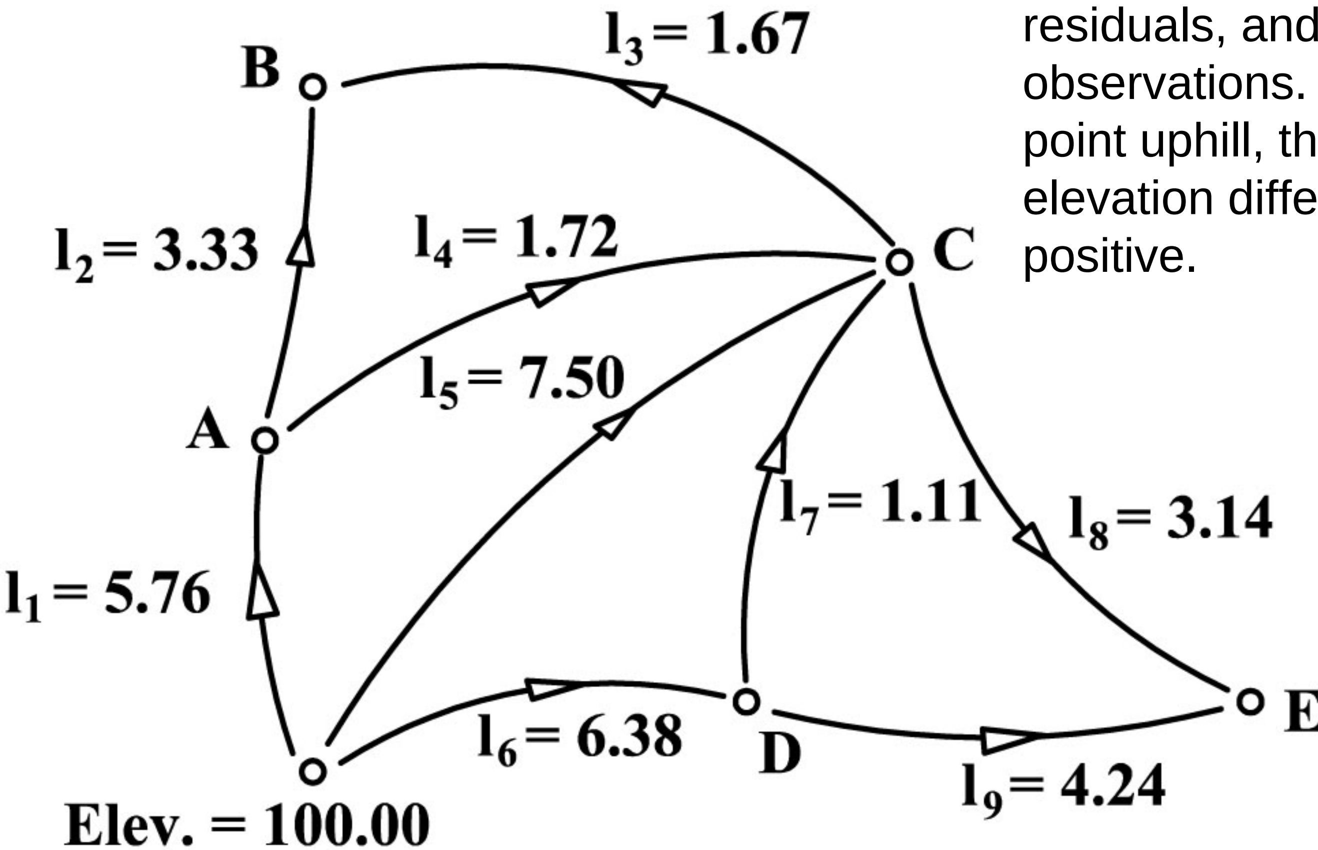
CE 506 Homework 2 – 13 Sept. 2005
due in 1 week, 20 Sept.

1. Adjust the level network by least squares using method of indirect observations. The observations are of equal precision and are uncorrelated. Note the fixed bench mark. Use the matrix approach. Show n, n_0, and r.



Show resulting parameters, residuals, and adjusted observations. Note that the arrows point uphill, the observation is the elevation difference, always positive.

2. The given points have fixed coordinates in the X,Y system and observed coordinates in the x,y system. Solve for the 4 parameters (a,b,c,d) in the following 2D coordinate transformation model:

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} a & b \\ -b & a \end{bmatrix} \begin{bmatrix} X \\ Y \end{bmatrix} + \begin{bmatrix} c \\ d \end{bmatrix}$$

or,

$$\begin{bmatrix} x \\ y \end{bmatrix} = \begin{bmatrix} X & Y & 1 & 0 \\ Y & -X & 0 & 1 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \\ d \end{bmatrix}$$

No.	X	Y	x	y	sigma
1	101.00	201.00	98.28	200.32	0.02
2	104.00	201.00	101.22	199.80	0.02
3	101.00	205.00	98.99	204.21	0.02
4	102.00	204.00	99.75	203.06	0.02
5	105.00	203.00	102.54	201.57	0.05
6	105.00	205.00	102.91	203.54	0.05

Show n, n_0, and r. The observation sigmas are for each coordinate component. Use the least squares method of indirect observations. Show resulting parameters, residuals, and adjusted observations. This model can be used for digitizing map data, relating systems with different origin, scale, and orientation, inner orientation for photogrammetry, etc. It is *conformal* meaning shapes are preserved. There is a 3D version as well.