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Intial values

```
clear;
m = 200;
n= 500;
r_m = .9*m;
v_m = .1*m;
close all;
addpath('./l1_ls_matlab');
```

Setting x value

```
x = zeros(n,1);
random_index = randi([0,n], 18,1);
for i = 1: size(random_index,1)
    x(random_index(i)) =  0 + (1000) * rand(1);
end

A = rand(m, n);
for i = 1:m
    for j = 1:n
        if A(i,j) > .5
            A(i,j) = 1/sqrt(m);
        else
            A(i,j) = -1/sqrt(m);
        end
    end
end
R = A(1:r_m,:);
V = A(r_m+1:m,:);

sigma = 0.05 * sum(norm(A*x)/m);
x_noise = x+ sigma*randn(size(x));

y=A*x_noise;
lambdas = [0.0001 0.0005  0.001 0.005  0.01 0.05 0.1 0.5 1 2 5];
errors = zeros(size(lambdas,1));
rmses = zeros(size(lambdas,1));
for i = 1:size(lambdas,2)
    [x_pred, status] = l1_ls(R,y(1:r_m),lambdas(i), 0.01);

    %validation error check
    y_pred = V*x_pred;
```

```
    error = sum((y(r_m+1:200) - y_pred).^2)/size(V,1);
    errors(i) = error;

    %rmse error check
    rmses(i) = norm(x_pred-x,2)/norm(x,2);
end
figure;
plot(log(lambdas), errors );
set(gca, 'XTick',log(lambdas));
xtickangle(90)


title('VE vs logarithm lambdas');
ylabel('VE');
xlabel('log(lambda)');

figure;
plot(log(lambdas), rmses );
set(gca, 'XTick',log(lambdas));
xtickangle(90)


title('RMSE vs logarithm lambdas');
xlabel('log(lambda)');
ylabel('RMSE');
```

```
Solving a problem of size (m=180, n=500), with lambda=1.00000e-04
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     5.19734e-01         Inf        0
   1     4.36e+06     4.36243e+06     5.19743e-01     2.0e-03        3
   2     4.36e+06     4.35822e+06     5.19746e-01     4.9e-04        0
   3     4.29e+06     4.29026e+06     5.19746e-01     7.8e-03        4
   4     4.26e+06     4.25647e+06     5.19746e-01     3.9e-03        0
   5     4.25e+06     4.24819e+06     5.19746e-01     9.8e-04        2
   6     4.25e+06     4.24612e+06     5.19746e-01     2.4e-04        0
   7     4.21e+06     4.21292e+06     5.19746e-01     3.9e-03        2
   8     4.20e+06     4.19637e+06     5.19746e-01     2.0e-03        0
   9     3.69e+06     3.68830e+06     5.19746e-01     6.3e-02        4
  10     3.57e+06     3.56641e+06     5.19746e-01     1.6e-02        0
  11     3.13e+06     3.13407e+06     5.19746e-01     6.3e-02        3
  12     3.03e+06     3.03035e+06     5.19746e-01     1.6e-02        0
  13     2.98e+06     2.98318e+06     5.19746e-01     7.8e-03        3
  14     2.97e+06     2.97145e+06     5.19746e-01     2.0e-03        0
  15     2.79e+06     2.78865e+06     5.19746e-01     3.1e-02        2
  16     2.70e+06     2.69943e+06     5.19746e-01     1.6e-02        0
  17     2.37e+06     2.37237e+06     5.19746e-01     6.3e-02        3
  18     1.94e+00     2.46372e+00     5.19746e-01     1.0e+00        9
  19     1.69e+00     2.20575e+00     5.19746e-01     1.0e+00       17
  20     1.68e+00     2.20030e+00     5.19746e-01     1.0e+00        7
  21     1.68e+00     2.19992e+00     5.19746e-01     1.0e+00       11
  22     1.67e+00     2.19976e+00     5.25134e-01     1.0e+00        7
```

```
 23     1.67e+00     2.19957e+00     5.25134e-01     1.0e+00        6
 24     1.63e+00     2.15569e+00     5.25134e-01     1.6e-02       51
 25     1.55e+00     2.07391e+00     5.25134e-01     3.1e-02       43
 26     1.47e+00     2.00010e+00     5.25134e-01     3.1e-02       44
 27     1.41e+00     1.93453e+00     5.25134e-01     3.1e-02       77
 28     1.35e+00     1.87546e+00     5.25134e-01     3.1e-02       95
 29     1.29e+00     1.81824e+00     5.25134e-01     3.1e-02       42
 30     1.24e+00     1.76719e+00     5.25134e-01     3.1e-02       79
 31     1.19e+00     1.71755e+00     5.25134e-01     3.1e-02       60
 32     1.14e+00     1.66983e+00     5.25134e-01     3.1e-02       60
 33     1.10e+00     1.62690e+00     5.25134e-01     3.1e-02      113
 34     1.06e+00     1.58555e+00     5.25134e-01     3.1e-02       77
 35     1.02e+00     1.54596e+00     5.25134e-01     3.1e-02       61
 36     9.47e-01     1.47241e+00     5.25134e-01     6.3e-02       79
 37     8.79e-01     1.40399e+00     5.25134e-01     6.3e-02      128
 38     8.13e-01     1.33815e+00     5.25134e-01     6.3e-02      111
 39     7.49e-01     1.27392e+00     5.25134e-01     6.3e-02      145
 40     6.89e-01     1.21373e+00     5.25134e-01     6.3e-02      214
 41     5.77e-01     1.10181e+00     5.25134e-01     3.1e-02      566
 42     5.08e-01     1.03336e+00     5.25134e-01     3.1e-02      603
 43     4.42e-01     9.67149e-01     5.25134e-01     6.3e-02      518
 44     4.07e-01     9.31760e-01     5.25134e-01     1.3e-01      395
 45     3.83e-01     9.08144e-01     5.25134e-01     2.5e-01      215
 46     3.74e-01     8.98756e-01     5.25134e-01     2.5e-01      147
 47     3.62e-01     8.87200e-01     5.25134e-01     5.0e-01       97
 48     1.31e-01     8.85304e-01     7.53890e-01     1.0e+00       81
 49     8.46e-02     8.83188e-01     7.98549e-01     5.0e-01       64
 50     5.37e-02     8.79718e-01     8.26018e-01     5.0e-01       64
 51     3.20e-02     8.77420e-01     8.45453e-01     5.0e-01       44
 52     2.09e-02     8.76500e-01     8.55638e-01     5.0e-01      112
 53     1.72e-02     8.76003e-01     8.58790e-01     5.0e-01      122
 54     1.16e-02     8.75597e-01     8.64033e-01     1.0e+00      118
 55     8.82e-03     8.75343e-01     8.66523e-01     1.0e+00      131
 56     8.69e-03     8.75209e-01     8.66523e-01     1.0e+00      139
 57     6.07e-03     8.75220e-01     8.69150e-01     1.0e+00      174
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-04
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     2.59867e+00         Inf        0
   1     4.36e+06     4.36244e+06     2.59872e+00     2.0e-03        3
   2     4.36e+06     4.35823e+06     2.59873e+00     4.9e-04        0
   3     4.29e+06     4.29028e+06     2.59873e+00     7.8e-03        4
   4     4.26e+06     4.25650e+06     2.59873e+00     3.9e-03        0
   5     4.22e+06     4.22345e+06     2.59873e+00     3.9e-03        2
   6     4.21e+06     4.20697e+06     2.59873e+00     2.0e-03        0
   7     3.70e+06     3.69739e+06     2.59873e+00     6.3e-02        3
   8     3.58e+06     3.57514e+06     2.59873e+00     1.6e-02        0
   9     3.35e+06     3.35495e+06     2.59873e+00     3.1e-02        3
  10     3.25e+06     3.24748e+06     2.59873e+00     1.6e-02        0
  11     3.15e+06     3.14659e+06     2.59873e+00     1.6e-02        2
  12     3.12e+06     3.12162e+06     2.59873e+00     3.9e-03        0
```

```
  13     1.76e+06     1.75609e+06     2.59873e+00     2.5e-01         3
  14     1.34e+06     1.33877e+06     2.60439e+00     1.3e-01         2
  15     1.25e+06     1.25316e+06     2.60548e+00     3.1e-02         1
  16     1.21e+06     1.21142e+06     2.60604e+00     1.6e-02         0
  17     3.03e+05     3.03463e+05     2.60717e+00     5.0e-01         5
  18     2.32e+05     2.31517e+05     2.60717e+00     1.3e-01         3
  19     2.17e+05     2.16807e+05     2.60717e+00     3.1e-02         1
  20     2.10e+05     2.09636e+05     2.60717e+00     1.6e-02         0
  21     1.18e+05     1.18003e+05     2.60890e+00     2.5e-01         5
  22     5.22e+02     5.24153e+02     2.60890e+00     1.0e+00         2
  23     1.39e+02     1.41300e+02     2.60890e+00     5.0e-01         9
  24     9.78e+00     1.23911e+01     2.60890e+00     1.0e+00         4
  25     8.38e+00     1.09893e+01     2.60890e+00     1.0e+00        13
  26     7.03e+00     9.63437e+00     2.60890e+00     7.8e-03       692
  27     5.02e+00     7.62954e+00     2.60890e+00     1.6e-02       403
  28     4.07e+00     6.68043e+00     2.60890e+00     1.6e-02       552
  29     3.28e+00     5.88654e+00     2.60890e+00     3.1e-02       468
  30     2.58e+00     5.19151e+00     2.60890e+00     6.3e-02       364
  31     2.19e+00     4.80260e+00     2.60890e+00     1.3e-01       261
  32     1.98e+00     4.59330e+00     2.60890e+00     2.5e-01       181
  33     1.88e+00     4.48995e+00     2.60890e+00     5.0e-01       129
  34     1.83e+00     4.44311e+00     2.60890e+00     5.0e-01        81
  35     9.52e-01     4.42004e+00     3.46829e+00     1.0e+00        67
  36     5.34e-01     4.42238e+00     3.88848e+00     1.0e+00        55
  37     3.28e-01     4.40848e+00     4.08045e+00     5.0e-01        56
  38     1.81e-01     4.38945e+00     4.20869e+00     5.0e-01        74
  39     1.28e-01     4.38320e+00     4.25533e+00     5.0e-01       101
  40     1.23e-01     4.37930e+00     4.25620e+00     1.0e+00       108
  41     9.44e-02     4.37977e+00     4.28539e+00     1.0e+00       133
  42     9.33e-02     4.37865e+00     4.28539e+00     1.0e+00        76
  43     6.40e-02     4.37867e+00     4.31466e+00     1.0e+00        73
  44     4.87e-02     4.37690e+00     4.32815e+00     1.0e+00       104
  45     3.29e-02     4.37637e+00     4.34344e+00     1.0e+00       141
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e-03
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     5.19734e+00         Inf         0
   1     4.36e+06     4.36244e+06     5.19743e+00     2.0e-03         3
   2     4.36e+06     4.35823e+06     5.19745e+00     4.9e-04         0
   3     4.29e+06     4.29030e+06     5.19745e+00     7.8e-03         4
   4     4.26e+06     4.25654e+06     5.19745e+00     3.9e-03         0
   5     4.00e+06     3.99579e+06     5.19745e+00     3.1e-02         2
   6     3.87e+06     3.86851e+06     5.19745e+00     1.6e-02         0
   7     3.63e+06     3.63028e+06     5.19776e+00     3.1e-02         2
   8     3.60e+06     3.60103e+06     5.19781e+00     3.9e-03         0
   9     3.16e+06     3.16494e+06     5.19781e+00     6.3e-02         4
  10     3.06e+06     3.06031e+06     5.19781e+00     1.6e-02         0
  11     1.72e+06     1.72124e+06     5.19815e+00     2.5e-01         4
  12     1.31e+06     1.31214e+06     5.21074e+00     1.3e-01         2
  13     1.23e+06     1.22823e+06     5.21293e+00     3.1e-02         1
  14     1.19e+06     1.18733e+06     5.21409e+00     1.6e-02         0
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  15     2.97e+05     2.97467e+05     5.21632e+00     5.0e-01         5
  16     2.27e+05     2.26947e+05     5.21632e+00     1.3e-01         3
  17     2.13e+05     2.12529e+05     5.21632e+00     3.1e-02         1
  18     2.05e+05     2.05500e+05     5.21632e+00     1.6e-02         0
  19     1.16e+05     1.15681e+05     5.21981e+00     2.5e-01         5
  20     2.83e+04     2.83416e+04     5.30492e+00     5.0e-01         2
  21     7.11e+03     7.11053e+03     5.31503e+00     5.0e-01         4
  22     4.06e+03     4.06206e+03     5.31503e+00     2.5e-01         4
  23     3.56e+03     3.57022e+03     5.32166e+00     6.3e-02         2
  24     3.33e+03     3.33637e+03     5.32558e+00     3.1e-02         0
  25     1.71e+01     2.23823e+01     5.32558e+00     1.0e+00         5
  26     1.66e+01     2.19654e+01     5.32558e+00     1.0e+00        13
  27     1.41e+01     1.93912e+01     5.32558e+00     7.8e-03       588
  28     1.03e+01     1.55919e+01     5.32558e+00     1.6e-02       384
  29     8.29e+00     1.36161e+01     5.32558e+00     1.6e-02       573
  30     6.55e+00     1.18748e+01     5.32558e+00     3.1e-02       462
  31     5.07e+00     1.03929e+01     5.32558e+00     6.3e-02       368
  32     4.28e+00     9.60645e+00     5.32558e+00     1.3e-01       265
  33     3.86e+00     9.18856e+00     5.32558e+00     2.5e-01       170
  34     3.66e+00     8.98068e+00     5.32558e+00     5.0e-01       122
  35     3.56e+00     8.88923e+00     5.32558e+00     5.0e-01        77
  36     2.58e+00     8.85288e+00     6.27462e+00     5.0e-01        49
  37     1.71e+00     8.84547e+00     7.13418e+00     1.0e+00        48
  38     1.71e+00     8.84399e+00     7.13418e+00     1.0e+00        19
  39     1.71e+00     8.84383e+00     7.13418e+00     1.0e+00        18
  40     1.49e+00     8.84491e+00     7.35240e+00     1.0e+00        19
  41     6.03e-01     8.83214e+00     8.22944e+00     1.0e+00        37
  42     4.96e-01     8.78210e+00     8.28659e+00     5.0e-01        71
  43     4.80e-01     8.76678e+00     8.28659e+00     1.0e+00        94
  44     3.94e-01     8.76851e+00     8.37463e+00     1.0e+00       105
  45     1.69e-01     8.76573e+00     8.59664e+00     1.0e+00        61
  46     9.94e-02     8.75926e+00     8.65988e+00     5.0e-01        93
  47     8.02e-02     8.75364e+00     8.67343e+00     5.0e-01       126
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-03
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     2.59866e+01         Inf         0
   1     4.36e+06     4.36247e+06     2.59871e+01     2.0e-03         3
   2     4.36e+06     4.35826e+06     2.59872e+01     4.9e-04         0
   3     4.29e+06     4.29048e+06     2.59872e+01     7.8e-03         4
   4     4.27e+06     4.27361e+06     2.59872e+01     2.0e-03         0
   5     4.01e+06     4.01179e+06     2.59872e+01     3.1e-02         2
   6     3.88e+06     3.88399e+06     2.59872e+01     1.6e-02         0
   7     3.65e+06     3.64537e+06     2.59872e+01     3.1e-02         3
   8     3.53e+06     3.52890e+06     2.59872e+01     1.6e-02         0
   9     3.31e+06     3.31181e+06     2.59872e+01     3.1e-02         3
  10     3.26e+06     3.25993e+06     2.59872e+01     7.8e-03         1
  11     8.14e+05     8.14071e+05     2.59872e+01     5.0e-01         3
  12     6.21e+05     6.21137e+05     2.59872e+01     1.3e-01         3
  13     5.82e+05     5.81617e+05     2.59872e+01     3.1e-02         1
  14     5.62e+05     5.62353e+05     2.59872e+01     1.6e-02         0
```

```
 15     1.41e+05     1.40866e+05     2.60387e+01     5.0e-01         5
 16     1.32e+05     1.32095e+05     2.60387e+01     3.1e-02         3
 17     1.16e+05     1.16036e+05     2.60414e+01     6.3e-02         2
 18     1.09e+05     1.08810e+05     2.60478e+01     3.1e-02         1
 19     2.73e+04     2.73321e+04     2.60478e+01     5.0e-01         3
 20     6.85e+03     6.87945e+03     2.60478e+01     5.0e-01         3
 21     1.46e+02     1.72362e+02     2.60478e+01     1.0e+00         4
 22     8.34e+01     1.09472e+02     2.60478e+01     1.0e+00         8
 23     7.94e+01     1.08860e+02     2.94392e+01     1.0e+00        10
 24     6.60e+01     9.55307e+01     2.94961e+01     7.8e-03       552
 25     4.61e+01     7.56280e+01     2.94961e+01     1.6e-02       303
 26     3.76e+01     6.71342e+01     2.95473e+01     1.6e-02       519
 27     2.93e+01     5.88672e+01     2.96134e+01     3.1e-02       353
 28     2.18e+01     5.18189e+01     3.00593e+01     6.3e-02       288
 29     1.74e+01     4.80006e+01     3.06385e+01     1.3e-01       228
 30     1.39e+01     4.59923e+01     3.20920e+01     2.5e-01       149
 31     1.29e+01     4.49636e+01     3.20920e+01     5.0e-01       106
 32     1.24e+01     4.44963e+01     3.20920e+01     5.0e-01        67
 33     5.47e+00     4.42472e+01     3.87800e+01     1.0e+00        54
 34     5.28e+00     4.40772e+01     3.88012e+01     5.0e-01        33
 35     2.54e+00     4.39702e+01     4.14337e+01     1.0e+00        64
 36     1.33e+00     4.38743e+01     4.25402e+01     5.0e-01        52
 37     7.02e-01     4.38072e+01     4.31048e+01     5.0e-01        78
 38     4.88e-01     4.37819e+01     4.32937e+01     5.0e-01       126
 39     3.69e-01     4.37560e+01     4.33865e+01     1.0e+00       108
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e-02
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     5.19732e+01         Inf        0
   1     4.36e+06     4.36250e+06     5.19741e+01     2.0e-03        3
   2     4.36e+06     4.35830e+06     5.19743e+01     4.9e-04        0
   3     4.29e+06     4.29066e+06     5.19743e+01     7.8e-03        4
   4     4.27e+06     4.27383e+06     5.19743e+01     2.0e-03        0
   5     4.01e+06     4.01218e+06     5.19743e+01     3.1e-02        2
   6     3.88e+06     3.88445e+06     5.19743e+01     1.6e-02        0
   7     3.41e+06     3.41488e+06     5.19743e+01     6.3e-02        3
   8     3.30e+06     3.30221e+06     5.19743e+01     1.6e-02        0
   9     2.53e+06     2.52820e+06     5.19743e+01     1.3e-01        4
  10     2.37e+06     2.36842e+06     5.19803e+01     3.1e-02        1
  11     2.08e+06     2.08265e+06     5.19818e+01     6.3e-02        2
  12     1.59e+06     1.59452e+06     5.20095e+01     1.3e-01        2
  13     9.75e+02     1.02676e+03     5.20095e+01     1.0e+00        3
  14     4.09e+02     4.60844e+02     5.20095e+01     5.0e-01        8
  15     2.29e+02     2.80628e+02     5.20095e+01     5.0e-01        2
  16     1.98e+02     2.49980e+02     5.20095e+01     1.0e+00        2
  17     1.65e+02     2.17171e+02     5.20095e+01     1.0e+00        5
  18     1.64e+02     2.15722e+02     5.20095e+01     1.0e+00        5
  19     1.63e+02     2.14939e+02     5.20095e+01     1.0e+00        2
  20     1.62e+02     2.13927e+02     5.20095e+01     1.0e+00        3
  21     1.61e+02     2.13019e+02     5.20095e+01     1.0e+00        3
  22     1.33e+02     1.84807e+02     5.20095e+01     1.6e-02      222
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 23     1.14e+02     1.65918e+02     5.20095e+01     1.6e-02      170
 24     9.92e+01     1.51235e+02     5.20095e+01     1.6e-02      132
 25     8.70e+01     1.39016e+02     5.20095e+01     1.6e-02      132
 26     7.65e+01     1.28475e+02     5.20095e+01     1.6e-02      108
 27     6.77e+01     1.19704e+02     5.20095e+01     1.6e-02      119
 28     5.36e+01     1.05580e+02     5.20095e+01     3.1e-02      143
 29     4.84e+01     1.00433e+02     5.20095e+01     6.3e-02      228
 30     4.23e+01     9.43236e+01     5.20095e+01     1.3e-01      121
 31     3.86e+01     9.13372e+01     5.27825e+01     2.5e-01      115
 32     3.64e+01     8.91468e+01     5.27825e+01     5.0e-01       69
 33     3.58e+01     8.85368e+01     5.27825e+01     5.0e-01       69
 34     2.06e+01     8.83901e+01     6.78095e+01     1.0e+00       55
 35     1.01e+01     8.84623e+01     7.83340e+01     1.0e+00       38
 36     5.27e+00     8.81238e+01     8.28543e+01     5.0e-01       44
 37     3.76e+00     8.76883e+01     8.39299e+01     5.0e-01       67
 38     1.48e+00     8.76477e+01     8.61658e+01     1.0e+00      106
 39     1.10e+00     8.75852e+01     8.64840e+01     5.0e-01       88
 40     6.87e-01     8.75428e+01     8.68556e+01     5.0e-01       94
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-02
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     2.59863e+02         Inf        0
   1     4.36e+06     4.36275e+06     2.59867e+02     2.0e-03        3
   2     4.36e+06     4.35862e+06     2.59867e+02     4.9e-04        0
   3     4.29e+06     4.29195e+06     2.59867e+02     7.8e-03        4
   4     4.28e+06     4.27537e+06     2.59867e+02     2.0e-03        0
   5     4.01e+06     4.01440e+06     2.59867e+02     3.1e-02        2
   6     3.89e+06     3.88699e+06     2.59867e+02     1.6e-02        0
   7     2.98e+06     2.97876e+06     2.59867e+02     1.3e-01        3
   8     2.26e+06     2.26353e+06     2.60033e+02     1.3e-01        1
   9     2.19e+06     2.19273e+06     2.60064e+02     1.6e-02        2
  10     2.06e+06     2.05692e+06     2.60074e+02     3.1e-02        2
  11     5.14e+05     5.14755e+05     2.60074e+02     5.0e-01        3
  12     3.93e+05     3.93237e+05     2.60074e+02     1.3e-01        3
  13     3.87e+05     3.86933e+05     2.60074e+02     7.8e-03        1
  14     2.97e+05     2.97348e+05     2.60074e+02     1.3e-01        2
  15     2.78e+05     2.78661e+05     2.60074e+02     3.1e-02        1
  16     2.61e+05     2.61747e+05     2.60074e+02     3.1e-02        2
  17     8.84e+02     1.14378e+03     2.60074e+02     1.0e+00        2
  18     7.83e+02     1.04318e+03     2.60074e+02     1.0e+00       10
  19     7.72e+02     1.03243e+03     2.60074e+02     5.0e-01        6
  20     6.57e+02     9.16643e+02     2.60074e+02     7.8e-03      466
  21     4.76e+02     7.35942e+02     2.60074e+02     1.6e-02      231
  22     3.89e+02     6.49012e+02     2.60074e+02     1.6e-02      316
  23     3.20e+02     5.79706e+02     2.60074e+02     3.1e-02      259
  24     2.82e+02     5.42011e+02     2.60074e+02     3.1e-02      163
  25     2.45e+02     5.05519e+02     2.60074e+02     6.3e-02      134
  26     2.29e+02     4.89026e+02     2.60074e+02     6.3e-02       86
  27     2.10e+02     4.70299e+02     2.60074e+02     1.3e-01       64
  28     1.98e+02     4.57681e+02     2.60074e+02     2.5e-01       61
  29     1.86e+02     4.45756e+02     2.60074e+02     5.0e-01       39
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  30     1.83e+02     4.43051e+02     2.60074e+02     5.0e-01       46
  31     1.47e+02     4.42135e+02     2.95457e+02     1.0e+00       28
  32     5.96e+01     4.42450e+02     3.82827e+02     1.0e+00       23
  33     4.27e+01     4.41194e+02     3.98499e+02     5.0e-01       34
  34     3.52e+01     4.38696e+02     4.03471e+02     1.0e+00       41
  35     3.51e+01     4.38839e+02     4.03720e+02     1.0e+00       50
  36     7.11e+00     4.38929e+02     4.31815e+02     1.0e+00       36
  37     5.91e+00     4.38185e+02     4.32275e+02     5.0e-01       63
  38     3.58e+00     4.37820e+02     4.34242e+02     5.0e-01       65
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e-01
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     5.19718e+02         Inf       0
   1     4.36e+06     4.36305e+06     5.19723e+02     2.0e-03       3
   2     4.36e+06     4.35900e+06     5.19724e+02     4.9e-04       0
   3     4.29e+06     4.29345e+06     5.19724e+02     7.8e-03       4
   4     4.28e+06     4.27715e+06     5.19724e+02     2.0e-03       0
   5     4.15e+06     4.14587e+06     5.19728e+02     1.6e-02       9
   6     4.08e+06     4.08100e+06     5.19735e+02     7.8e-03       0
   7     3.83e+06     3.83128e+06     5.19779e+02     3.1e-02       2
   8     3.77e+06     3.77008e+06     5.19791e+02     7.8e-03       0
   9     3.31e+06     3.31439e+06     5.19791e+02     6.3e-02       3
  10     3.20e+06     3.20505e+06     5.19791e+02     1.6e-02       0
  11     2.82e+06     2.81706e+06     5.19791e+02     6.3e-02       4
  12     2.63e+06     2.63245e+06     5.19801e+02     3.1e-02       0
  13     2.31e+06     2.31379e+06     5.19819e+02     6.3e-02       4
  14     2.24e+06     2.23734e+06     5.19824e+02     1.6e-02       0
  15     1.97e+06     1.96655e+06     5.19844e+02     6.3e-02       4
  16     1.93e+06     1.93393e+06     5.19847e+02     7.8e-03       0
  17     1.70e+06     1.69988e+06     5.19864e+02     6.3e-02       4
  18     1.67e+06     1.67169e+06     5.19866e+02     7.8e-03       0
  19     1.47e+06     1.46939e+06     5.19889e+02     6.3e-02       4
  20     1.42e+06     1.42085e+06     5.19895e+02     1.6e-02       0
  21     1.25e+06     1.24896e+06     5.19914e+02     6.3e-02       4
  22     1.21e+06     1.20772e+06     5.19919e+02     1.6e-02       0
  23     1.06e+06     1.06164e+06     5.19937e+02     6.3e-02       4
  24     9.92e+05     9.92137e+05     5.19947e+02     3.1e-02       0
  25     9.31e+05     9.31179e+05     5.19961e+02     3.1e-02       4
  26     9.01e+05     9.01426e+05     5.19969e+02     1.6e-02       0
  27     8.46e+05     8.46098e+05     5.19969e+02     3.1e-02       3
  28     8.32e+05     8.32540e+05     5.19969e+02     7.8e-03       0
  29     7.31e+05     7.32005e+05     5.19969e+02     6.3e-02       3
  30     7.19e+05     7.19894e+05     5.19969e+02     7.8e-03       0
  31     6.75e+05     6.75671e+05     5.19969e+02     3.1e-02       4
  32     6.64e+05     6.64835e+05     5.19969e+02     7.8e-03       0
  33     6.24e+05     6.24042e+05     5.19969e+02     3.1e-02       3
  34     6.14e+05     6.14046e+05     5.19969e+02     7.8e-03       0
  35     5.76e+05     5.76398e+05     5.19969e+02     3.1e-02       3
  36     5.58e+05     5.58021e+05     5.19969e+02     1.6e-02       0
  37     5.23e+05     5.23838e+05     5.19969e+02     3.1e-02       3
  38     5.07e+05     5.07153e+05     5.19969e+02     1.6e-02       0
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39	4.76e+05	4.76078e+05	5.19969e+02	3.1e-02	3
40	4.72e+05	4.72264e+05	5.19969e+02	3.9e-03	0
41	4.43e+05	4.43325e+05	5.19969e+02	3.1e-02	3
42	4.29e+05	4.29201e+05	5.19969e+02	1.6e-02	0
43	4.02e+05	4.02916e+05	5.19969e+02	3.1e-02	3
44	3.90e+05	3.90086e+05	5.19969e+02	1.6e-02	0
45	3.43e+05	3.43106e+05	5.19969e+02	6.3e-02	3
46	3.31e+05	3.31834e+05	5.19969e+02	1.6e-02	0
47	3.11e+05	3.11510e+05	5.19969e+02	3.1e-02	4
48	3.06e+05	3.06530e+05	5.19969e+02	7.8e-03	0
49	2.87e+05	2.87778e+05	5.19969e+02	3.1e-02	3
50	2.78e+05	2.78625e+05	5.19969e+02	1.6e-02	0
51	2.61e+05	2.61612e+05	5.19969e+02	3.1e-02	3
52	2.59e+05	2.59524e+05	5.19969e+02	3.9e-03	0
53	2.43e+05	2.43671e+05	5.19969e+02	3.1e-02	3
54	2.35e+05	2.35934e+05	5.19969e+02	1.6e-02	0
55	2.21e+05	2.21540e+05	5.19969e+02	3.1e-02	3
56	2.14e+05	2.14515e+05	5.19969e+02	1.6e-02	0
57	2.01e+05	2.01440e+05	5.19969e+02	3.1e-02	3
58	1.95e+05	1.95058e+05	5.19969e+02	1.6e-02	0
59	1.83e+05	1.83182e+05	5.19969e+02	3.1e-02	3
60	1.77e+05	1.77386e+05	5.19969e+02	1.6e-02	0
61	1.66e+05	1.66595e+05	5.19969e+02	3.1e-02	3
62	1.61e+05	1.61328e+05	5.19969e+02	1.6e-02	0
63	1.42e+05	1.42033e+05	5.19969e+02	6.3e-02	3
64	1.33e+05	1.33533e+05	5.19969e+02	3.1e-02	2
65	1.29e+05	1.29382e+05	5.19969e+02	1.6e-02	0
66	1.21e+05	1.21533e+05	5.19969e+02	3.1e-02	3
67	1.19e+05	1.19610e+05	5.19969e+02	7.8e-03	0
68	1.05e+05	1.05360e+05	5.19969e+02	6.3e-02	3
69	9.25e+04	9.30411e+04	5.19969e+02	6.3e-02	2
70	8.96e+04	9.00841e+04	5.19969e+02	1.6e-02	0
71	8.41e+04	8.46502e+04	5.19971e+02	3.1e-02	4
72	8.28e+04	8.33188e+04	5.19974e+02	7.8e-03	0
73	7.30e+04	7.34856e+04	5.19974e+02	6.3e-02	3
74	7.18e+04	7.23013e+04	5.19974e+02	7.8e-03	0
75	6.33e+04	6.37842e+04	5.19974e+02	6.3e-02	4
76	6.22e+04	6.27585e+04	5.19974e+02	7.8e-03	0
77	5.49e+04	5.54173e+04	5.19999e+02	6.3e-02	4
78	5.40e+04	5.45332e+04	5.20003e+02	7.8e-03	0
79	4.77e+04	4.81864e+04	5.20086e+02	6.3e-02	4
80	4.49e+04	4.54104e+04	5.20182e+02	3.1e-02	2
81	4.35e+04	4.40553e+04	5.20233e+02	1.6e-02	0
82	3.85e+04	3.89885e+04	5.20241e+02	6.3e-02	3
83	3.41e+04	3.46225e+04	5.20355e+02	6.3e-02	2
84	3.31e+04	3.35749e+04	5.20386e+02	1.6e-02	0
85	2.93e+04	2.98015e+04	5.20394e+02	6.3e-02	10
86	2.84e+04	2.88966e+04	5.20396e+02	1.6e-02	0
87	2.52e+04	2.56904e+04	5.20396e+02	6.3e-02	14
88	2.36e+04	2.41659e+04	5.20396e+02	3.1e-02	0
89	2.10e+04	2.15401e+04	5.20396e+02	6.3e-02	4
90	2.07e+04	2.12240e+04	5.20396e+02	7.8e-03	0
91	2.01e+04	2.06085e+04	5.20396e+02	7.8e-03	236
92	1.98e+04	2.03016e+04	5.20396e+02	3.9e-03	0

93	1.93e+04	1.98507e+04	5.20396e+02	7.8e-03	165
94	1.91e+04	1.96262e+04	5.20396e+02	3.9e-03	0
95	1.84e+04	1.89203e+04	5.20396e+02	1.6e-02	157
96	1.83e+04	1.88326e+04	5.20396e+02	2.0e-03	0
97	1.77e+04	1.82305e+04	5.20396e+02	1.6e-02	141
98	1.76e+04	1.81558e+04	5.20396e+02	2.0e-03	0
99	1.65e+04	1.70613e+04	5.20396e+02	3.1e-02	115
100	1.64e+04	1.69269e+04	5.20396e+02	3.9e-03	0
101	1.54e+04	1.59404e+04	5.20399e+02	3.1e-02	110
102	1.49e+04	1.54587e+04	5.20424e+02	1.6e-02	0
103	1.41e+04	1.45759e+04	5.20472e+02	3.1e-02	75
104	1.36e+04	1.41450e+04	5.20497e+02	1.6e-02	0
105	1.20e+04	1.25682e+04	5.20534e+02	6.3e-02	58
106	1.17e+04	1.22178e+04	5.20534e+02	1.6e-02	2
107	1.15e+04	1.20398e+04	5.20534e+02	7.8e-03	2
108	1.14e+04	1.18709e+04	5.20534e+02	7.8e-03	2
109	1.10e+04	1.15345e+04	5.20534e+02	1.6e-02	2
110	1.07e+04	1.12147e+04	5.20534e+02	1.6e-02	2
111	1.05e+04	1.10578e+04	5.20534e+02	7.8e-03	2
112	1.05e+04	1.09799e+04	5.20534e+02	3.9e-03	0
113	9.26e+03	9.77863e+03	5.20587e+02	6.3e-02	82
114	8.69e+03	9.20695e+03	5.20633e+02	3.1e-02	0
115	6.77e+03	7.29278e+03	5.20633e+02	1.3e-01	41
116	5.99e+03	6.51519e+03	5.20789e+02	6.3e-02	1
117	5.82e+03	6.34546e+03	5.20789e+02	1.6e-02	2
118	5.49e+03	6.01462e+03	5.21097e+02	3.1e-02	2
119	5.19e+03	5.71544e+03	5.21097e+02	3.1e-02	2
120	5.05e+03	5.56904e+03	5.21170e+02	1.6e-02	2
121	4.77e+03	5.29418e+03	5.21201e+02	3.1e-02	2
122	4.51e+03	5.03049e+03	5.21232e+02	3.1e-02	5
123	4.38e+03	4.90195e+03	5.21248e+02	1.6e-02	0
124	4.09e+03	4.60800e+03	5.21248e+02	3.1e-02	143
125	3.94e+03	4.46388e+03	5.21248e+02	1.6e-02	0
126	3.47e+03	3.98651e+03	5.21319e+02	6.3e-02	142
127	3.41e+03	3.92889e+03	5.21330e+02	7.8e-03	0
128	2.67e+03	3.19597e+03	5.21465e+02	1.3e-01	108
129	2.53e+03	3.05222e+03	5.21709e+02	3.1e-02	2
130	2.46e+03	2.98093e+03	5.21753e+02	1.6e-02	2
131	2.33e+03	2.84778e+03	5.21897e+02	3.1e-02	9
132	2.20e+03	2.72458e+03	5.21995e+02	3.1e-02	6
133	2.14e+03	2.66698e+03	5.21995e+02	1.6e-02	2
134	2.03e+03	2.55499e+03	5.21995e+02	3.1e-02	5
135	1.98e+03	2.50422e+03	5.21995e+02	1.6e-02	2
136	1.88e+03	2.40592e+03	5.21995e+02	3.1e-02	2
137	1.71e+03	2.23236e+03	5.21995e+02	6.3e-02	2
138	1.56e+03	2.08142e+03	5.21995e+02	6.3e-02	2
139	1.31e+03	1.83382e+03	5.21995e+02	1.3e-01	2
140	1.13e+03	1.65323e+03	5.21995e+02	1.3e-01	2
141	8.81e+02	1.40319e+03	5.21995e+02	2.5e-01	2
142	8.16e+02	1.33776e+03	5.21995e+02	1.3e-01	2
143	8.04e+02	1.32583e+03	5.21995e+02	3.1e-02	2
144	7.62e+02	1.28451e+03	5.22267e+02	1.3e-01	2
145	7.09e+02	1.23144e+03	5.22267e+02	5.0e-01	2
146	7.09e+02	1.23144e+03	5.22267e+02	5.7e-14	4

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 147     7.09e+02     1.23144e+03     5.22267e+02     5.6e-17        0
 148     5.92e+02     1.11399e+03     5.22355e+02     3.1e-02      197
 149     5.01e+02     1.02350e+03     5.22413e+02     6.3e-02      112
 150     4.67e+02     9.90152e+02     5.23510e+02     6.3e-02       72
 151     4.27e+02     9.51071e+02     5.24070e+02     1.3e-01       39
 152     4.06e+02     9.32482e+02     5.26932e+02     1.3e-01       33
 153     3.91e+02     9.19013e+02     5.27705e+02     1.3e-01       10
 154     3.69e+02     9.03237e+02     5.34142e+02     2.5e-01       10
 155     3.50e+02     8.93946e+02     5.43735e+02     5.0e-01       18
 156     3.49e+02     8.93097e+02     5.43735e+02     1.0e+00       18
 157     3.48e+02     8.92148e+02     5.43735e+02     1.0e+00       53
 158     3.48e+02     8.91410e+02     5.43735e+02     1.0e+00       44
 159     3.44e+02     8.87450e+02     5.43735e+02     1.0e+00       46
 160     2.52e+01     8.86233e+02     8.61043e+02     1.0e+00       40
 161     1.81e+01     8.79551e+02     8.61444e+02     5.0e-01       46
 162     1.54e+01     8.76798e+02     8.61444e+02     5.0e-01       50
 163     1.13e+01     8.75837e+02     8.64510e+02     5.0e-01       52
 164     8.08e+00     8.75186e+02     8.67108e+02     5.0e-01       40
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-01
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37929e+06     2.59828e+03         Inf        0
   1     4.36e+06     4.36505e+06     2.59828e+03     2.0e-03        3
   2     4.33e+06     4.33629e+06     2.59828e+03     3.9e-03        1
   3     4.21e+06     4.21514e+06     2.59859e+03     1.6e-02        2
   4     3.72e+06     3.71967e+06     2.59859e+03     6.3e-02        2
   5     3.49e+06     3.49496e+06     2.59859e+03     3.1e-02        1
   6     2.68e+06     2.68068e+06     2.59859e+03     1.3e-01        3
   7     2.35e+06     2.34980e+06     2.59955e+03     6.3e-02        1
   8     2.19e+06     2.19259e+06     2.60018e+03     3.1e-02        0
   9     1.23e+06     1.23731e+06     2.60122e+03     2.5e-01        4
  10     9.43e+05     9.45617e+05     2.60742e+03     1.3e-01        2
  11     9.13e+05     9.15488e+05     2.60803e+03     1.6e-02        1
  12     8.04e+05     8.06937e+05     2.60813e+03     6.3e-02        2
  13     7.07e+05     7.09338e+05     2.60909e+03     6.3e-02        1
  14     5.43e+05     5.45442e+05     2.60909e+03     1.3e-01        3
  15     4.14e+05     4.16669e+05     2.61156e+03     1.3e-01        1
  16     4.01e+05     4.03881e+05     2.61233e+03     1.6e-02        1
  17     3.09e+05     3.11865e+05     2.61233e+03     1.3e-01        2
  18     1.77e+05     1.79202e+05     2.61333e+03     2.5e-01        7
  19     1.56e+05     1.58280e+05     2.61666e+03     6.3e-02        2
  20     1.21e+05     1.23476e+05     2.61832e+03     1.3e-01        2
  21     1.07e+05     1.09714e+05     2.62073e+03     6.3e-02        2
  22     8.34e+04     8.59867e+04     2.62245e+03     1.3e-01        2
  23     7.37e+04     7.63347e+04     2.62414e+03     6.3e-02        1
  24     5.77e+04     6.02780e+04     2.62432e+03     1.3e-01        3
  25     4.54e+04     4.80083e+04     2.62432e+03     1.3e-01        3
  26     4.06e+04     4.32194e+04     2.62521e+03     6.3e-02        2
  27     3.22e+04     3.48330e+04     2.62805e+03     1.3e-01        2
  28     2.89e+04     3.15721e+04     2.63110e+03     6.3e-02        2
  29     2.33e+04     2.59364e+04     2.63442e+03     1.3e-01        2
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 30     2.11e+04     2.37748e+04     2.63818e+03     6.3e-02        2
 31     2.01e+04     2.27832e+04     2.63840e+03     3.1e-02        1
 32     1.83e+04     2.09373e+04     2.64043e+03     6.3e-02        2
 33     1.74e+04     2.00581e+04     2.64155e+03     3.1e-02        0
 34     1.62e+04     1.88871e+04     2.64174e+03     1.6e-02      277
 35     1.57e+04     1.83039e+04     2.64183e+03     7.8e-03        0
 36     1.43e+04     1.69848e+04     2.64233e+03     3.1e-02      272
 37     1.40e+04     1.66586e+04     2.64247e+03     7.8e-03        0
 38     1.24e+04     1.49965e+04     2.64320e+03     6.3e-02      149
 39     1.16e+04     1.42298e+04     2.64320e+03     3.1e-02        5
 40     1.09e+04     1.35310e+04     2.64320e+03     3.1e-02       16
 41     1.03e+04     1.28945e+04     2.64320e+03     3.1e-02       17
 42     9.65e+03     1.22914e+04     2.64320e+03     3.1e-02       12
 43     9.08e+03     1.17211e+04     2.64320e+03     3.1e-02        7
 44     8.56e+03     1.12060e+04     2.64320e+03     3.1e-02       16
 45     7.66e+03     1.03001e+04     2.64320e+03     6.3e-02       17
 46     6.89e+03     9.53688e+03     2.64320e+03     6.3e-02       16
 47     6.23e+03     8.87735e+03     2.64320e+03     6.3e-02        6
 48     5.66e+03     8.30227e+03     2.64320e+03     6.3e-02        6
 49     5.17e+03     7.81126e+03     2.64320e+03     6.3e-02        6
 50     4.36e+03     7.00537e+03     2.64320e+03     1.3e-01        2
 51     3.76e+03     6.40333e+03     2.64320e+03     1.3e-01        2
 52     2.95e+03     5.59777e+03     2.64320e+03     2.5e-01        2
 53     2.54e+03     5.18459e+03     2.64320e+03     2.5e-01        3
 54     2.35e+03     4.98944e+03     2.64320e+03     1.3e-01       14
 55     2.06e+03     4.70130e+03     2.64320e+03     2.5e-01        6
 56     1.91e+03     4.55174e+03     2.64320e+03     2.5e-01        6
 57     1.73e+03     4.43712e+03     2.70897e+03     5.0e-01       12
 58     1.71e+03     4.41987e+03     2.70897e+03     1.0e+00        7
 59     1.72e+03     4.43256e+03     2.70897e+03     1.0e+00       15
 60     1.27e+03     4.43708e+03     3.17189e+03     1.0e+00       14
 61     1.26e+03     4.43003e+03     3.17189e+03     1.0e+00       23
 62     6.72e+02     4.42736e+03     3.75552e+03     1.0e+00       19
 63     2.63e+02     4.39861e+03     4.13604e+03     1.0e+00       21
 64     2.28e+02     4.38707e+03     4.15875e+03     5.0e-01       14
 65     2.20e+02     4.37881e+03     4.15875e+03     5.0e-01        7
 66     1.61e+02     4.37670e+03     4.21550e+03     1.0e+00       21
 67     1.46e+02     4.37352e+03     4.22713e+03     1.0e+00        9
 68     6.60e+01     4.37305e+03     4.30702e+03     1.0e+00       13
 69     6.33e+01     4.37028e+03     4.30702e+03     5.0e-01        6
 70     6.13e+01     4.36834e+03     4.30702e+03     1.0e+00       14
 71     2.66e+01     4.36847e+03     4.34190e+03     1.0e+00       20
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e+00
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.37e+06     4.37929e+06     5.19580e+03         Inf        0
   1     4.35e+06     4.35471e+06     5.19580e+03     3.9e-03        2
   2     4.25e+06     4.25341e+06     5.19580e+03     1.6e-02        2
   3     4.00e+06     4.00781e+06     5.20052e+03     3.1e-02        5
   4     3.88e+06     3.88631e+06     5.20052e+03     1.6e-02        1
   5     3.42e+06     3.42343e+06     5.20408e+03     6.3e-02        2
```

6	3.20e+06	3.20304e+06	5.20626e+03	3.1e-02	0
7	1.80e+06	1.80964e+06	5.21217e+03	2.5e-01	6
8	1.69e+06	1.69766e+06	5.21464e+03	3.1e-02	2
9	1.64e+06	1.64303e+06	5.21594e+03	1.6e-02	0
10	1.26e+06	1.26076e+06	5.21669e+03	1.3e-01	9
11	1.18e+06	1.18194e+06	5.21878e+03	3.1e-02	1
12	1.14e+06	1.14350e+06	5.21988e+03	1.6e-02	0
13	8.73e+05	8.78504e+05	5.22249e+03	1.3e-01	6
14	8.19e+05	8.23793e+05	5.22502e+03	3.1e-02	1
15	7.93e+05	7.98451e+05	5.22605e+03	1.6e-02	1
16	6.97e+05	7.02100e+05	5.22813e+03	6.3e-02	2
17	6.74e+05	6.78996e+05	5.22869e+03	1.6e-02	0
18	5.17e+05	5.22727e+05	5.23091e+03	1.3e-01	9
19	5.09e+05	5.14630e+05	5.23164e+03	7.8e-03	1
20	4.49e+05	4.54181e+05	5.23420e+03	6.3e-02	2
21	4.20e+05	4.25408e+05	5.23561e+03	3.1e-02	0
22	3.23e+05	3.28310e+05	5.23818e+03	1.3e-01	9
23	2.84e+05	2.88822e+05	5.24373e+03	6.3e-02	1
24	2.75e+05	2.80388e+05	5.24564e+03	1.6e-02	1
25	2.42e+05	2.47241e+05	5.24867e+03	6.3e-02	2
26	2.13e+05	2.18712e+05	5.25128e+03	6.3e-02	2
27	2.00e+05	2.05744e+05	5.25416e+03	3.1e-02	1
28	1.77e+05	1.82066e+05	5.25852e+03	6.3e-02	2
29	1.71e+05	1.76387e+05	5.25970e+03	1.6e-02	0
30	9.83e+04	1.03574e+05	5.26553e+03	2.5e-01	19
31	9.24e+04	9.77177e+04	5.26959e+03	3.1e-02	2
32	8.16e+04	8.68903e+04	5.27273e+03	6.3e-02	2
33	7.65e+04	8.17420e+04	5.27446e+03	3.1e-02	0
34	6.75e+04	7.27537e+04	5.27623e+03	6.3e-02	60
35	6.32e+04	6.84699e+04	5.27721e+03	3.1e-02	0
36	4.91e+04	5.43648e+04	5.27910e+03	1.3e-01	50
37	4.62e+04	5.14429e+04	5.28057e+03	3.1e-02	1
38	4.08e+04	4.61179e+04	5.28057e+03	6.3e-02	1
39	3.84e+04	4.36802e+04	5.28057e+03	3.1e-02	5
40	3.40e+04	3.92602e+04	5.28057e+03	6.3e-02	4
41	3.03e+04	3.55389e+04	5.28057e+03	6.3e-02	10
42	2.86e+04	3.38761e+04	5.28057e+03	3.1e-02	1
43	2.55e+04	3.07799e+04	5.28057e+03	6.3e-02	2
44	2.28e+04	2.80339e+04	5.28057e+03	6.3e-02	2
45	1.82e+04	2.34614e+04	5.28057e+03	1.3e-01	2
46	1.47e+04	2.00133e+04	5.28057e+03	1.3e-01	2
47	1.20e+04	1.73303e+04	5.28057e+03	1.3e-01	1
48	8.45e+03	1.37278e+04	5.28057e+03	2.5e-01	2
49	7.34e+03	1.26181e+04	5.28057e+03	1.3e-01	8
50	5.79e+03	1.10681e+04	5.28057e+03	2.5e-01	2
51	4.29e+03	9.57250e+03	5.28057e+03	5.0e-01	3
52	4.06e+03	9.34211e+03	5.28057e+03	1.3e-01	13
53	3.88e+03	9.16423e+03	5.28057e+03	1.3e-01	5
54	3.64e+03	8.97072e+03	5.32585e+03	2.5e-01	10
55	3.28e+03	8.84344e+03	5.56523e+03	5.0e-01	6
56	2.58e+03	8.84290e+03	6.26036e+03	1.0e+00	10
57	1.50e+03	8.85088e+03	7.35477e+03	1.0e+00	14
58	4.28e+02	8.80551e+03	8.37720e+03	1.0e+00	17
59	3.81e+02	8.77303e+03	8.39244e+03	5.0e-01	12

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  60     3.58e+02     8.75651e+03     8.39819e+03     2.5e-01        6
  61     3.36e+02     8.73466e+03     8.39819e+03     1.0e+00       12
  62     3.37e+02     8.73509e+03     8.39819e+03     1.0e+00        9
  63     1.53e+02     8.73640e+03     8.58313e+03     1.0e+00        7
  64     1.47e+02     8.72973e+03     8.58313e+03     5.0e-01        5
  65     1.20e+02     8.72475e+03     8.60460e+03     1.0e+00       10
  66     1.19e+02     8.72366e+03     8.60460e+03     1.0e+00        7
  67     7.63e+01     8.72349e+03     8.64719e+03     1.0e+00        9
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=2.00000e+00
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.37e+06     4.37929e+06     1.03885e+04         Inf        0
   1     4.34e+06     4.35476e+06     1.03885e+04     3.9e-03        2
   2     4.24e+06     4.25386e+06     1.03885e+04     1.6e-02        2
   3     4.00e+06     4.00893e+06     1.03982e+04     3.1e-02        5
   4     3.88e+06     3.88772e+06     1.03982e+04     1.6e-02        1
   5     3.42e+06     3.42653e+06     1.04060e+04     6.3e-02        2
   6     3.20e+06     3.20694e+06     1.04108e+04     3.1e-02        0
   7     2.45e+06     2.46387e+06     1.04150e+04     1.3e-01        7
   8     2.30e+06     2.31050e+06     1.04191e+04     3.1e-02        1
   9     2.23e+06     2.23568e+06     1.04212e+04     1.6e-02        0
  10     1.71e+06     1.71772e+06     1.04268e+04     1.3e-01        4
  11     1.65e+06     1.66396e+06     1.04294e+04     1.6e-02        1
  12     1.46e+06     1.46759e+06     1.04339e+04     6.3e-02        2
  13     1.28e+06     1.29326e+06     1.04397e+04     6.3e-02        2
  14     1.20e+06     1.21030e+06     1.04429e+04     3.1e-02        0
  15     9.22e+05     9.32491e+05     1.04450e+04     1.3e-01        9
  16     8.09e+05     8.19641e+05     1.04574e+04     6.3e-02        1
  17     7.60e+05     7.70367e+05     1.04612e+04     3.1e-02        2
  18     7.37e+05     7.47307e+05     1.04642e+04     1.6e-02        1
  19     6.49e+05     6.59303e+05     1.04726e+04     6.3e-02        2
  20     6.28e+05     6.38191e+05     1.04748e+04     1.6e-02        0
  21     4.83e+05     4.93823e+05     1.04807e+04     1.3e-01        9
  22     4.68e+05     4.78817e+05     1.04844e+04     1.6e-02        1
  23     4.41e+05     4.51005e+05     1.04889e+04     3.1e-02        2
  24     4.27e+05     4.37426e+05     1.04912e+04     1.6e-02        0
  25     4.00e+05     4.10499e+05     1.04917e+04     3.1e-02       57
  26     3.93e+05     4.03895e+05     1.04919e+04     7.8e-03        0
  27     3.46e+05     3.56590e+05     1.04938e+04     6.3e-02       58
  28     3.25e+05     3.35384e+05     1.04938e+04     3.1e-02        2
  29     3.15e+05     3.25111e+05     1.04938e+04     1.6e-02        4
  30     3.05e+05     3.15267e+05     1.04938e+04     1.6e-02        4
  31     2.95e+05     3.05648e+05     1.04938e+04     1.6e-02        4
  32     2.86e+05     2.96151e+05     1.04938e+04     1.6e-02        2
  33     2.68e+05     2.78272e+05     1.04938e+04     3.1e-02        4
  34     2.51e+05     2.61795e+05     1.04938e+04     3.1e-02        6
  35     2.36e+05     2.46511e+05     1.04938e+04     3.1e-02        1
  36     2.07e+05     2.17926e+05     1.04938e+04     6.3e-02        2
  37     1.82e+05     1.92382e+05     1.04938e+04     6.3e-02        2
  38     1.60e+05     1.70425e+05     1.04938e+04     6.3e-02        1
  39     1.23e+05     1.33429e+05     1.04938e+04     1.3e-01        1
```

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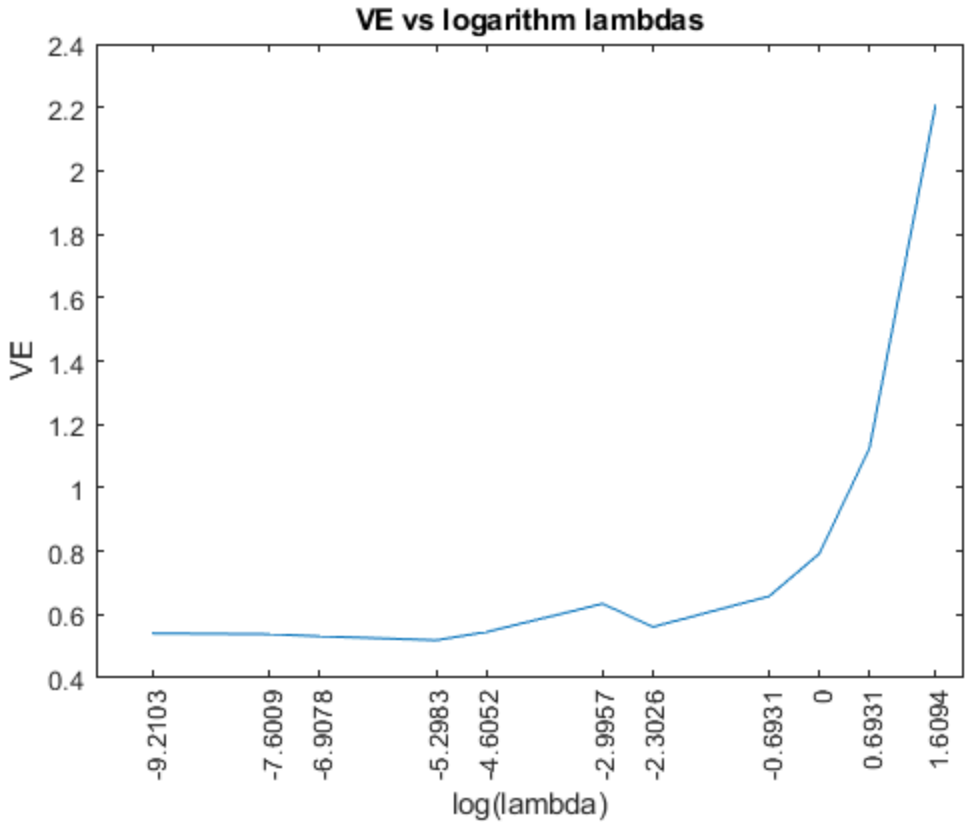
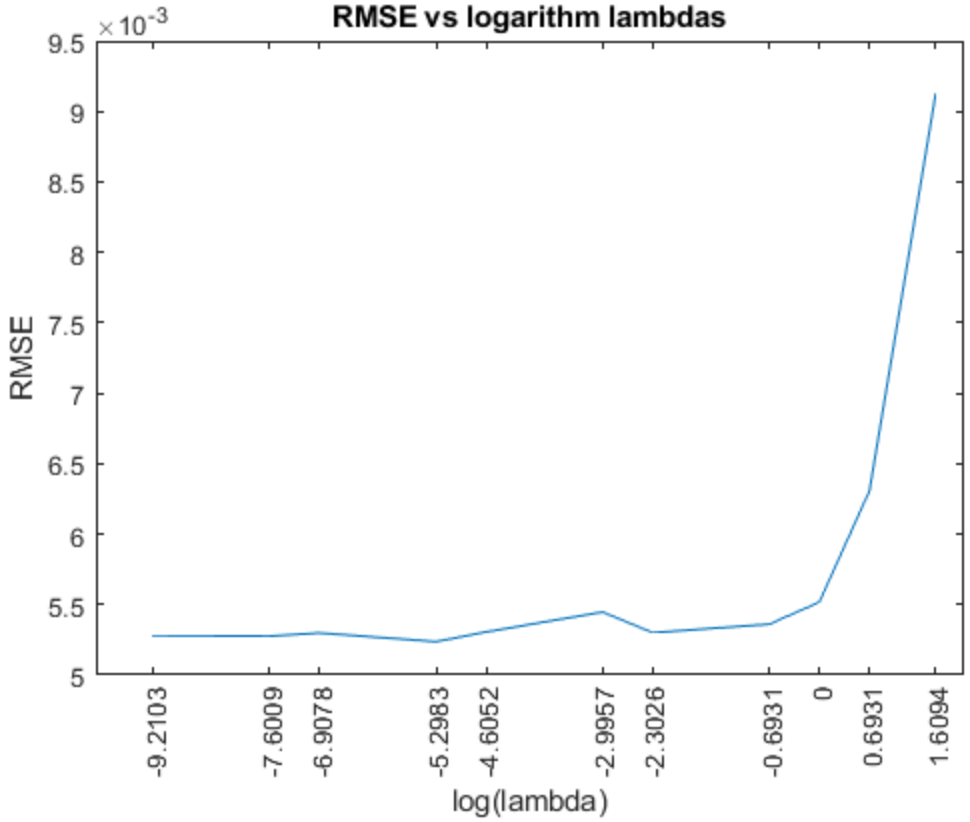
  40     7.18e+04     8.22582e+04     1.04938e+04     2.5e-01        2
  41     4.33e+04     5.38150e+04     1.04938e+04     2.5e-01        2
  42     2.86e+04     3.90657e+04     1.04938e+04     2.5e-01        2
  43     2.53e+04     3.57662e+04     1.04938e+04     6.3e-02       16
  44     2.27e+04     3.31509e+04     1.04938e+04     6.3e-02        9
  45     2.06e+04     3.11331e+04     1.04997e+04     6.3e-02       10
  46     1.73e+04     2.78223e+04     1.05299e+04     1.3e-01        4
  47     1.48e+04     2.53629e+04     1.05374e+04     1.3e-01        5
  48     1.14e+04     2.20248e+04     1.05919e+04     2.5e-01        2
  49     9.41e+03     2.01350e+04     1.07292e+04     2.5e-01        2
  50     6.28e+03     1.76099e+04     1.13261e+04     1.0e+00        2
  51     4.69e+03     1.75164e+04     1.28297e+04     5.0e-01       11
  52     3.11e+03     1.75132e+04     1.44077e+04     1.0e+00        8
  53     4.11e+02     1.75293e+04     1.71185e+04     1.0e+00       11
  54     3.58e+02     1.74765e+04     1.71185e+04     5.0e-01        6
  55     3.31e+02     1.74492e+04     1.71185e+04     5.0e-01        5
  56     3.02e+02     1.74203e+04     1.71185e+04     5.0e-01        5
  57     2.94e+02     1.74128e+04     1.71185e+04     1.0e+00        7
  58     1.21e+02     1.74126e+04     1.72916e+04     1.0e+00        8
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e+00
------------------------------------------------------------------------------
 iter       gap          primobj         dualobj      step len   pcg
 iters
   0     4.35e+06     4.37929e+06     2.59481e+04         Inf        0
   1     4.33e+06     4.35493e+06     2.59481e+04     3.9e-03        2
   2     4.28e+06     4.30492e+06     2.59481e+04     7.8e-03        2
   3     4.05e+06     4.07467e+06     2.59652e+04     3.1e-02        2
   4     3.58e+06     3.60257e+06     2.59652e+04     6.3e-02        2
   5     3.46e+06     3.48921e+06     2.59652e+04     1.6e-02        0
   6     3.25e+06     3.27695e+06     2.59654e+04     3.1e-02       27
   7     3.22e+06     3.25088e+06     2.59658e+04     3.9e-03        0
   8     3.03e+06     3.05353e+06     2.59673e+04     3.1e-02       14
   9     2.98e+06     3.00516e+06     2.59677e+04     7.8e-03        0
  10     2.80e+06     2.82260e+06     2.59696e+04     3.1e-02       10
  11     2.71e+06     2.73349e+06     2.59706e+04     1.6e-02        0
  12     2.54e+06     2.56752e+06     2.59726e+04     3.1e-02        8
  13     2.46e+06     2.48652e+06     2.59736e+04     1.6e-02        0
  14     2.16e+06     2.19021e+06     2.59736e+04     6.3e-02       11
  15     2.13e+06     2.15452e+06     2.59736e+04     7.8e-03        0
  16     1.63e+06     1.65859e+06     2.59817e+04     1.3e-01        9
  17     1.53e+06     1.55596e+06     2.59941e+04     3.1e-02        1
  18     1.43e+06     1.46035e+06     2.59941e+04     3.1e-02        1
  19     1.39e+06     1.41371e+06     2.59941e+04     1.6e-02        0
  20     7.88e+05     8.14271e+05     2.60114e+04     2.5e-01        6
  21     6.92e+05     7.17662e+05     2.60114e+04     6.3e-02        2
  22     5.34e+05     5.59910e+05     2.60114e+04     1.3e-01        3
  23     3.06e+05     3.31555e+05     2.60114e+04     2.5e-01        3
  24     8.94e+04     1.15450e+05     2.60362e+04     5.0e-01        3
  25     3.55e+04     6.15657e+04     2.60362e+04     5.0e-01        4
  26     2.18e+04     4.80387e+04     2.62201e+04     5.0e-01        4
  27     1.77e+04     4.46031e+04     2.68739e+04     5.0e-01        4
  28     6.61e+03     4.34479e+04     3.68398e+04     1.0e+00        4
```

```
    29      6.51e+02      4.34563e+04      4.28054e+04      1.0e+00          8
    30      6.21e+02      4.34261e+04      4.28054e+04      5.0e-01          2
    31      5.45e+02      4.33504e+04      4.28054e+04      5.0e-01          4
    32      5.31e+02      4.33363e+04      4.28054e+04      1.0e+00          5
    33      5.30e+02      4.33357e+04      4.28054e+04      1.0e+00          4
    34      9.62e+01      4.33367e+04      4.32405e+04      1.0e+00          4
Absolute tolerance reached.
```





Coincident case:

```
V = A(171:190, :);
sigma = 0.05 * sum(norm(A*x)/m);
x_noise = x+ sigma*randn(size(x));

y=A*x_noise;
errors_co = zeros(11,1);
rmses_co = zeros(11, 1);
for i = 1:size(lambdas, 2)
    [x_pred, status] = l1_ls(R,y(1:180),lambdas(i), 0.01);

    %validation error check
    y_pred = V*x_pred;
    error = sum((y(171:190) - y_pred).^2)/size(V,1);
    errors_co(i) = error;

    %rmse error check
    rmses_co(i) = norm(x_pred-x,2)/norm(x,2);
end
figure;
plot(log(lambdas), errors_co );
set(gca, 'XTick',log(lambdas));
xtickangle(90)
```

```
title('VE vs logarithm lambdas coincident set');
ylabel('VE');
xlabel('log(lambda)');

figure;
plot(log(lambdas), rmses_co );
set(gca, 'XTick',log(lambdas)) ;
xtickangle(90)


title('RMSE vs logarithm lambdas coincident set');
xlabel('log(lambda)');
ylabel('RMSE');
```

```
Solving a problem of size (m=180, n=500), with lambda=1.00000e-04
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     5.19645e-01         Inf        0
   1     4.36e+06     4.36037e+06     5.19655e-01     2.0e-03        3
   2     4.36e+06     4.35616e+06     5.19657e-01     4.9e-04        0
   3     4.29e+06     4.28822e+06     5.19657e-01     7.8e-03        4
   4     4.25e+06     4.25445e+06     5.19657e-01     3.9e-03        0
   5     4.25e+06     4.24617e+06     5.19657e-01     9.8e-04        2
   6     4.24e+06     4.24410e+06     5.19657e-01     2.4e-04        0
   7     4.21e+06     4.21092e+06     5.19657e-01     3.9e-03        2
   8     4.19e+06     4.19438e+06     5.19657e-01     2.0e-03        0
   9     3.69e+06     3.68656e+06     5.19657e-01     6.3e-02        4
  10     3.56e+06     3.56472e+06     5.19657e-01     1.6e-02        0
  11     3.13e+06     3.13258e+06     5.19657e-01     6.3e-02        3
  12     3.03e+06     3.02891e+06     5.19657e-01     1.6e-02        0
  13     2.98e+06     2.98176e+06     5.19657e-01     7.8e-03        3
  14     2.96e+06     2.95833e+06     5.19657e-01     3.9e-03        0
  15     2.46e+00     2.97971e+00     5.19657e-01     1.0e+00        6
  16     1.68e+00     2.20042e+00     5.19657e-01     1.0e+00       23
  17     1.68e+00     2.20025e+00     5.19657e-01     1.0e+00       14
  18     1.41e+00     1.93257e+00     5.19657e-01     7.8e-03      797
  19     1.01e+00     1.53372e+00     5.19657e-01     1.6e-02      430
  20     8.35e-01     1.35443e+00     5.19657e-01     1.6e-02      768
  21     6.70e-01     1.18981e+00     5.19657e-01     3.1e-02      565
  22     5.30e-01     1.05013e+00     5.19657e-01     6.3e-02      466
  23     4.44e-01     9.63835e-01     5.19657e-01     1.3e-01      273
  24     4.05e-01     9.24663e-01     5.19657e-01     2.5e-01      241
  25     3.84e-01     9.03173e-01     5.19657e-01     5.0e-01      148
  26     3.72e-01     8.92098e-01     5.19657e-01     5.0e-01      108
  27     1.35e-01     8.84517e-01     7.49435e-01     1.0e+00       77
  28     8.29e-02     8.82630e-01     7.99759e-01     5.0e-01       64
  29     7.84e-02     8.80719e-01     8.02281e-01     5.0e-01       62
  30     6.58e-02     8.78862e-01     8.13067e-01     1.0e+00       42
  31     4.37e-02     8.78797e-01     8.35142e-01     1.0e+00       62
  32     3.54e-02     8.77585e-01     8.42184e-01     1.0e+00       62
  33     2.46e-02     8.77362e-01     8.52787e-01     1.0e+00       89
```

```
  34     1.70e-02     8.76780e-01     8.59756e-01     1.0e+00       58
  35     1.53e-02     8.76451e-01     8.61196e-01     1.0e+00      103
  36     9.89e-03     8.76406e-01     8.66513e-01     1.0e+00      129
  37     8.41e-03     8.75993e-01     8.67584e-01     1.0e+00      132
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-04
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     2.59823e+00         Inf        0
   1     4.36e+06     4.36037e+06     2.59827e+00     2.0e-03        3
   2     4.36e+06     4.35616e+06     2.59828e+00     4.9e-04        0
   3     4.29e+06     4.28824e+06     2.59828e+00     7.8e-03        4
   4     4.25e+06     4.25449e+06     2.59828e+00     3.9e-03        0
   5     4.22e+06     4.22145e+06     2.59828e+00     3.9e-03        2
   6     4.20e+06     4.20498e+06     2.59828e+00     2.0e-03        0
   7     3.70e+06     3.69564e+06     2.59828e+00     6.3e-02        3
   8     3.57e+06     3.57344e+06     2.59828e+00     1.6e-02        0
   9     3.35e+06     3.35336e+06     2.59828e+00     3.1e-02        3
  10     3.25e+06     3.24594e+06     2.59828e+00     1.6e-02        0
  11     3.15e+06     3.14510e+06     2.59828e+00     1.6e-02        2
  12     3.12e+06     3.12013e+06     2.59828e+00     3.9e-03        0
  13     1.76e+06     1.75526e+06     2.59828e+00     2.5e-01        3
  14     1.34e+06     1.33813e+06     2.60398e+00     1.3e-01        2
  15     1.03e+06     1.02699e+06     2.60710e+00     1.3e-01        2
  16     5.80e+05     5.80327e+05     2.61601e+00     2.5e-01        2
  17     4.44e+05     4.44092e+05     2.62343e+00     1.3e-01        2
  18     4.37e+05     4.36931e+05     2.62372e+00     7.8e-03        1
  19     1.12e+05     1.12309e+05     2.62372e+00     5.0e-01        2
  20     8.60e+04     8.60363e+04     2.62372e+00     1.3e-01        3
  21     8.06e+04     8.06228e+04     2.62372e+00     3.1e-02        1
  22     4.53e+04     4.53397e+04     2.62372e+00     2.5e-01        6
  23     2.53e+04     2.53381e+04     2.63223e+00     2.5e-01        2
  24     6.44e+03     6.43974e+03     2.68011e+00     5.0e-01        2
  25     6.04e+03     6.04686e+03     2.68011e+00     3.1e-02        3
  26     5.86e+03     5.86041e+03     2.68011e+00     1.6e-02        1
  27     5.77e+03     5.76829e+03     2.68011e+00     7.8e-03        0
  28     8.42e+00     1.11032e+01     2.68011e+00     1.0e+00        5
  29     8.31e+00     1.09902e+01     2.68011e+00     1.0e+00       12
  30     8.31e+00     1.09869e+01     2.68011e+00     1.0e+00        7
  31     8.30e+00     1.09837e+01     2.68011e+00     1.0e+00        3
  32     6.99e+00     9.67333e+00     2.68011e+00     7.8e-03      688
  33     5.05e+00     7.72887e+00     2.68011e+00     1.6e-02      404
  34     4.04e+00     6.71842e+00     2.68011e+00     1.6e-02      538
  35     3.25e+00     5.93158e+00     2.68011e+00     3.1e-02      508
  36     2.84e+00     5.51518e+00     2.68011e+00     3.1e-02      290
  37     2.45e+00     5.12621e+00     2.68011e+00     6.3e-02      278
  38     2.12e+00     4.80294e+00     2.68011e+00     1.3e-01      211
  39     1.92e+00     4.60205e+00     2.68011e+00     2.5e-01      167
  40     1.82e+00     4.49652e+00     2.68011e+00     5.0e-01      124
  41     1.56e+00     4.44646e+00     2.88322e+00     5.0e-01       64
  42     1.49e+00     4.42574e+00     2.93442e+00     1.0e+00       65
  43     1.14e+00     4.42732e+00     3.29085e+00     1.0e+00       51
```

```
  44     7.42e-01     4.42917e+00     3.68761e+00     1.0e+00       20
  45     5.52e-01     4.42660e+00     3.87473e+00     1.0e+00       21
  46     2.68e-01     4.40263e+00     4.13499e+00     1.0e+00       55
  47     1.73e-01     4.39368e+00     4.22080e+00     5.0e-01       85
  48     1.21e-01     4.38773e+00     4.26689e+00     5.0e-01       98
  49     8.25e-02     4.38300e+00     4.30048e+00     1.0e+00       96
  50     4.30e-02     4.38236e+00     4.33940e+00     1.0e+00      145
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e-03
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     5.19645e+00         Inf       0
   1     4.36e+06     4.36037e+06     5.19654e+00     2.0e-03       3
   2     4.36e+06     4.35617e+06     5.19657e+00     4.9e-04       0
   3     4.29e+06     4.28827e+06     5.19657e+00     7.8e-03       4
   4     4.25e+06     4.25452e+06     5.19657e+00     3.9e-03       0
   5     3.99e+06     3.99390e+06     5.19657e+00     3.1e-02       2
   6     3.87e+06     3.86668e+06     5.19657e+00     1.6e-02       0
   7     3.63e+06     3.62856e+06     5.19688e+00     3.1e-02       2
   8     3.60e+06     3.59933e+06     5.19693e+00     3.9e-03       0
   9     3.16e+06     3.16343e+06     5.19693e+00     6.3e-02       4
  10     3.06e+06     3.05885e+06     5.19693e+00     1.6e-02       0
  11     7.64e+05     7.64488e+05     5.19792e+00     5.0e-01       4
  12     4.29e+05     4.29424e+05     5.20193e+00     2.5e-01       4
  13     3.27e+05     3.27403e+05     5.21877e+00     1.3e-01       2
  14     2.48e+05     2.47974e+05     5.23114e+00     1.3e-01       1
  15     1.90e+05     1.89814e+05     5.23114e+00     1.3e-01       7
  16     1.84e+05     1.83777e+05     5.23155e+00     1.6e-02       1
  17     1.72e+05     1.72484e+05     5.23155e+00     3.1e-02       3
  18     1.67e+05     1.66971e+05     5.23155e+00     1.6e-02       0
  19     9.40e+04     9.39637e+04     5.23155e+00     2.5e-01       4
  20     5.24e+04     5.24442e+04     5.25926e+00     2.5e-01       2
  21     4.02e+04     4.02115e+04     5.27360e+00     1.3e-01       2
  22     3.89e+04     3.89260e+04     5.27467e+00     1.6e-02       1
  23     3.83e+04     3.82911e+04     5.27521e+00     7.8e-03       0
  24     2.15e+04     2.15446e+04     5.27590e+00     2.5e-01       6
  25     5.30e+03     5.30655e+03     5.35339e+00     5.0e-01       2
  26     1.35e+03     1.35453e+03     5.35339e+00     5.0e-01       3
  27     1.19e+03     1.19442e+03     5.35339e+00     6.3e-02       4
  28     1.11e+03     1.11823e+03     5.35339e+00     3.1e-02       0
  29     1.66e+01     2.19890e+01     5.35339e+00     1.0e+00       6
  30     1.66e+01     2.19585e+01     5.35339e+00     1.0e+00      11
  31     1.43e+01     1.96757e+01     5.35339e+00     7.8e-03     486
  32     1.09e+01     1.62089e+01     5.35339e+00     1.6e-02     275
  33     8.63e+00     1.39792e+01     5.35339e+00     1.6e-02     298
  34     7.37e+00     1.27186e+01     5.35339e+00     1.6e-02     488
  35     6.17e+00     1.15258e+01     5.35339e+00     3.1e-02     406
  36     4.94e+00     1.02911e+01     5.35339e+00     6.3e-02     288
  37     4.24e+00     9.59661e+00     5.35339e+00     1.3e-01     240
  38     3.83e+00     9.18175e+00     5.35339e+00     2.5e-01     147
  39     3.39e+00     8.98305e+00     5.59250e+00     5.0e-01     140
  40     2.91e+00     8.89011e+00     5.97969e+00     5.0e-01      68
```

```
 41     1.65e+00     8.86023e+00     7.20605e+00     1.0e+00       70
 42     1.11e+00     8.84613e+00     7.73867e+00     1.0e+00       45
 43     9.03e-01     8.81103e+00     7.90812e+00     1.0e+00       75
 44     7.11e-01     8.79785e+00     8.08722e+00     1.0e+00       61
 45     5.54e-01     8.78636e+00     8.23201e+00     1.0e+00       61
 46     3.84e-01     8.78254e+00     8.39806e+00     1.0e+00       62
 47     3.23e-01     8.77450e+00     8.45102e+00     1.0e+00       34
 48     1.38e-01     8.77253e+00     8.63455e+00     1.0e+00       85
 49     1.29e-01     8.76565e+00     8.63708e+00     5.0e-01       92
 50     8.55e-02     8.76197e+00     8.67643e+00     1.0e+00      140
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-03
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     2.59822e+01         Inf       0
   1     4.36e+06     4.36040e+06     2.59827e+01     2.0e-03       3
   2     4.36e+06     4.35620e+06     2.59828e+01     4.9e-04       0
   3     4.29e+06     4.28844e+06     2.59828e+01     7.8e-03       4
   4     4.27e+06     4.27159e+06     2.59828e+01     2.0e-03       0
   5     4.01e+06     4.00989e+06     2.59828e+01     3.1e-02       2
   6     3.88e+06     3.88215e+06     2.59828e+01     1.6e-02       0
   7     3.64e+06     3.64364e+06     2.59828e+01     3.1e-02       3
   8     3.53e+06     3.52723e+06     2.59828e+01     1.6e-02       0
   9     3.31e+06     3.31024e+06     2.59828e+01     3.1e-02       3
  10     3.26e+06     3.25866e+06     2.59828e+01     7.8e-03       2
  11     2.50e+06     2.49553e+06     2.59828e+01     1.3e-01       2
  12     8.66e+01     1.12591e+02     2.59828e+01     1.0e+00       8
  13     8.60e+01     1.11940e+02     2.59828e+01     5.0e-01      11
  14     8.41e+01     1.10087e+02     2.59828e+01     1.0e+00       3
  15     8.33e+01     1.09276e+02     2.59828e+01     1.0e+00       3
  16     8.31e+01     1.09072e+02     2.59828e+01     1.0e+00       3
  17     8.28e+01     1.08803e+02     2.59828e+01     1.0e+00       3
  18     8.25e+01     1.08532e+02     2.59828e+01     1.0e+00       3
  19     8.23e+01     1.08291e+02     2.59828e+01     1.0e+00       3
  20     6.94e+01     9.53373e+01     2.59828e+01     7.8e-03     530
  21     4.98e+01     7.57408e+01     2.59828e+01     1.6e-02     281
  22     4.08e+01     6.68163e+01     2.59828e+01     1.6e-02     489
  23     3.30e+01     5.89801e+01     2.59828e+01     3.1e-02     379
  24     2.60e+01     5.20292e+01     2.59828e+01     6.3e-02     290
  25     2.20e+01     4.80019e+01     2.59828e+01     1.3e-01     206
  26     2.00e+01     4.59520e+01     2.59828e+01     2.5e-01     147
  27     1.53e+01     4.49319e+01     2.96626e+01     5.0e-01     104
  28     1.31e+01     4.44540e+01     3.13052e+01     5.0e-01      56
  29     6.60e+00     4.42983e+01     3.76935e+01     1.0e+00      56
  30     4.05e+00     4.42316e+01     4.01787e+01     5.0e-01      18
  31     2.34e+00     4.40003e+01     4.16564e+01     5.0e-01      58
  32     1.44e+00     4.39018e+01     4.24648e+01     5.0e-01      70
  33     7.27e-01     4.38647e+01     4.31379e+01     5.0e-01      89
  34     5.08e-01     4.38209e+01     4.33132e+01     5.0e-01      76
  35     2.93e-01     4.38002e+01     4.35073e+01     1.0e+00     139
Absolute tolerance reached.
```

```
Solving a problem of size (m=180, n=500), with lambda=1.00000e-02
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     5.19644e+01         Inf        0
   1     4.36e+06     4.36043e+06     5.19653e+01     2.0e-03        3
   2     4.36e+06     4.35624e+06     5.19655e+01     4.9e-04        0
   3     4.29e+06     4.28863e+06     5.19655e+01     7.8e-03        4
   4     4.27e+06     4.27181e+06     5.19655e+01     2.0e-03        0
   5     4.01e+06     4.01028e+06     5.19655e+01     3.1e-02        2
   6     3.88e+06     3.88261e+06     5.19655e+01     1.6e-02        0
   7     3.41e+06     3.41326e+06     5.19655e+01     6.3e-02        3
   8     3.30e+06     3.30065e+06     5.19655e+01     1.6e-02        0
   9     2.53e+06     2.52700e+06     5.19655e+01     1.3e-01        4
  10     2.37e+06     2.36729e+06     5.19714e+01     3.1e-02        1
  11     1.33e+06     1.32977e+06     5.19714e+01     2.5e-01        3
  12     1.01e+06     1.01354e+06     5.20946e+01     1.3e-01        2
  13     8.86e+05     8.86069e+05     5.21414e+01     6.3e-02        1
  14     8.31e+05     8.31109e+05     5.21790e+01     3.1e-02        1
  15     8.18e+05     8.17646e+05     5.21889e+01     7.8e-03        0
  16     4.60e+05     4.59652e+05     5.21982e+01     2.5e-01        5
  17     3.51e+05     3.50629e+05     5.23213e+01     1.3e-01        2
  18     3.07e+05     3.06653e+05     5.23651e+01     6.3e-02        1
  19     2.69e+05     2.69376e+05     5.24383e+01     6.3e-02        1
  20     2.37e+05     2.37022e+05     5.24383e+01     6.3e-02        2
  21     1.34e+05     1.33646e+05     5.24383e+01     2.5e-01        3
  22     7.92e+02     8.44431e+02     5.24383e+01     1.0e+00        2
  23     6.46e+02     6.98144e+02     5.24383e+01     1.3e-01        9
  24     5.87e+02     6.39316e+02     5.24383e+01     6.3e-02        2
  25     5.34e+02     5.86000e+02     5.24383e+01     6.3e-02        1
  26     1.65e+02     2.17617e+02     5.24383e+01     1.0e+00        2
  27     1.64e+02     2.16058e+02     5.24383e+01     1.0e+00        8
  28     1.63e+02     2.15070e+02     5.24383e+01     1.0e+00        5
  29     1.43e+02     1.95844e+02     5.24383e+01     7.8e-03      314
  30     1.13e+02     1.65658e+02     5.24383e+01     1.6e-02      190
  31     9.24e+01     1.44856e+02     5.24383e+01     1.6e-02      214
  32     7.75e+01     1.29979e+02     5.24383e+01     1.6e-02      215
  33     6.81e+01     1.20558e+02     5.24383e+01     1.6e-02      246
  34     5.88e+01     1.11210e+02     5.24383e+01     3.1e-02      265
  35     5.34e+01     1.05887e+02     5.24383e+01     3.1e-02      154
  36     4.79e+01     1.00295e+02     5.24383e+01     6.3e-02      142
  37     4.20e+01     9.47470e+01     5.27688e+01     1.3e-01      104
  38     3.73e+01     9.15959e+01     5.43374e+01     2.5e-01      108
  39     3.52e+01     8.95619e+01     5.43374e+01     5.0e-01       81
  40     3.44e+01     8.87158e+01     5.43374e+01     5.0e-01       60
  41     1.88e+01     8.84809e+01     6.97255e+01     1.0e+00       39
  42     1.87e+01     8.84375e+01     6.97255e+01     1.0e+00       27
  43     1.38e+01     8.85225e+01     7.47566e+01     1.0e+00       35
  44     7.23e+00     8.83198e+01     8.10920e+01     1.0e+00       40
  45     5.48e+00     8.79486e+01     8.24683e+01     5.0e-01       54
  46     5.32e+00     8.77842e+01     8.24683e+01     1.0e+00       63
  47     5.34e+00     8.78041e+01     8.24683e+01     1.0e+00       63
  48     2.11e+00     8.78193e+01     8.57125e+01     1.0e+00       36
  49     1.19e+00     8.77074e+01     8.65208e+01     5.0e-01       65
```

```
 50     7.11e-01     8.76332e+01     8.69227e+01     5.0e-01       90
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-02
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     2.59819e+02         Inf        0
   1     4.36e+06     4.36068e+06     2.59822e+02     2.0e-03        3
   2     4.36e+06     4.35655e+06     2.59823e+02     4.9e-04        0
   3     4.29e+06     4.28992e+06     2.59823e+02     7.8e-03        4
   4     4.27e+06     4.27334e+06     2.59823e+02     2.0e-03        0
   5     4.01e+06     4.01250e+06     2.59823e+02     3.1e-02        2
   6     3.88e+06     3.88515e+06     2.59823e+02     1.6e-02        0
   7     2.98e+06     2.97736e+06     2.59823e+02     1.3e-01        3
   8     2.26e+06     2.26245e+06     2.59986e+02     1.3e-01        1
   9     2.23e+06     2.22693e+06     2.60002e+02     7.8e-03        2
  10     2.09e+06     2.08855e+06     2.60011e+02     3.1e-02        2
  11     1.96e+06     1.95984e+06     2.60035e+02     3.1e-02        2
  12     4.91e+05     4.91052e+05     2.60035e+02     5.0e-01        3
  13     3.75e+05     3.75115e+05     2.60035e+02     1.3e-01        3
  14     3.63e+05     3.63133e+05     2.60035e+02     1.6e-02        1
  15     3.57e+05     3.57217e+05     2.60035e+02     7.8e-03        0
  16     8.98e+04     9.00478e+04     2.60035e+02     5.0e-01        6
  17     6.87e+04     6.89760e+04     2.60035e+02     1.3e-01        3
  18     1.81e+04     1.83125e+04     2.62238e+02     5.0e-01        2
  19     5.14e+03     5.40342e+03     2.62800e+02     5.0e-01        4
  20     8.02e+02     1.06463e+03     2.62800e+02     1.0e+00        4
  21     7.51e+02     1.01335e+03     2.62800e+02     1.0e+00        8
  22     6.36e+02     8.99211e+02     2.62800e+02     7.8e-03      545
  23     4.61e+02     7.23411e+02     2.62800e+02     1.6e-02      282
  24     3.28e+02     5.90645e+02     2.62800e+02     3.1e-02      459
  25     2.94e+02     5.57053e+02     2.62800e+02     3.1e-02      280
  26     2.48e+02     5.10319e+02     2.62800e+02     6.3e-02      115
  27     2.31e+02     4.93371e+02     2.62800e+02     6.3e-02      124
  28     2.11e+02     4.73366e+02     2.62800e+02     1.3e-01       74
  29     1.96e+02     4.58343e+02     2.62800e+02     2.5e-01       64
  30     1.84e+02     4.46300e+02     2.62800e+02     5.0e-01       49
  31     1.57e+02     4.43284e+02     2.86668e+02     5.0e-01       56
  32     1.00e+02     4.42271e+02     3.41824e+02     1.0e+00       29
  33     3.46e+01     4.43056e+02     4.08485e+02     1.0e+00       33
  34     2.69e+01     4.40588e+02     4.13707e+02     5.0e-01       48
  35     1.41e+01     4.39051e+02     4.24961e+02     5.0e-01       34
  36     7.16e+00     4.38555e+02     4.31394e+02     5.0e-01       58
  37     5.41e+00     4.38122e+02     4.32717e+02     5.0e-01       54
  38     5.22e+00     4.37937e+02     4.32717e+02     1.0e+00       70
  39     3.66e+00     4.37960e+02     4.34297e+02     1.0e+00       56
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e-01
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.38e+06     4.37722e+06     5.19630e+02         Inf        0
```

1	4.36e+06	4.36098e+06	5.19635e+02	2.0e-03	3
2	4.36e+06	4.35693e+06	5.19636e+02	4.9e-04	0
3	4.29e+06	4.29142e+06	5.19636e+02	7.8e-03	4
4	4.27e+06	4.27512e+06	5.19636e+02	2.0e-03	0
5	4.14e+06	4.14391e+06	5.19639e+02	1.6e-02	9
6	4.08e+06	4.07907e+06	5.19646e+02	7.8e-03	0
7	3.83e+06	3.82947e+06	5.19690e+02	3.1e-02	2
8	3.77e+06	3.76830e+06	5.19702e+02	7.8e-03	0
9	3.31e+06	3.31282e+06	5.19702e+02	6.3e-02	3
10	3.20e+06	3.20353e+06	5.19702e+02	1.6e-02	0
11	2.82e+06	2.81567e+06	5.19702e+02	6.3e-02	3
12	2.72e+06	2.72262e+06	5.19702e+02	1.6e-02	0
13	2.39e+06	2.39303e+06	5.19702e+02	6.3e-02	4
14	2.31e+06	2.31395e+06	5.19702e+02	1.6e-02	0
15	2.17e+06	2.17156e+06	5.19702e+02	3.1e-02	3
16	2.10e+06	2.10206e+06	5.19702e+02	1.6e-02	0
17	1.85e+06	1.84789e+06	5.19702e+02	6.3e-02	3
18	1.82e+06	1.81727e+06	5.19702e+02	7.8e-03	0
19	1.60e+06	1.59728e+06	5.19702e+02	6.3e-02	4
20	1.57e+06	1.57078e+06	5.19702e+02	7.8e-03	0
21	1.38e+06	1.38072e+06	5.19702e+02	6.3e-02	4
22	1.36e+06	1.35782e+06	5.19702e+02	7.8e-03	0
23	1.19e+06	1.19356e+06	5.19706e+02	6.3e-02	4
24	1.15e+06	1.15415e+06	5.19710e+02	1.6e-02	0
25	1.01e+06	1.01448e+06	5.19710e+02	6.3e-02	3
26	9.97e+05	9.97652e+05	5.19710e+02	7.8e-03	0
27	9.36e+05	9.36309e+05	5.19710e+02	3.1e-02	4
28	9.06e+05	9.06369e+05	5.19710e+02	1.6e-02	0
29	8.50e+05	8.50722e+05	5.19710e+02	3.1e-02	3
30	8.23e+05	8.23561e+05	5.19710e+02	1.6e-02	0
31	7.72e+05	7.73016e+05	5.19710e+02	3.1e-02	3
32	7.48e+05	7.48345e+05	5.19710e+02	1.6e-02	0
33	6.57e+05	6.58007e+05	5.19710e+02	6.3e-02	3
34	6.52e+05	6.52554e+05	5.19710e+02	3.9e-03	0
35	6.12e+05	6.12451e+05	5.19710e+02	3.1e-02	4
36	6.07e+05	6.07527e+05	5.19710e+02	3.9e-03	0
37	5.34e+05	5.34167e+05	5.19710e+02	6.3e-02	3
38	5.29e+05	5.29739e+05	5.19710e+02	3.9e-03	0
39	4.97e+05	4.97196e+05	5.19710e+02	3.1e-02	4
40	4.81e+05	4.81313e+05	5.19710e+02	1.6e-02	0
41	4.51e+05	4.51817e+05	5.19710e+02	3.1e-02	3
42	4.44e+05	4.44590e+05	5.19710e+02	7.8e-03	0
43	4.17e+05	4.17365e+05	5.19710e+02	3.1e-02	3
44	4.04e+05	4.04077e+05	5.19710e+02	1.6e-02	0
45	3.79e+05	3.79344e+05	5.19710e+02	3.1e-02	3
46	3.73e+05	3.73283e+05	5.19710e+02	7.8e-03	0
47	3.50e+05	3.50446e+05	5.19710e+02	3.1e-02	3
48	3.39e+05	3.39299e+05	5.19710e+02	1.6e-02	0
49	3.18e+05	3.18552e+05	5.19710e+02	3.1e-02	3
50	3.13e+05	3.13468e+05	5.19710e+02	7.8e-03	0
51	2.94e+05	2.94308e+05	5.19710e+02	3.1e-02	3
52	2.89e+05	2.89613e+05	5.19710e+02	7.8e-03	0
53	2.54e+05	2.54776e+05	5.19710e+02	6.3e-02	3
54	2.39e+05	2.39334e+05	5.19710e+02	3.1e-02	2

55	2.24e+05	2.24714e+05	5.19710e+02	3.1e-02	2
56	2.21e+05	2.21132e+05	5.19710e+02	7.8e-03	0
57	1.94e+05	1.94566e+05	5.19710e+02	6.3e-02	3
58	1.82e+05	1.82804e+05	5.19710e+02	3.1e-02	2
59	1.71e+05	1.71666e+05	5.19710e+02	3.1e-02	2
60	1.66e+05	1.66231e+05	5.19710e+02	1.6e-02	0
61	1.56e+05	1.56120e+05	5.19710e+02	3.1e-02	3
62	1.51e+05	1.51186e+05	5.19710e+02	1.6e-02	0
63	1.41e+05	1.42009e+05	5.19710e+02	3.1e-02	3
64	1.39e+05	1.39760e+05	5.19710e+02	7.8e-03	0
65	1.31e+05	1.31283e+05	5.19710e+02	3.1e-02	3
66	1.29e+05	1.29206e+05	5.19710e+02	7.8e-03	0
67	1.21e+05	1.21382e+05	5.19710e+02	3.1e-02	3
68	1.17e+05	1.17564e+05	5.19710e+02	1.6e-02	0
69	1.03e+05	1.03583e+05	5.19710e+02	6.3e-02	3
70	1.01e+05	1.02014e+05	5.19710e+02	7.8e-03	1
71	8.94e+04	8.99389e+04	5.19710e+02	6.3e-02	2
72	8.81e+04	8.86164e+04	5.19710e+02	7.8e-03	1
73	7.76e+04	7.80853e+04	5.19710e+02	6.3e-02	2
74	7.50e+04	7.55598e+04	5.19710e+02	1.6e-02	0
75	6.62e+04	6.66808e+04	5.19710e+02	6.3e-02	9
76	6.19e+04	6.24568e+04	5.19710e+02	3.1e-02	0
77	5.82e+04	5.87476e+04	5.19710e+02	3.1e-02	4
78	5.64e+04	5.69375e+04	5.19710e+02	1.6e-02	0
79	5.31e+04	5.35703e+04	5.19710e+02	3.1e-02	3
80	5.14e+04	5.19271e+04	5.19710e+02	1.6e-02	0
81	4.54e+04	4.59169e+04	5.19710e+02	6.3e-02	3
82	4.40e+04	4.44755e+04	5.19710e+02	1.6e-02	0
83	3.89e+04	3.93776e+04	5.19710e+02	6.3e-02	9
84	3.64e+04	3.69528e+04	5.19710e+02	3.1e-02	0
85	2.83e+04	2.88357e+04	5.19710e+02	1.3e-01	11
86	2.75e+04	2.80025e+04	5.19710e+02	1.6e-02	1
87	2.59e+04	2.64550e+04	5.19710e+02	3.1e-02	2
88	2.45e+04	2.50238e+04	5.19991e+02	3.1e-02	1
89	2.38e+04	2.43250e+04	5.20159e+02	1.6e-02	0
90	2.32e+04	2.37608e+04	5.20168e+02	7.8e-03	152
91	2.30e+04	2.34797e+04	5.20172e+02	3.9e-03	0
92	2.25e+04	2.29922e+04	5.20179e+02	7.8e-03	132
93	2.22e+04	2.27494e+04	5.20183e+02	3.9e-03	0
94	2.14e+04	2.18935e+04	5.20183e+02	1.6e-02	114
95	2.13e+04	2.17895e+04	5.20188e+02	2.0e-03	14
96	2.12e+04	2.16881e+04	5.20188e+02	2.0e-03	21
97	2.10e+04	2.14903e+04	5.20191e+02	3.9e-03	17
98	2.08e+04	2.13020e+04	5.20191e+02	3.9e-03	28
99	2.07e+04	2.12081e+04	5.20191e+02	2.0e-03	0
100	2.00e+04	2.05434e+04	5.20191e+02	1.6e-02	146
101	1.97e+04	2.02148e+04	5.20191e+02	7.8e-03	0
102	1.91e+04	1.96049e+04	5.20191e+02	1.6e-02	118
103	1.88e+04	1.93034e+04	5.20191e+02	7.8e-03	0
104	1.76e+04	1.81667e+04	5.20191e+02	3.1e-02	75
105	1.75e+04	1.80271e+04	5.20191e+02	3.9e-03	0
106	1.65e+04	1.69764e+04	5.20191e+02	3.1e-02	79
107	1.63e+04	1.68474e+04	5.20191e+02	3.9e-03	0
108	1.54e+04	1.58763e+04	5.20191e+02	3.1e-02	61

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 109     1.49e+04     1.54023e+04     5.20191e+02     1.6e-02        0
 110     1.31e+04     1.36668e+04     5.20191e+02     6.3e-02       56
 111     1.23e+04     1.28410e+04     5.20191e+02     3.1e-02        0
 112     9.56e+03     1.00759e+04     5.20191e+02     1.3e-01       59
 113     8.99e+03     9.50621e+03     5.20191e+02     3.1e-02        1
 114     8.73e+03     9.25066e+03     5.20191e+02     1.6e-02        2
 115     8.47e+03     8.99503e+03     5.20191e+02     1.6e-02        2
 116     8.35e+03     8.86881e+03     5.20191e+02     7.8e-03        0
 117     7.32e+03     7.84333e+03     5.20191e+02     6.3e-02      139
 118     7.21e+03     7.72785e+03     5.20191e+02     7.8e-03        6
 119     7.09e+03     7.61216e+03     5.20191e+02     7.8e-03        6
 120     6.98e+03     7.50165e+03     5.20191e+02     7.8e-03        7
 121     6.93e+03     7.44626e+03     5.20191e+02     3.9e-03        2
 122     6.82e+03     7.33841e+03     5.20191e+02     7.8e-03        6
 123     6.71e+03     7.23317e+03     5.20191e+02     7.8e-03        2
 124     6.66e+03     7.18099e+03     5.20191e+02     3.9e-03        0
 125     5.88e+03     6.40237e+03     5.20191e+02     6.3e-02      119
 126     5.70e+03     6.21545e+03     5.20191e+02     1.6e-02        0
 127     4.43e+03     4.95340e+03     5.20191e+02     1.3e-01       72
 128     4.19e+03     4.70883e+03     5.20191e+02     3.1e-02        2
 129     3.95e+03     4.46859e+03     5.20191e+02     3.1e-02        5
 130     3.73e+03     4.24789e+03     5.20191e+02     3.1e-02        2
 131     3.32e+03     3.83837e+03     5.20191e+02     6.3e-02       11
 132     3.14e+03     3.65806e+03     5.20191e+02     3.1e-02        2
 133     2.97e+03     3.48765e+03     5.20191e+02     3.1e-02        2
 134     2.81e+03     3.32994e+03     5.20191e+02     3.1e-02        4
 135     2.73e+03     3.25331e+03     5.20191e+02     1.6e-02        0
 136     1.70e+03     2.21740e+03     5.20191e+02     2.5e-01       42
 137     1.38e+03     1.90129e+03     5.21253e+02     1.3e-01        2
 138     1.13e+03     1.65663e+03     5.22429e+02     1.3e-01        1
 139     9.57e+02     1.47935e+03     5.22429e+02     1.3e-01        2
 140     8.86e+02     1.40890e+03     5.22600e+02     6.3e-02        2
 141     6.63e+02     1.18667e+03     5.23306e+02     2.5e-01        2
 142     5.35e+02     1.06258e+03     5.27280e+02     2.5e-01        2
 143     4.68e+02     9.95773e+02     5.27280e+02     2.5e-01        3
 144     4.09e+02     9.36100e+02     5.27280e+02     1.0e+00        3
 145     3.89e+02     9.16188e+02     5.27280e+02     1.3e-01       54
 146     3.69e+02     8.96150e+02     5.27280e+02     2.5e-01       33
 147     3.59e+02     8.85814e+02     5.27280e+02     5.0e-01       32
 148     1.41e+02     8.84386e+02     7.43100e+02     1.0e+00       25
 149     7.39e+01     8.83527e+02     8.09655e+02     1.0e+00       38
 150     5.60e+01     8.79146e+02     8.23186e+02     5.0e-01       50
 151     4.30e+01     8.77672e+02     8.34634e+02     1.0e+00       50
 152     1.97e+01     8.77361e+02     8.57691e+02     1.0e+00       43
 153     1.46e+01     8.76513e+02     8.61915e+02     5.0e-01       36
 154     1.23e+01     8.75756e+02     8.63480e+02     1.0e+00       49
 155     9.47e+00     8.75813e+02     8.66346e+02     1.0e+00       46
 156     7.47e+00     8.75635e+02     8.68169e+02     1.0e+00       35
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e-01
-----------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
```

0	4.37e+06	4.37722e+06	2.59784e+03	Inf	0
1	4.36e+06	4.36299e+06	2.59784e+03	2.0e-03	3
2	4.33e+06	4.33424e+06	2.59784e+03	3.9e-03	1
3	4.21e+06	4.21316e+06	2.59815e+03	1.6e-02	2
4	3.72e+06	3.71794e+06	2.59815e+03	6.3e-02	2
5	3.60e+06	3.60476e+06	2.59815e+03	1.6e-02	1
6	3.38e+06	3.38269e+06	2.59815e+03	3.1e-02	1
7	2.59e+06	2.59512e+06	2.59815e+03	1.3e-01	3
8	2.27e+06	2.27443e+06	2.59905e+03	6.3e-02	1
9	2.12e+06	2.12207e+06	2.59970e+03	3.1e-02	0
10	1.19e+06	1.19760e+06	2.60079e+03	2.5e-01	4
11	9.13e+05	9.15317e+05	2.60715e+03	1.3e-01	2
12	7.01e+05	7.03165e+05	2.60715e+03	1.3e-01	3
13	6.57e+05	6.59311e+05	2.60715e+03	3.1e-02	1
14	6.17e+05	6.19108e+05	2.60739e+03	3.1e-02	1
15	4.74e+05	4.76311e+05	2.60794e+03	1.3e-01	2
16	4.44e+05	4.46803e+05	2.60856e+03	3.1e-02	1
17	4.31e+05	4.33157e+05	2.60908e+03	1.6e-02	1
18	2.44e+05	2.46467e+05	2.60963e+03	2.5e-01	2
19	1.87e+05	1.89884e+05	2.61683e+03	1.3e-01	2
20	1.65e+05	1.67137e+05	2.61990e+03	6.3e-02	1
21	1.27e+05	1.29692e+05	2.62081e+03	1.3e-01	3
22	1.23e+05	1.25849e+05	2.62135e+03	1.6e-02	1
23	9.61e+04	9.87464e+04	2.62264e+03	1.3e-01	2
24	7.50e+04	7.75843e+04	2.62264e+03	1.3e-01	3
25	7.06e+04	7.32061e+04	2.62354e+03	3.1e-02	1
26	6.84e+04	7.10703e+04	2.62402e+03	1.6e-02	0
27	6.56e+04	6.82514e+04	2.62413e+03	1.6e-02	212
28	6.42e+04	6.68536e+04	2.62418e+03	7.8e-03	0
29	6.19e+04	6.44807e+04	2.62421e+03	1.6e-02	180
30	6.07e+04	6.33054e+04	2.62422e+03	7.8e-03	0
31	5.69e+04	5.95080e+04	2.62425e+03	3.1e-02	173
32	5.50e+04	5.76515e+04	2.62427e+03	1.6e-02	0
33	4.84e+04	5.10731e+04	2.62434e+03	6.3e-02	89
34	4.69e+04	4.94925e+04	2.62436e+03	1.6e-02	0
35	4.13e+04	4.39496e+04	2.62460e+03	6.3e-02	57
36	3.87e+04	4.13091e+04	2.62474e+03	3.1e-02	0
37	3.42e+04	3.67935e+04	2.62495e+03	6.3e-02	48
38	3.20e+04	3.46432e+04	2.62506e+03	3.1e-02	0
39	1.88e+04	2.13934e+04	2.62583e+03	2.5e-01	42
40	1.67e+04	1.93015e+04	2.62583e+03	6.3e-02	3
41	1.48e+04	1.74289e+04	2.62583e+03	6.3e-02	2
42	1.32e+04	1.58021e+04	2.62583e+03	6.3e-02	2
43	1.17e+04	1.43593e+04	2.62583e+03	6.3e-02	2
44	1.11e+04	1.37202e+04	2.62583e+03	3.1e-02	2
45	9.91e+03	1.25384e+04	2.62583e+03	6.3e-02	2
46	8.92e+03	1.15454e+04	2.62583e+03	6.3e-02	2
47	8.05e+03	1.06721e+04	2.62583e+03	6.3e-02	2
48	6.64e+03	9.26530e+03	2.62583e+03	1.3e-01	2
49	5.60e+03	8.22128e+03	2.62583e+03	1.3e-01	6
50	5.20e+03	7.82529e+03	2.62583e+03	6.3e-02	1
51	4.58e+03	7.20369e+03	2.62583e+03	1.3e-01	2
52	4.12e+03	6.74165e+03	2.62583e+03	1.3e-01	2
53	3.55e+03	6.17193e+03	2.62583e+03	2.5e-01	2

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  54     3.33e+03     5.95197e+03     2.62583e+03     2.5e-01        3
  55     3.00e+03     5.62704e+03     2.62583e+03     3.1e-02       54
  56     2.63e+03     5.25628e+03     2.62583e+03     6.3e-02       52
  57     2.47e+03     5.09632e+03     2.62583e+03     6.3e-02       36
  58     2.24e+03     4.86809e+03     2.62583e+03     1.3e-01       16
  59     2.03e+03     4.65314e+03     2.62583e+03     2.5e-01       16
  60     1.87e+03     4.55079e+03     2.68523e+03     2.5e-01       11
  61     1.62e+03     4.47053e+03     2.85148e+03     5.0e-01        7
  62     1.51e+03     4.45012e+03     2.94469e+03     5.0e-01       13
  63     1.50e+03     4.44232e+03     2.94469e+03     1.0e+00       11
  64     3.94e+02     4.43015e+03     4.03567e+03     1.0e+00       28
  65     2.18e+02     4.40141e+03     4.18388e+03     5.0e-01       24
  66     1.99e+02     4.38318e+03     4.18388e+03     5.0e-01       13
  67     1.81e+02     4.37991e+03     4.19851e+03     1.0e+00       24
  68     5.33e+01     4.37925e+03     4.32597e+03     1.0e+00       17
  69     4.94e+01     4.37533e+03     4.32597e+03     5.0e-01       12
  70     4.63e+01     4.37229e+03     4.32597e+03     5.0e-01        9
  71     4.51e+01     4.37110e+03     4.32597e+03     1.0e+00       18
  72     1.68e+01     4.37117e+03     4.35432e+03     1.0e+00       20
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=1.00000e+00
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.37e+06     4.37722e+06     5.19491e+03         Inf        0
   1     4.35e+06     4.35265e+06     5.19491e+03     3.9e-03        2
   2     4.25e+06     4.25142e+06     5.19491e+03     1.6e-02        2
   3     4.00e+06     4.00597e+06     5.19964e+03     3.1e-02        5
   4     3.88e+06     3.88453e+06     5.19964e+03     1.6e-02        1
   5     3.42e+06     3.42188e+06     5.20317e+03     6.3e-02        2
   6     3.20e+06     3.20160e+06     5.20533e+03     3.1e-02        0
   7     1.80e+06     1.80882e+06     5.21131e+03     2.5e-01        6
   8     1.69e+06     1.69690e+06     5.21375e+03     3.1e-02        2
   9     1.64e+06     1.64229e+06     5.21504e+03     1.6e-02        0
  10     1.25e+06     1.26019e+06     5.21573e+03     1.3e-01        9
  11     1.10e+06     1.10521e+06     5.22000e+03     6.3e-02        1
  12     1.03e+06     1.03762e+06     5.22022e+03     3.1e-02        2
  13     9.08e+05     9.13063e+05     5.22328e+03     6.3e-02        2
  14     8.49e+05     8.53808e+05     5.22496e+03     3.1e-02        0
  15     6.51e+05     6.56666e+05     5.22608e+03     1.3e-01        9
  16     6.11e+05     6.15918e+05     5.22860e+03     3.1e-02        1
  17     5.91e+05     5.96044e+05     5.22993e+03     1.6e-02        0
  18     4.54e+05     4.59112e+05     5.23287e+03     1.3e-01        9
  19     3.98e+05     4.03417e+05     5.23843e+03     6.3e-02        1
  20     3.50e+05     3.55720e+05     5.24029e+03     6.3e-02        2
  21     3.08e+05     3.13738e+05     5.24561e+03     6.3e-02        2
  22     3.03e+05     3.08682e+05     5.24633e+03     7.8e-03        0
  23     2.34e+05     2.38851e+05     5.24869e+03     1.3e-01       12
  24     2.05e+05     2.10449e+05     5.25472e+03     6.3e-02        1
  25     1.92e+05     1.96956e+05     5.25807e+03     3.1e-02        0
  26     1.10e+05     1.15272e+05     5.25963e+03     2.5e-01       14
  27     8.52e+04     9.05007e+04     5.26185e+03     1.3e-01        3
  28     8.02e+04     8.54897e+04     5.26708e+03     3.1e-02        2
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 29     7.05e+04     7.58097e+04     5.26970e+03     6.3e-02        2
 30     6.64e+04     7.17045e+04     5.27424e+03     3.1e-02        2
 31     6.24e+04     6.76594e+04     5.27565e+03     3.1e-02        2
 32     5.88e+04     6.40364e+04     5.27963e+03     3.1e-02        2
 33     5.53e+04     6.06149e+04     5.28277e+03     3.1e-02        1
 34     4.90e+04     5.42654e+04     5.30035e+03     6.3e-02        4
 35     4.34e+04     4.86971e+04     5.30740e+03     6.3e-02        2
 36     3.84e+04     4.36921e+04     5.31438e+03     6.3e-02        2
 37     3.40e+04     3.93509e+04     5.32937e+03     6.3e-02        4
 38     3.21e+04     3.74049e+04     5.33078e+03     3.1e-02        3
 39     2.85e+04     3.37996e+04     5.33480e+03     6.3e-02        3
 40     2.53e+04     3.06497e+04     5.33567e+03     6.3e-02        5
 41     2.26e+04     2.79114e+04     5.33567e+03     6.3e-02        5
 42     2.02e+04     2.54919e+04     5.33567e+03     6.3e-02        5
 43     1.91e+04     2.44085e+04     5.33567e+03     3.1e-02        5
 44     1.71e+04     2.24513e+04     5.33567e+03     6.3e-02        5
 45     1.63e+04     2.15948e+04     5.33567e+03     3.1e-02        2
 46     1.47e+04     1.99865e+04     5.33567e+03     6.3e-02        5
 47     1.20e+04     1.73064e+04     5.33567e+03     1.3e-01        5
 48     8.20e+03     1.35332e+04     5.33567e+03     2.5e-01        5
 49     6.14e+03     1.14782e+04     5.33567e+03     2.5e-01        5
 50     5.06e+03     1.03941e+04     5.33567e+03     2.5e-01        2
 51     4.38e+03     9.71274e+03     5.33567e+03     2.5e-01        7
 52     3.52e+03     8.85363e+03     5.33567e+03     1.0e+00        3
 53     2.84e+03     8.80736e+03     5.96530e+03     5.0e-01       17
 54     8.00e+02     8.83756e+03     8.03760e+03     1.0e+00       12
 55     3.76e+02     8.79664e+03     8.42026e+03     5.0e-01       17
 56     3.41e+02     8.76168e+03     8.42026e+03     5.0e-01       12
 57     3.20e+02     8.74019e+03     8.42026e+03     1.0e+00       14
 58     3.21e+02     8.74164e+03     8.42026e+03     1.0e+00       10
 59     2.22e+02     8.74329e+03     8.52154e+03     1.0e+00        6
 60     2.16e+02     8.73707e+03     8.52154e+03     1.0e+00        5
 61     2.16e+02     8.73762e+03     8.52154e+03     1.0e+00        4
 62     1.22e+02     8.73751e+03     8.61502e+03     1.0e+00        8
 63     1.20e+02     8.73498e+03     8.61502e+03     5.0e-01        2
 64     1.15e+02     8.73007e+03     8.61502e+03     1.0e+00        6
 65     7.72e+01     8.73059e+03     8.65339e+03     1.0e+00       11
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=2.00000e+00
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.37e+06     4.37722e+06     1.03867e+04         Inf        0
   1     4.34e+06     4.35271e+06     1.03867e+04     3.9e-03        2
   2     4.24e+06     4.25187e+06     1.03867e+04     1.6e-02        2
   3     4.00e+06     4.00709e+06     1.03965e+04     3.1e-02        5
   4     3.88e+06     3.88594e+06     1.03965e+04     1.6e-02        1
   5     3.41e+06     3.42498e+06     1.04042e+04     6.3e-02        2
   6     3.20e+06     3.20551e+06     1.04089e+04     3.1e-02        0
   7     2.45e+06     2.46279e+06     1.04131e+04     1.3e-01        7
   8     2.30e+06     2.30948e+06     1.04171e+04     3.1e-02        1
   9     2.22e+06     2.23470e+06     1.04192e+04     1.6e-02        0
  10     1.71e+06     1.71702e+06     1.04246e+04     1.3e-01        4
```

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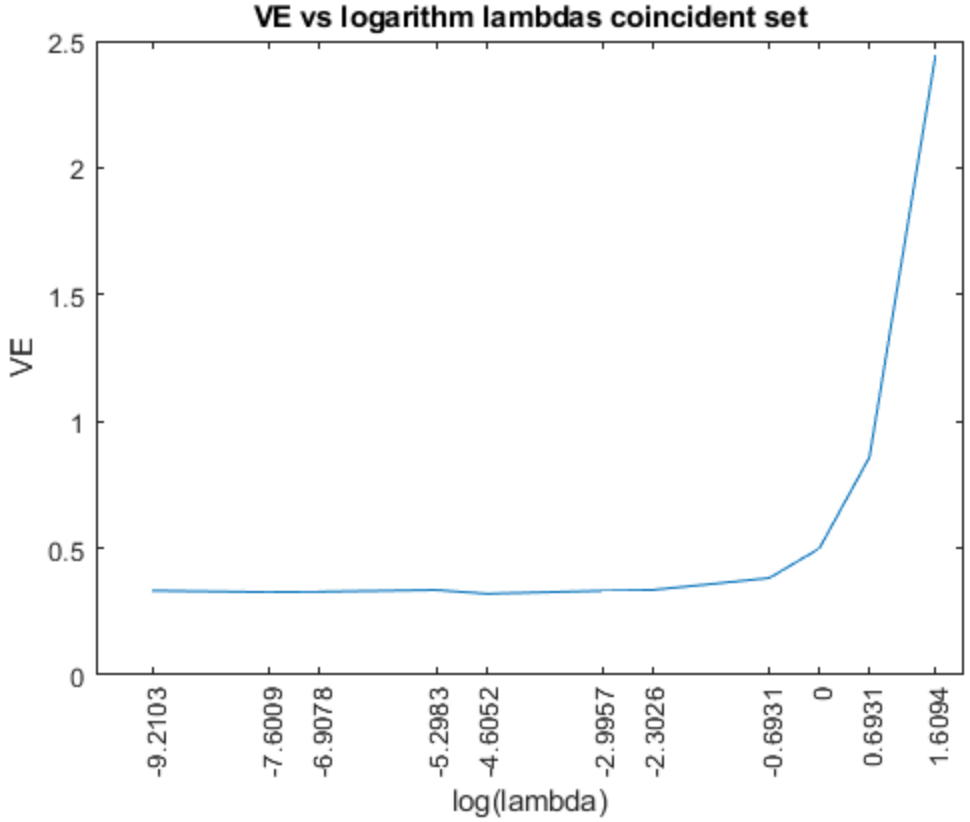
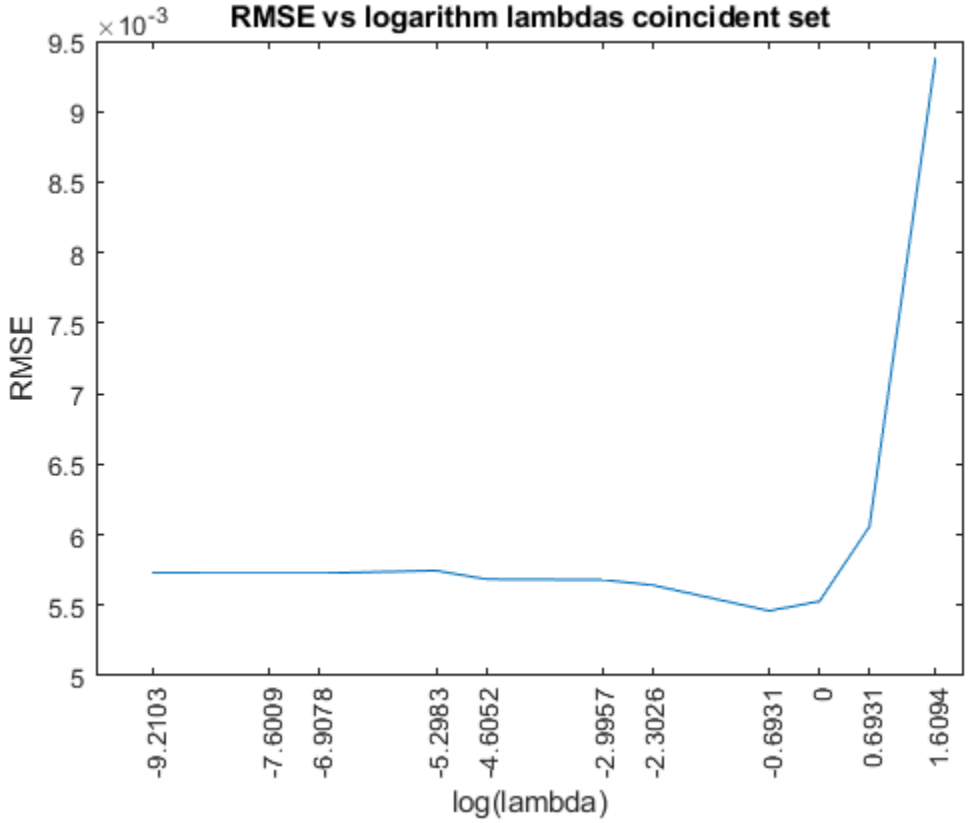
  11     1.65e+06     1.66329e+06     1.04272e+04     1.6e-02         1
  12     1.46e+06     1.46705e+06     1.04317e+04     6.3e-02         2
  13     1.28e+06     1.29280e+06     1.04375e+04     6.3e-02         2
  14     1.20e+06     1.20988e+06     1.04407e+04     3.1e-02         0
  15     9.21e+05     9.31809e+05     1.04459e+04     1.3e-01         6
  16     8.93e+05     9.02968e+05     1.04492e+04     1.6e-02         1
  17     7.87e+05     7.97516e+05     1.04559e+04     6.3e-02         2
  18     7.63e+05     7.73536e+05     1.04596e+04     1.6e-02         1
  19     7.15e+05     7.25725e+05     1.04628e+04     3.1e-02         1
  20     6.30e+05     6.40564e+05     1.04753e+04     6.3e-02         2
  21     6.10e+05     6.20132e+05     1.04787e+04     1.6e-02         0
  22     5.90e+05     6.00905e+05     1.04792e+04     1.6e-02        60
  23     5.81e+05     5.91402e+05     1.04795e+04     7.8e-03         0
  24     5.45e+05     5.55092e+05     1.04810e+04     3.1e-02        36
  25     5.36e+05     5.46293e+05     1.04810e+04     7.8e-03         4
  26     5.27e+05     5.37750e+05     1.04810e+04     7.8e-03         8
  27     5.19e+05     5.29226e+05     1.04810e+04     7.8e-03         8
  28     5.03e+05     5.13156e+05     1.04810e+04     1.6e-02        13
  29     4.95e+05     5.05351e+05     1.04810e+04     7.8e-03         1
  30     4.64e+05     4.74865e+05     1.04810e+04     3.1e-02         4
  31     4.50e+05     4.60241e+05     1.04810e+04     1.6e-02         4
  32     4.36e+05     4.46116e+05     1.04810e+04     1.6e-02         1
  33     4.22e+05     4.32521e+05     1.04810e+04     1.6e-02         4
  34     4.15e+05     4.25807e+05     1.04810e+04     7.8e-03         0
  35     2.37e+05     2.47167e+05     1.04814e+04     2.5e-01        13
  36     2.08e+05     2.18410e+05     1.04893e+04     6.3e-02         2
  37     2.01e+05     2.11524e+05     1.04915e+04     1.6e-02         0
  38     1.16e+05     1.26543e+05     1.05005e+04     2.5e-01         9
  39     8.96e+04     1.00075e+05     1.05116e+04     1.3e-01         2
  40     6.99e+04     8.03971e+04     1.05116e+04     1.3e-01         2
  41     5.46e+04     6.51136e+04     1.05116e+04     1.3e-01         2
  42     4.29e+04     5.33649e+04     1.05116e+04     1.3e-01         1
  43     2.70e+04     3.75615e+04     1.05116e+04     2.5e-01         5
  44     7.28e+03     1.77891e+04     1.05116e+04     1.0e+00         3
  45     7.08e+03     1.75920e+04     1.05116e+04     2.5e-01        15
  46     6.99e+03     1.75019e+04     1.05116e+04     5.0e-01         8
  47     3.96e+03     1.75163e+04     1.35530e+04     1.0e+00         7
  48     1.96e+03     1.75363e+04     1.55811e+04     1.0e+00         8
  49     3.50e+02     1.75412e+04     1.71912e+04     1.0e+00         9
  50     2.95e+02     1.74861e+04     1.71912e+04     5.0e-01         6
  51     2.79e+02     1.74702e+04     1.71912e+04     2.5e-01         5
  52     2.54e+02     1.74451e+04     1.71912e+04     5.0e-01         4
  53     2.43e+02     1.74347e+04     1.71912e+04     2.5e-01         2
  54     2.30e+02     1.74209e+04     1.71912e+04     1.0e+00         6
  55     2.29e+02     1.74204e+04     1.71912e+04     1.0e+00         4
  56     2.29e+02     1.74205e+04     1.71912e+04     1.0e+00         5
  57     5.52e+01     1.74206e+04     1.73654e+04     1.0e+00         7
Absolute tolerance reached.

Solving a problem of size (m=180, n=500), with lambda=5.00000e+00
------------------------------------------------------------------------------
 iter       gap         primobj         dualobj      step len   pcg
 iters
   0     4.35e+06     4.37722e+06     2.59437e+04         Inf         0
```

```
  1     4.33e+06     4.35287e+06     2.59437e+04     3.9e-03       2
  2     4.28e+06     4.30289e+06     2.59437e+04     7.8e-03       2
  3     4.05e+06     4.07279e+06     2.59607e+04     3.1e-02       2
  4     3.57e+06     3.60091e+06     2.59607e+04     6.3e-02       2
  5     3.46e+06     3.48760e+06     2.59607e+04     1.6e-02       0
  6     3.25e+06     3.27543e+06     2.59609e+04     3.1e-02      27
  7     3.22e+06     3.24938e+06     2.59613e+04     3.9e-03       0
  8     3.03e+06     3.05210e+06     2.59626e+04     3.1e-02      14
  9     2.98e+06     3.00375e+06     2.59630e+04     7.8e-03       0
 10     2.62e+06     2.64455e+06     2.59666e+04     6.3e-02      10
 11     2.54e+06     2.56287e+06     2.59691e+04     1.6e-02       2
 12     2.50e+06     2.52252e+06     2.59704e+04     7.8e-03       0
 13     2.20e+06     2.22164e+06     2.59734e+04     6.3e-02      13
 14     2.16e+06     2.18800e+06     2.59743e+04     7.8e-03       1
 15     2.03e+06     2.05397e+06     2.59743e+04     3.1e-02       2
 16     1.90e+06     1.92968e+06     2.59743e+04     3.1e-02       1
 17     1.78e+06     1.80447e+06     2.59743e+04     3.1e-02       1
 18     1.67e+06     1.69148e+06     2.59743e+04     3.1e-02       2
 19     1.64e+06     1.66383e+06     2.59743e+04     7.8e-03       0
 20     9.29e+05     9.54709e+05     2.59743e+04     2.5e-01       5
 21     8.15e+05     8.40972e+05     2.59743e+04     6.3e-02       2
 22     6.20e+05     6.45862e+05     2.59743e+04     1.3e-01       2
 23     4.78e+05     5.03534e+05     2.59743e+04     1.3e-01       2
 24     4.19e+05     4.45354e+05     2.59743e+04     6.3e-02       1
 25     3.24e+05     3.49822e+05     2.59743e+04     1.3e-01       1
 26     2.51e+05     2.77162e+05     2.59743e+04     1.3e-01       2
 27     2.22e+05     2.47736e+05     2.59743e+04     6.3e-02       1
 28     2.15e+05     2.40696e+05     2.59743e+04     1.6e-02       0
 29     1.91e+05     2.16486e+05     2.59743e+04     6.3e-02       9
 30     1.80e+05     2.06274e+05     2.59743e+04     3.1e-02       1
 31     1.61e+05     1.86791e+05     2.59846e+04     6.3e-02       1
 32     1.44e+05     1.69832e+05     2.60402e+04     6.3e-02       2
 33     1.29e+05     1.54882e+05     2.60769e+04     6.3e-02       1
 34     1.03e+05     1.29318e+05     2.61769e+04     1.3e-01       1
 35     3.77e+04     6.43817e+04     2.67051e+04     5.0e-01       2
 36     2.15e+04     4.85985e+04     2.70602e+04     5.0e-01       4
 37     1.68e+04     4.47311e+04     2.79629e+04     5.0e-01       4
 38     4.95e+03     4.34610e+04     3.85101e+04     1.0e+00       4
 39     1.01e+03     4.34693e+04     4.24621e+04     1.0e+00       7
 40     9.75e+02     4.34374e+04     4.24621e+04     5.0e-01       2
 41     7.98e+02     4.33811e+04     4.25832e+04     1.0e+00       5
 42     7.91e+02     4.33741e+04     4.25832e+04     1.0e+00       4
 43     3.37e+02     4.33728e+04     4.30363e+04     1.0e+00       4
Absolute tolerance reached.
```


VE vs logarithm lambdas coincident set
VE
log(lambda)
2.5
2
1.5
1
0.5
0
-9.2103
-7.6009
-6.9078
-5.2983
-4.6052
-2.9957
-2.3026
-0.6931
0
0.6931
1.6094


RMSE vs logarithm lambdas coincident set
×10-3
RMSE
log(lambda)
9.5
9
8.5
8
7.5
7
6.5
6
5.5
5
-9.2103
-7.6009
-6.9078
-5.2983
-4.6052
-2.9957
-2.3026
-0.6931
0
0.6931
1.6094

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