34_PeerAssessment_GionRubitschung

December 3, 2023

Solve in the sense of least squares:

$$\begin{aligned} x + y &\approx 5 \\ x + 2z &\approx 7 \\ y - z - x &\approx 9 \\ 6y + z &\approx -4 \\ y + 5x &\approx 0 \end{aligned}$$

That is, find numbers x, y, z that minimize

$$(x+y-5)^2+(x+2z-7)^2+(y-z-x-9)^2+(6y+z+4)^2+(y+5x)^2$$

Hint. First translate to matrix form.

[1]:

```
import numpy as np

A = np.array([[1, 1, 0], [1, 0, 2], [-1, 1, -1], [0, 6, 1], [5, 1, 0]])
b = np.array([5, 7, 9, -4, 0])
```

[2]:

```
A
```

[2]:

```
array([[ 1,  1,  0],
       [ 1,  0,  2],
       [-1,  1, -1],
       [ 0,  6,  1],
       [ 5,  1,  0]])
```

[3]:

```
b
```

```
[3]: array([ 5,  7,  9, -4,  0])
```

```
[4]: Q, R = np.linalg.qr(A)
```

```
[5]: Q
```

```
[5]: array([[-0.18898224,  0.13306585, -0.08956879],
            [-0.18898224, -0.02892736,  0.84285469],
            [ 0.18898224,  0.19092057, -0.45403534],
            [-0.        ,  0.97195925,  0.13084473],
            [-0.94491118,  0.01735642, -0.24146425]])
```

```
[6]: R
```

```
[6]: array([[-5.29150262, -0.94491118, -0.56694671],
            [ 0.        ,  6.17309832,  0.72318396],
            [ 0.        ,  0.        ,  2.27058944]])
```

```
[7]: f = np.linalg.inv(R) @ (Q.T @ b)
     f
```

```
[7]: array([ 0.12452281, -0.31994183,  0.37102345])
```

```
[8]: f = np.linalg.solve(R, Q.T @ b)
     f
```

```
[8]: array([ 0.12452281, -0.31994183,  0.37102345])
```

```
[9]: f = np.linalg.lstsq(A, b)[0]
     f
```

```
/var/folders/ng/m_18wrfj7_ldv648sq9dh1km0000gn/T/ipykernel_66357/1992027921.py:1
: FutureWarning: `rcond` parameter will change to the default of machine
precision times ``max(M, N)`` where M and N are the input matrix dimensions.
To use the future default and silence this warning we advise to pass
`rcond=None`, to keep using the old, explicitly pass `rcond=-1`.
  f = np.linalg.lstsq(A, b)[0]
```

```
[9]: array([ 0.12452281, -0.31994183,  0.37102345])
```