

2020-1 Spatial Informatics & Systems Final Exam (120 Pts)

Exam Date & Time : June 11th 16:00-18:00

Student Number : _____

Name : _____

※ Write your name and student number on both answer and problems sheets.

※ All calculation solutions should be rounded to the second decimal.

1. Photo interpretation is generally composed of 8 interpretation elements. These elements include Tone, Pattern, Texture, Shape, Size, Shadow, as well as Vertical Exaggeration and Location (Also referred to as Association). Briefly explain the meaning behind each of these 8 elements and provide an example for each element with respect to photo interpretation. [20pts]

2. Describe the advantages/disadvantages and the applications of ground (or terrestrial) surveying (Total Station, GPS), UAV, Airborne Photogrammetry using the following table. [9pts]

Technique	Advantages	Disadvantages	Applications
Ground (or Terrestrial) Surveying			
UAV			
Airborne Photogrammetry			

3. List **at least 10** different applications of LiDAR where laser surveying can be advantageous. Describe each application briefly and provide supporting evidence to reinforce your opinion. [10pts]

4. What is the purpose of the transition curve for route surveying (also known as path planning or 노선측량) when designing roads? In addition, explain the characteristics of clothoid, lemniscate, and cubic curves without using any formulae or diagrams. [12pts]

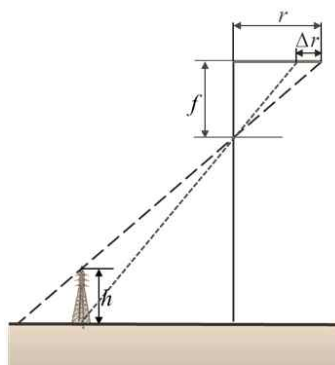
5. For highly precise positioning, methods to improve the positioning accuracy of GNSS include DGNSS (Differential GNSS), Post-processing static surveying, RTK(Real-Time Kinetic), and SBAS(Satellite based Augmentation Systems). Define each of these methods and explain their characteristics and applications. [16pts]

6. What are the full terms for DTM, DSM, DEM? Also, compare and explain DEM and DSM. Lastly, what data would be required to build a 3D digital model? [10pts]

7. A photograph taken from a camera of focal length $f = 15\text{cm}$ has a photo scale on the ground of $1/10,000$. The length of a tower in the photograph, thus relief displacement Δr is 4.8mm , and the distance from the principal point to the top of the tower, r , is measured to be 40cm . [7pts]

(1) Describe the characteristics of relief displacement. [3pts]

(2) Determine the height h of the tower. [4pts]



8. Answer the following questions on GPS error. [20pts]

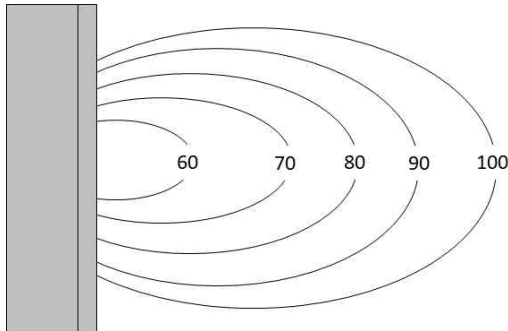
(1) Describe **at least 5** sources of error associated with GPS due to systematic factors. [10pts]

(2) Describe the error related to the effect of GPS satellite geometry [4pts]

(3) The geometry of four satellites are expressed using the following inverse matrix $(A^T A)^{-1}$ shown below. Solve for horizontal, position, and geometric dilution of precision. [6pts]

$$(A^T A)^{-1} = \begin{vmatrix} \frac{7}{15} & 0 & 0 & 0 \\ 0 & \frac{7}{15} & 0 & 0 \\ 0 & 0 & \frac{21}{4} & 0 \\ 0 & 0 & 0 & \frac{7}{6} \end{vmatrix}$$

9. A diagram of a water reservoir is illustrated by the diagram below with contours at 10m intervals and with area values at corresponding contour levels, as shown in the table. If the elevation of the water surface of the dam is designed to be 100m, determine the capacity (volume) of the water reservoir. (Use Simpson's Rule) [6pts]



Elevation (m)	Area (m ²)
60	1250
70	15000
80	18000
90	24500
100	45500

10. A concrete aggregate field was found and measured using a LiDAR sensor to find the following elevation measurements shown in the figure below. Use the **spot height method** (점고법) to calculate the aggregate volume. Consider rectangular cells as rectangular prismoids and triangle cells as triangular prismoids for the calculation. The width and length of the rectangle and triangle is 5m and 4m, respectively. [10pts]

