from point C to point D in Figure 9.5, p. 235? How about from point D to point A?

1-4. Refer to p. 242-243 and Figure 9.10; answer the following questions.

A. Define contour line.

B. Define index contour.

C. Define contour interval.

_____D. What is the contour interval of the 3-D diagram show in Fig. 9.10? In feet or meters?

_____E. How is a circular hilltop depicted on a topographic map, as "V-shape" contour lines or "closed circles? (refer to Fig. 9.10)

_____F. The "relief" of a map or object is the difference between the highest elevation and lowest land elevation depicted on a topographic map. What is the relief of the island depicted in Fig. 9.10?

G. Define the term "benchmark", how is it symbolized on a topographic map?

1-5. Refer to p. 244-245 and Figures 9.12 and 9.13; answer the following questions.

A. Define "gradient", how is it measured and what is the formula for calculating it?

B. Define "regional relief" on a map.

____C. True or False: contour lines of different elevation can cross one another on a topo map?
____D. True or False: Closely spaced contour lines indicate a steeper slope than widely spaced contour lines.
____E. True or False: When contour lines cross a stream valley, they form a "V" shape, the apex or point of which, points down stream.

F. Draw a sketch of contour line patterns depicting a stream crossing.

G. Draw a sketch of contour line patterns depicting the top of a hill.

H. Draw a sketch of contour line patterns depicting a closed depression at the top of a hill

____I. What is the elevation of the point marked “BM24” on the map model shown on Fig. 9.13?

____ J. What is the total relief (in feet) of the map model shown in Fig. 9.13?

____ K. Using a ruler and the map scale on Fig. 9.13, determine approximately how many miles of ground distance are represented by one inch of measurement on the map sheet.

____ L. In which direction is the water flowing in the main “valley” river shown on Fig. 9.13?

M. Draw a sketch showing contour line patterns depicting a vertical cliff face.

1-6. Refer to p. 230 of the lab manual regarding “ratio” or “fractional” scales. The common fractional scales for 7.5-minute topographic maps is 1:24,000 or expressed as a fraction 1/24,000. This means that one unit of map measurement is equal to 24,000 units of actual ground measurement. The length units of measurement are the same in the numerator or denominator. For example 1 cm on map = 24,000 cm on the ground; 1 in on the map = 24,000 in on the ground; 2 in on the map = 48,000 in on the ground, etc.

Fractional Scale

- The fractional scale or the representative scale expresses the scale of a map as a fraction or ratio.
  - 1/24,000 or 1:24,000
- This scale, which is read “one to twenty-four thousand”, says that one unit of measurement on the map represents 24,000 units of measurement on the Earth.
- At this scale, one centimeter on the map represents an actual distance of 24,000 centimeters on the Earth, and one inch on the map equals 24,000 inches on the map.
  - Units of measurement must be the same in both the numerator and the denominator.

$$\frac{\text{Distance on the Map}}{\text{Distance on the Ground}} = \frac{2\,\text{cm}}{1\,\text{km}} = \frac{2\,\text{cm}}{100\,000\,\text{cm}} = \frac{1}{50\,000}$$

= 1/50 000 Scale

A. Given a fractional scale of 1:24,000 (1/24,000), one inch on the map equals how many inches on the ground (refer to your conversion tables) (show all your math work)?

One inch on the map equals how many miles on the ground (show all your math work).

One centimeter on the map equals how many centimeters on the ground (show all your math work).

One centimeter on the map equals how many kilometers on the ground (show all your math work).

B. If 5 inches on a hypothetical map equals 10 miles on the ground, determine the fractional scale of the map (show all your math work)

Step 1: determine how many inches are contained in 10 miles.

Step 2: 5 inches map = _____ inches ground.

Step 3: Divide both sides of equation by 5 inches, cancel units are both sides

Step 4: Fractional scale = 1 (map): _____ (ground)

1-7. Complete the topographic map depicted in Activity 9.3 Item C (p. 253). Label each contour line using a contour interval of 10 feet. Start with 0 m elevation at sea level.

1-8. Refer to Activity 9.5 Item A (p. 257), Read the instructions and complete the tasks 1-5.

1-9. Read and review the topographic profile instructions presented in Figure 9.16, p. 248. Using the example topographic map in Activity 9.6 (p. 258), draw a topographic profile along line A-A'. Plot your profile on the graph paper provided in the lab manual. Start with an elevation of 500 ft at the origin of the y-axis, and use a vertical scale of 1 in = 100 ft.

A) What is the horizontal fractional scale of the map?

B) What is the fractional scale of the vertical axis of your profile (hint: convert 1in =100 ft to a dimensionless fractional scale)?

C) Refer to the example on Fig. 9.16, p. 248 of your lab manual ("step 4") and determine the vertical exaggeration of your profile from p. 258.

1-10. Using a contour interval of 10 ft, draw the following contour lines for the spot elevation data provided on Activity 9.3 B (p. 253): 80 ft, 90 ft, 100 ft, 110 ft, 120 ft, 130 ft, 140 ft.

1-11. Using a contour interval of 100 feet, draw the following contour lines for the spot elevation data provided on Activity 9.3 A (p. 253): 100, 200, 300, 400, 500, 600.