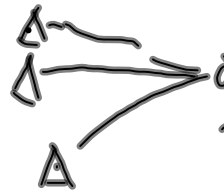
15-1



$F_i = \hat{\ell}_i - \left[(x-x_i)^2+(y-y_i)^2\right]^{1/2} = 0$

$B, f, W \Rightarrow \Delta, \dots, v, \ell$

$n=3$
$n_0=2$
$r=1$
I/O
$x, y$

$$\frac{\partial F_i}{\partial x} = -\left(\frac{1}{2}\right)\left[(x-x_i)^2+(y-y_i)^2\right]^{-\frac{1}{2}}(2)(x-x_i)$$

$$= \frac{-(x-x_i)}{D_i}$$ eval @ $x^0$ current approx $y^0$

$$\frac{\partial F_i}{\partial y} = -\frac{1}{2}[\,]^{-\frac{1}{2}} \cdot 2(y-y_i)$$

$$= \frac{-(y-y_i)}{D_i}$$ eval @ $x^0, y^0$ current approx

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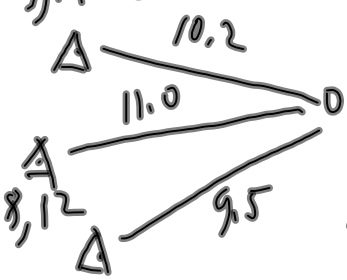
15-2

$$B = \begin{bmatrix} \partial F_1/\partial x & \partial F_1/\partial y \\ \partial F_2/\partial x & \partial F_2/\partial y \\ \partial F_3/\partial x & \partial F_3/\partial y \end{bmatrix}, \quad f = \begin{bmatrix} -F_1(\ell_1, x^0, y^0) \\ -F_2(\ell_2, x^0, y^0) \\ -F_3(\ell_3, x^0, y^0) \end{bmatrix}, \quad W = I_3$$

$$w_i = \sigma_0^2/\sigma_i^2$$




$xy = ?$
(19.0, 12.6)
initial approx

$$B = \begin{bmatrix} .9903 & .1386 \\ -.9985 & -.0544 \\ -.9607 & -.2775 \end{bmatrix}, \quad f = \begin{bmatrix} -.1024 \\ .0163 \\ -.1319 \end{bmatrix}$$

$$\Delta = (B^T W B)^{-1} B^T W f = \begin{bmatrix} .0672 \\ .0925 \end{bmatrix}$$

$x^0 + \delta x = 19.0672$
$y^0 + \delta y = 12.6925$

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15-3

iteration #2 $B = \begin{bmatrix} -.9916 & .1287 \\ -.9980 & -.0624 \\ -.9586 & -.2846 \end{bmatrix}$ $f \begin{bmatrix} -.6482 \\ .0888 \\ -.0414 \end{bmatrix}$

$\Delta = \begin{pmatrix} -.0004 \\ .0013 \end{pmatrix}$, $\begin{pmatrix} x^0 \\ y^0 \end{pmatrix} = \begin{matrix} 19.0667 \\ 12.6539 \end{matrix}$

$\Delta = \begin{bmatrix} 1.16 \times 10^{-6} \\ 1.34 \times 10^{-5} \end{bmatrix}$, $\begin{matrix} 19.0667 \\ 12.6539 \end{matrix}$

testing for convergence: lazy way, do 10 iter print results, look manually

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15-4

all(v): true if all elements of v are true (1=true, 0=false)

```
n_iter = 0;
keep_going = 1;
while (keep_going == 1)
    [ LS code ]   % Δ, δ1, ...
                  % update par, obs, ...
    if (all (abs (del) < 1e-06))
        keep_going = 0
    end
    if (n_iter > 10)
        keep_going = 0
    end
    n_iter = n_iter + 1
end
```

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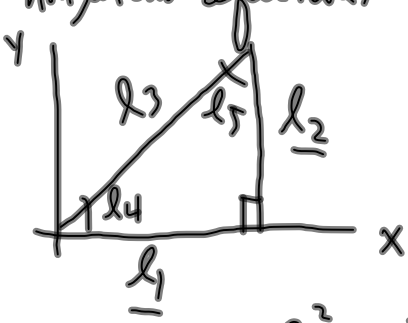
nonlinear equations : obs. only method 15-5




$n = 5$
$n_0 = 2$
$r = 3$

$C = r = 3$

1. $\hat{l}_1^2 + \hat{l}_2^2 = \hat{l}_3^2$
2. $\hat{l}_4 + \hat{l}_5 = \pi/2$ Radians
3. $\hat{l}_4 = \tan^{-1}\left(\hat{l}_2/\hat{l}_1\right)$

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15-6

$F_1 = \hat{l}_1^2 + \hat{l}_2^2 - \hat{l}_3^2 = 0$
$F_2 = \hat{l}_4 + \hat{l}_5 - \pi/2 = 0$
$F_3 = \hat{l}_4 - \tan^{-1}\left(\hat{l}_2/\hat{l}_1\right) = 0$

$\partial F/\partial l = A$

$\partial F_1/\partial l_1 = 2l_1 \,|\, l_1^0$, $\partial F_1/\partial l_2 = 2l_2 \,|\, l_2^0$

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