setup

overhead

tag

In[6]:=
```
(* project directory *)
home = "projects/least squares/lines/triangulation/novus/";
(* common variable definitions *)
Get["utility modules.m", Path → dirPack];
(* Get["Bevington modules.m",Path→dirPack]; *)
(* Get["LaTeX-tools.m",Path→dirPack]; *)
 (* time, date, system user *)
stamp1;
```

```
maximum memory: 0.105512 GB

seed file: /Users/dantopa/Mathematica_files/nb/seed 22_01.nb

user: dantopa, CPU: Quaxolotl,  MM v. 13.1.0 for Mac OS X x86

date: Nov 27, 2022, time: 11:38:32

nb:
 /Users/dantopa/Mathematica_files/nb/projects/least squares/lines/triangulation/novus/
 seed 22-05 least squares.nb
```

modules, functions, settings, ...

1 input

locations

In[66]:=
```
target = {1, 1};
```

observation posts

In[67]:=
```
posts = {{0, 0}, {2, 2}, {0, 2}};
m = Length[posts]
```

Out[68]=

```
3
```

view

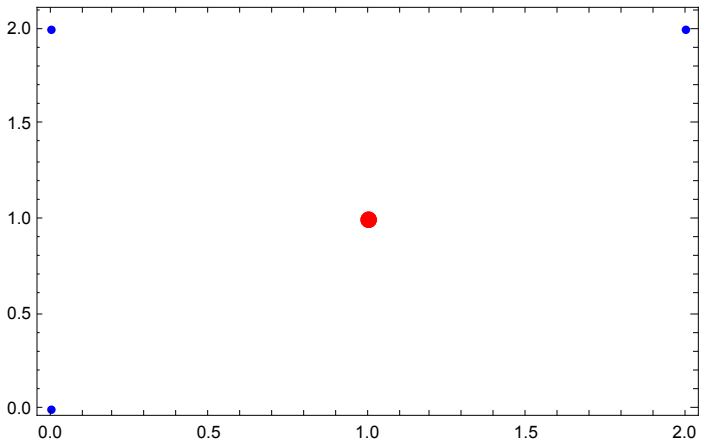
In[64]:=
```
gtarget = ListPlot[{target},
   PlotStyle → {Red, PointSize[0.025]}];
```

In[62]:=
```
gpost = ListPlot[{posts},
   PlotStyle → {Blue, PointSize[0.025]}];
```

```
(* gpost=ListPlot[{posts},
   PlotMarkers→{"1","2","3"},
   PlotStyle→{Blue,PointSize[0.025]}]; *)
```

In[65]:=
```
Show[{gtarget, gpost},
 PlotRange → All,
 Frame → True]
```

Out[65]=



bearings

In[69]:=
```
target[[1]] - #[[1]]
-------------------- & /@ posts
target[[2]] - #[[2]]
ArcTan[%]
```

Out[69]=
```
{1, 1, -1}
```

Out[70]=
$$\left\{\frac{\pi}{4}, \frac{\pi}{4}, -\frac{\pi}{4}\right\}$$

In[71]:=
```
angles = ArcTan[target[[1]] - #[[1]], target[[2]] - #[[2]]] & /@ posts
```

Out[71]=
$$\left\{\frac{\pi}{4}, -\frac{3\,\pi}{4}, -\frac{\pi}{4}\right\}$$

2

build linear system

In[81]:=
```
{Cos[#], -Sin[#]} & /@ angles;
A = %;
% // mf
```

Out[83]//MatrixForm=

$$\begin{pmatrix} \frac{1}{\sqrt{2}} & -\frac{1}{\sqrt{2}} \\ -\frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \\ \frac{1}{\sqrt{2}} & \frac{1}{\sqrt{2}} \end{pmatrix}$$

In[84]:=
```
b = Table[
  posts[[k, 1]] Cos[angles[[k]]] - posts[[k, 2]] Sin[angles[[k]]]
  , {k, m}]
```

Out[84]=

$$\left\{0,\ 0,\ \sqrt{2}\right\}$$

In[85]:=
```
x = LeastSquares[A, b]
```

Out[85]=

$$\{1,\ 1\}$$

In[86]:=
```
A.x - b
```

Out[86]=

$$\{0,\ 0,\ 0\}$$

3 normal equations

In[88]:=
```
W = A^H.A
```

Out[88]=

$$\left\{\left\{\frac{3}{2}, -\frac{1}{2}\right\}, \left\{-\frac{1}{2}, \frac{3}{2}\right\}\right\}$$

In[89]:=
```
Det[W]
```

Out[89]=

$$2$$

In[90]:=
```
Winv = Inverse[W]
```

Out[90]=

$$\left\{\left\{\frac{3}{4}, \frac{1}{4}\right\}, \left\{\frac{1}{4}, \frac{3}{4}\right\}\right\}$$

In[91]:=
```
A^H.b
```

Out[91]=
```
{1, 1}
```

In[93]:=
```
Apinv = Winv.A^H
```

Out[93]=
$$\left\{\left\{\frac{1}{2\sqrt{2}}, -\frac{1}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}, \left\{-\frac{1}{2\sqrt{2}}, \frac{1}{2\sqrt{2}}, \frac{1}{\sqrt{2}}\right\}\right\}$$

In[94]:=
```
LS = Apinv.b
```

Out[94]=
```
{1, 1}
```

In[95]:=
```
A.x - b
```

Out[95]=
```
{0, 0, 0}
```

In[97]:=
```
r = A.x - b
```

Out[97]=
```
{0, 0, 0}
```

---

end