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Problem 1 – Exercise 11.3

Note. I used the code “mgs.m”, “house.m” that I implemented when doing hw3.

```
1      %%%% Problem 1 %%%%
2      % setup
3      m = 50; n = 12;
4      t = linspace(0,1,m); A = flipplr(vander(t)); A = A(:,1:n);
5      b = cos(4*t); b = b';
6
7      % (a)
8      xnormal == (A'*A)\(A'*b)
9
10     % (b)
11     [q,r] = mgs(A);
12     xmgs == r\(q'*b)
13
14     % (c)
15     [w,r] = house(A);
16     q = formQ(w); q = q(:,1:n);
17     xhouse == r\(q'*b)
18
19     % (d)
20     [q,r] = qr(A); q = q(:,1:n); r = r(1:n,:);
21     xqr == r\(q'*b)
22
23     % (e)
24     xlsq == A\b
25
26     % (f)
27     [u,s,v] = svd(A);
28     xsvd == v*(s\(u'*b))|
```

The following is the result of the code. (xnormal, xmgs, xhouse, xqr, xlsq, xsvd)

```

xnormal =  xmgs =      xhouse =  xqr =      xlsq =      xsvd =

    1.0000    1.0000    1.0000    1.0000    1.0000    1.0000
    0.0000    0.0000   -0.0000   -0.0000   -0.0000   -0.0000
   -8.0001   -8.0000   -8.0000   -8.0000   -8.0000   -8.0000
    0.0014    0.0002   -0.0003   -0.0003   -0.0003   -0.0003
   10.6567   10.6656   10.6694   10.6694   10.6694   10.6694
    0.0421    0.0037   -0.0138   -0.0138   -0.0138   -0.0138
   -5.8026   -5.6969   -5.6471   -5.6471   -5.6471   -5.6471
    0.2046    0.0162   -0.0753   -0.0753   -0.0753   -0.0753
    1.3679    1.5853    1.6936    1.6936    1.6936    1.6936
    0.2425    0.0859    0.0060    0.0060    0.0060    0.0060
   -0.4716   -0.4076   -0.3742   -0.3742   -0.3742   -0.3742
    0.1054    0.0941    0.0880    0.0880    0.0880    0.0880

```

I look up those results in more detail by clicking each variable in workspace.

(First: xnormal / Second: xmgs / Third: xhouse, xqr, xlsq, xsvd)

| | 1 | | 1 | | 1 |
|----|------------|----|------------|----|-------------|
| 1 | 1.0000 | 1 | 1.0000 | 1 | 1.0000 |
| 2 | 2.8802e-06 | 2 | 4.7846e-07 | 2 | -4.2274e-07 |
| 3 | -8.0001 | 3 | -8.0000 | 3 | -8.0000 |
| 4 | 0.0014 | 4 | 1.8538e-04 | 4 | -3.1876e-04 |
| 5 | 10.6567 | 5 | 10.6656 | 5 | 10.6694 |
| 6 | 0.0421 | 6 | 0.0037 | 6 | -0.0138 |
| 7 | -5.8026 | 7 | -5.6969 | 7 | -5.6471 |
| 8 | 0.2046 | 8 | 0.0162 | 8 | -0.0753 |
| 9 | 1.3679 | 9 | 1.5853 | 9 | 1.6936 |
| 10 | 0.2425 | 10 | 0.0859 | 10 | 0.0060 |
| 11 | -0.4716 | 11 | -0.4076 | 11 | -0.3742 |
| 12 | 0.1054 | 12 | 0.0941 | 12 | 0.0880 |