```
>> HW5Demo

A =

  1.0e+04 *

    0.0001    0.0002    0.0004    0.0008    0.0016    0.0032    0.0064    0.0128
    0.0001    0.0002    0.0005    0.0011    0.0023    0.0052    0.0113    0.0249
    0.0001    0.0002    0.0006    0.0014    0.0033    0.0080    0.0191    0.0459
    0.0001    0.0003    0.0007    0.0018    0.0046    0.0119    0.0309    0.0803
    0.0001    0.0003    0.0008    0.0022    0.0061    0.0172    0.0482    0.1349
    0.0001    0.0003    0.0009    0.0027    0.0081    0.0243    0.0729    0.2187
    0.0001    0.0003    0.0010    0.0033    0.0105    0.0336    0.1074    0.3436
    0.0001    0.0003    0.0012    0.0039    0.0134    0.0454    0.1545    0.5252
    0.0001    0.0004    0.0013    0.0047    0.0168    0.0605    0.2177    0.7836
    0.0001    0.0004    0.0014    0.0055    0.0209    0.0792    0.3011    1.1442
    0.0001    0.0004    0.0016    0.0064    0.0256    0.1024    0.4096    1.6384


b =

  1.0e+04 *

    0.0255
    0.0456
    0.0786
    0.1305
    0.2098
    0.3280
    0.4997
    0.7440
    1.0850
    1.5527
    2.1845
```

Here is the QR-factorization by Gram-Schmidt process

```
Q =

  Columns 1 through 10

    0.3015   -0.4767    0.5121   -0.4580    0.3548   -0.2402    0.1416   -0.1030↙
   -0.0071    0.0726
    0.3015   -0.3814    0.2048    0.0916   -0.3548    0.4804   -0.4531    0.4287↙
   -0.0698   -0.2019
    0.3015   -0.2860   -0.0341    0.3359   -0.3548    0.0801    0.2738   -0.5267↙
    0.4171   -0.0496
    0.3015   -0.1907   -0.2048    0.3512   -0.0591   -0.3203    0.3398   -0.0542↙
   -0.7067    0.5790
    0.3015   -0.0953   -0.3073    0.2137    0.2365   -0.3203   -0.1133    0.4191↙
    0.2935   -0.3070
    0.3015   -0.0000   -0.3414    0.0000    0.3548   -0.0000   -0.3776    0.0933↙
    0.3209   -0.4540
    0.3015    0.0953   -0.3073   -0.2137    0.2365    0.3203   -0.1132   -0.3631↙
   -0.1903    0.2660
    0.3015    0.1907   -0.2048   -0.3512   -0.0591    0.3203    0.3399   -0.1138↙
   -0.2282    0.3683
    0.3015    0.2860   -0.0341   -0.3359   -0.3548   -0.0801    0.2738    0.3914↙
```

```
0.2085   -0.3286
    0.3015     0.3814     0.2048    -0.0916    -0.3548    -0.4804    -0.4532    -0.2045↙
-0.0275     0.0339
    0.3015     0.4767     0.5121     0.4580     0.3548     0.2402     0.1417     0.0329↙
-0.0104     0.0211

   Column 11

   -0.0764
    0.2198
    0.0209
   -0.5697
    0.3260
    0.4412
   -0.2745
   -0.3622
    0.3339
   -0.0393
   -0.0198


R =

   1.0e+04 *

    0.0003     0.0010     0.0031     0.0101     0.0341     0.1178     0.4158     1.4933
         0     0.0002     0.0013     0.0058     0.0244     0.0985     0.3887     1.5176
         0          0     0.0001     0.0011     0.0064     0.0334     0.1583     0.7110
         0          0          0     0.0001     0.0008     0.0057     0.0354     0.1934
         0          0          0          0     0.0000     0.0005     0.0044     0.0317
         0          0          0          0          0     0.0000     0.0003     0.0030
         0          0          0          0          0          0     0.0000     0.0002
         0          0          0          0          0          0          0     0.0000
         0          0          0          0          0          0          0          0
         0          0          0          0          0          0          0          0
         0          0          0          0          0          0          0          0
```

Here is the QR-factorization by Householder Reflectors.

Q =

   Columns 1 through 10

```
   -0.3015     0.0702    -0.0917    -0.1092    -0.0706    -0.0236     0.0220     0.0699↙
-0.4169    -0.5180
   -0.3015    -0.9154     0.2195     0.1283     0.0695     0.0345     0.0136     0.0024↙
-0.0032    -0.0051
   -0.3015    -0.0500    -0.8678     0.3019     0.1816     0.1019     0.0475     0.0101↙
0.0548     0.0750
   -0.3015    -0.0140    -0.0809    -0.8627     0.2849     0.1768     0.0983     0.0394↙
0.0643     0.1032
   -0.3015     0.0220    -0.0397    -0.0701    -0.8804     0.2467     0.1552     0.0819↙
0.0403     0.0956
   -0.3015     0.0579     0.0057    -0.0366    -0.0598    -0.8996     0.2119     0.1307↙
-0.0023     0.0677
   -0.3015     0.0939     0.0552     0.0056    -0.0294    -0.0516    -0.9138     0.1807↙
-0.0563     0.0261
   -0.3015     0.1299     0.1090     0.0572     0.0151    -0.0148    -0.0347    -0.9191↙
```

```
-0.1183   -0.0290
   -0.3015    0.1659    0.1668    0.1188    0.0760    0.0445    0.0223    0.0098↙
0.8462   -0.2050
   -0.3015    0.2019    0.2288    0.1914    0.1559    0.1318    0.1169    0.1124↙
-0.1851    0.7343
   -0.3015    0.2378    0.2950    0.2754    0.2573    0.2534    0.2608    0.2820↙
-0.2234   -0.3447

  Column 11

  -0.6563
  -0.0134
   0.0897
   0.1401
   0.1568
   0.1578
   0.1487
   0.1256
  -0.2705
  -0.3714
   0.4929


R =

  1.0e+04 *

  -0.0003   -0.0010   -0.0031   -0.0101   -0.0341   -0.1178   -0.4158   -1.4933
   0.0000    0.0001    0.0007    0.0034    0.0141    0.0562    0.2184    0.8414
   0.0000    0.0001    0.0007    0.0033    0.0141    0.0577    0.2302    0.9061
  -0.0000    0.0001    0.0005    0.0023    0.0103    0.0437    0.1796    0.7242
  -0.0000    0.0000    0.0003    0.0015    0.0071    0.0314    0.1339    0.5574
  -0.0000    0.0000    0.0002    0.0009    0.0047    0.0221    0.0993    0.4314
  -0.0000    0.0000    0.0001    0.0005    0.0028    0.0146    0.0706    0.3242
  -0.0000   -0.0000   -0.0000    0.0001    0.0012    0.0080    0.0442    0.2217
   0.0000    0.0000    0.0002    0.0008    0.0025    0.0068    0.0147    0.0109
   0.0000    0.0001    0.0003    0.0011    0.0039    0.0135    0.0444    0.1410
   0.0000    0.0001    0.0003    0.0014    0.0057    0.0221    0.0873    0.3500
```

--------------------------Summary--------------------------
1) The solution by Gram-Schmidt QR-factorization:

GSx =

  1.0e+04 *

   3.7719   -9.2807   9.6876   -5.5614   1.8969   -0.3843   0.0430   -0.0019

2) The solution by Householder reflector QR-factorization:

HRx =

   1.0000   1.0000   1.0000   1.0000   1.0000   1.0000   1.0000   1.0000

3) The solution of the normal equation by Matlab command \:

xMatlab =

```
   -2.8657    10.5537    -9.0170     6.7767    -0.9793     1.4030     0.9548     1.0021
```

4) The exact solution:

exactSol =

```
     1     1     1     1     1     1     1     1
```

\>\>