Name: _____

FO-4313/6313 Spatial Technologies for Forest Resource Management
Second Hour Exam, 2003

Formulas:

$$\frac{1}{S} = \frac{d}{D} = \frac{f}{(H-h)} \qquad \frac{\Delta h}{(H-h)} = \frac{d}{r}$$

$$\frac{\Delta h}{(H-h)} = \frac{dp}{AP_b + dp} \qquad dp = |X - X'| \qquad AP_b = |Z - Z'|$$

$$\tan\alpha = \frac{dh}{SL}$$

1. You are scheduling helicopter spraying in an area where a large tower is located and the pilot wants to know the tower height. Your photos have a nominal scale of 1:20,000 at m.s.l. and were taken with a camera focal length of 152.4mm. The base of the tower is located at 800 ft. above m.s.l. according to the local quad sheet.

   You can only find a **single, vertical photo**; the other photo of the stereo pair is lost in your truck or the dog ate it? The top of the tower is located 4.60 inches from the photo principal point. If the displaced tower image is 0.23 inches in length,

   The computed tower height (**a.g.l.**) is _____ ft. (10)
   (What is tower height above the ground?)

2. You are using the parallax bar (floating dot) instrument on a **stereo pair** of photographs taken with a 76.2mm focal length to measure the height of a lookout tower. The photo scale is 1:15,840 **at** the base of the tower that is located **at** 540 ft. elevation. If the average distance between the principal and conjugate principal points on the stereo pair was 7.9989**cm** and the following parallax measurements were obtained:

   Reading at top of object = 13.51 mm
   Reading at bottom of object = 9.30 mm

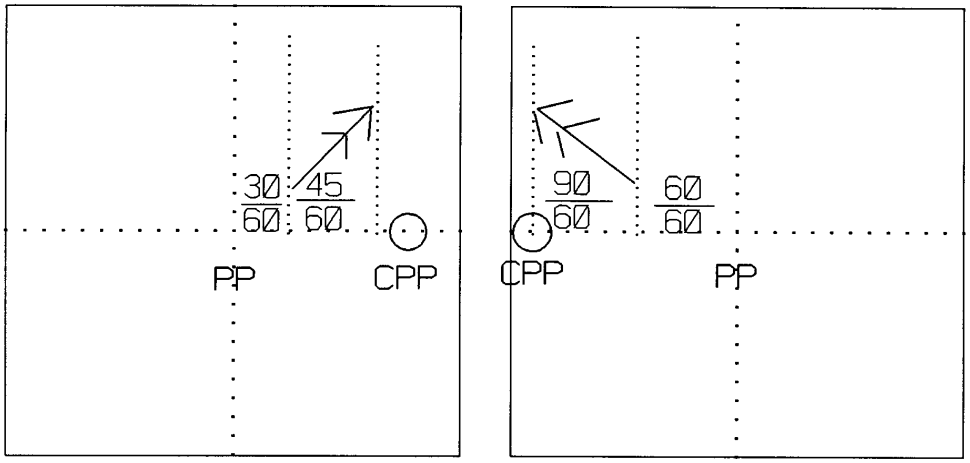
   a. The altitude of the aircraft was: _____ft. (5)

   b. The height of the lookout tower is calculated to be _____ ft. (5)

3. A **<u>stereo pair of vertical aerial photographs</u>** was taken of a single tree with a camera focal length of 76.2 mm; tilt was less than 3 degrees. The photo scale was 1:10,800 **<u>at</u>** the tree base which is located at 300 feet elevation. Using the stereo pair, you obtain the following parallax measurements:

Photo 1:	X-parallax to base of tree	= -60/60"
	X-parallax of tree image length	= -3/60"
Photo 2:	X-parallax to base of tree	= +30/60"
	X-parallax of tree image length	= +2/60"

The calculated height of the tree is: _____ft. (10)



4. Explain the differences between latitudes/longitudes, the UTM and/or state plane coordinate system and the G.L.O. survey system: (9)

Latitudes/Longitudes:_____
_____

UTM Coordinates:_____
_____

G.L.O. survey system:_____
_____

5. You are planning to contract for stereo coverage (60% endlap) photography at a scale of

1:15,840 of an area with an average elevation of 280 ft.. If the contractor has an airplane that cruises at 160 knots per hour and an aerial camera with a 152.4mm focal length that uses a 10 by 10 inch film format, your calculations show:

a. Single photo ground coverage is _____ by _____ ft. (5)

b. The acreage covered by one photo is _____ acres. (5)

c. In order to obtain 60% **endlap**, the distance between photo centers (on each flight line) should be _____ ft. (5)

d. In order to obtain a 20% photo (safety) **overhang** on the target area boundary, the first and last flight lines should be located _____ ft. inside the target area boundary. (5)

e. In order to obtain a 25% **sidelap**, interior flight lines (except for first and last) should be spaced a maximum of _____ ft. apart. (5)

7. Define GIS: _____

_____ _____ (4)

8. The two primary types of data in a GIS are: _____ and _____. (4)

9. The two types of geographic data in a GIS are: _____ and _____. (8)

10. Explain or define **topology** in a GIS: _____

_____

_____ (6)

11. Explain, in your own words, why or why not mix datums in a GIS; i.e. what happens if you have one theme in NAD27, utm and another theme in WGS84, utm: _____

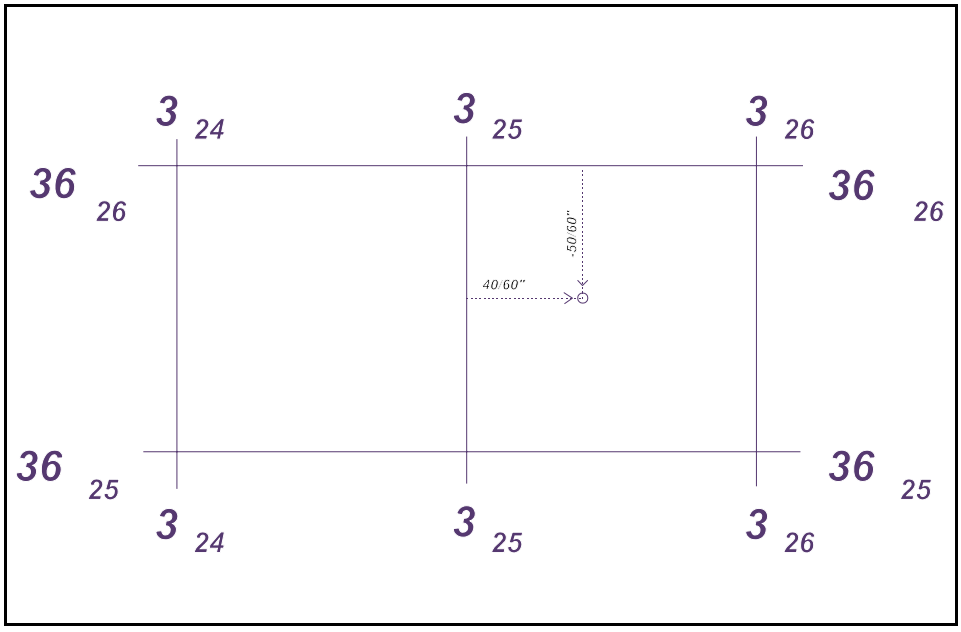
_____

_____ (4)

12. Refer to the sketch from a **7.5 minute quadrangle** below where the scale is **1:24,000**. If the measured distances are X=+40/60 inch from the $\mathbf{3_{25}}$ grid line and -50/60 inch from the $\mathbf{36_{26}}$ UTM grid lines to Control Point X, calculate the UTM coordinates of Control Point X. (<u>give distance, unit of measure, direction</u>)

a. Easting = _____ __ __ (5)

b. Northing = _____ __ __ (5)



FLIGHT PLANNING FORMULAS

1 *nautical mile* = 6,076.11 *ft.*

1 *statute mile* = 1.1507784 *n.m.*

PC = *Photo Coverage* = (*photo width, inches*)(*photo scale, ft/inch*)

SLC = *SideLap Coverage* = (1.0 - .*SideLap%*)(*PC*)

ELC = *EndLap Coverage* = (1-.*End%*)(*PC*)

Line Space 1,*N* = (.5-.*OverHang%*)(*PC*)

$$Total\ Flight\ Lines = \frac{(Target\ Area\ Width, ft.) + 2(.OverHang\%)(PC)}{(SLC)}$$

= (*round at* 0.5 *up/down*)

$$Interior\ Flight\ Lines = \frac{(Width) - 2(.5 - .OverHang\%)(PC)}{SLC} - 1$$

= (*round up to whole number*)

Check on Total Flight Lines = *Interior Lines* + 2

$$Interior\ Line\ Spacing = \frac{(AreaWidth) - 2(.5 - .OverHang\%)(PC)}{(Total\ Lines - 1)}$$

$$Interior\ Line\ Spacing = \frac{(AreaWidth) - 2(.5 - .OverHang\%)(PC)}{(Interior\ Lines + 1)}$$

$$Actual\ Side\% = \frac{(PC) - Interior\ Line\ Spacing\ ft.}{(PC)}\ 100\%$$

$$Actual\ Side\% = \frac{(PC) - [\frac{(width) - 2(.5 - .OverHang\%)(PC)}{Interior\ Lines + 1}]}{(PC)}\ 100\%$$

$$Actual\ Photos\ per\ line = \frac{(Line\ Length, ft.)}{(ELC)} \quad (round\ up)$$

Total Photos per line = (*Actual Photos per line*) + 4

$$Total\ Photos\ per\ job = \sum (Photos\ per\ line)$$

Photo Spacing, ft = *ELC*

1*st Photo* = 2.0 *spaces beyond target area boundary*

$$Photo\ Spacing, \sec = \frac{[Photo\ Spacing, ft]}{(speed, mph)(5{,}280)/(3600)}$$

$$Time, hrs = \frac{(Total\ Lines)(Area\ Length, miles)}{(speed, mph)}$$

***Image Blur*:**

$$GD = 1.4666667\left(\frac{S}{F}\right) \qquad PD = \frac{GD * 12}{scale}$$

where *GD* = *ground distance, ft* *PD* = *photo distance, inches*
S = *aircraft speed, mph* *scale* = *denominator of Photo RF*
F = *denom of shutter speed*