```
Python 3.7.0 (default, Jun 28 2018, 07:39:16)
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IPython 7.8.0 -- An enhanced Interactive Python.

In [1]: runfile('/Users/maged/Documents/GitHub/Poisson2D_FEM/
Poisson2D.py', wdir='/Users/maged/Documents/GitHub/
Poisson2D_FEM')

  Nodes along x axis:

  0  0.000000
  1  0.200000
  2  0.400000
  3  0.600000
  4  0.800000
  5  1.000000

   The elements, listing the nodes in counterclockwise order

   0     1     7     6
   1     2     8     7
   2     3     9     8
   3     4    10     9
   4     5    11    10
   6     7    13    12
   7     8    14    13
   8     9    15    14
   9    10    16    15
  10    11    17    16
  12    13    19    18
  13    14    20    19
  14    15    21    20
  15    16    22    21
  16    17    23    22
  18    19    25    24
  19    20    26    25
  20    21    27    26
  21    22    28    27
  22    23    29    28
  24    25    31    30
  25    26    32    31
  26    27    33    32
  27    28    34    33
  28    29    35    34

   Node    x         y              u               u_exact

    0  0.000000  0.000000              0                 0
    1  0.200000  0.000000              0                 0
```
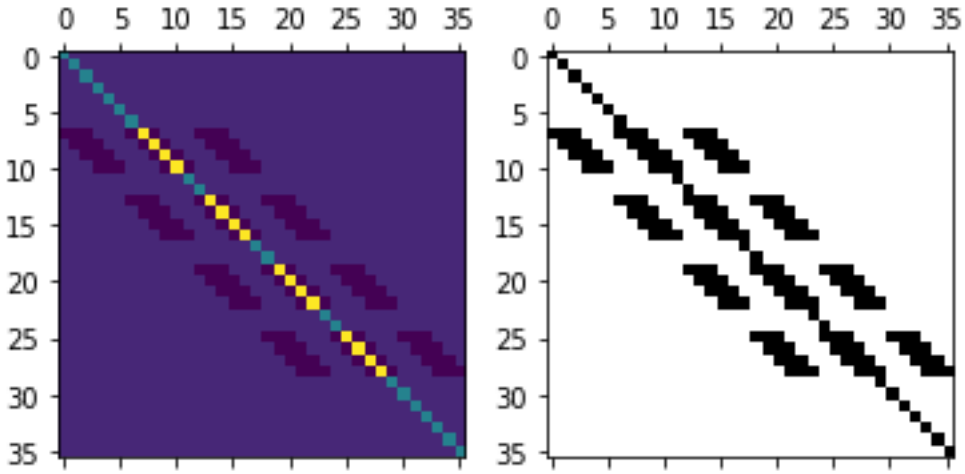
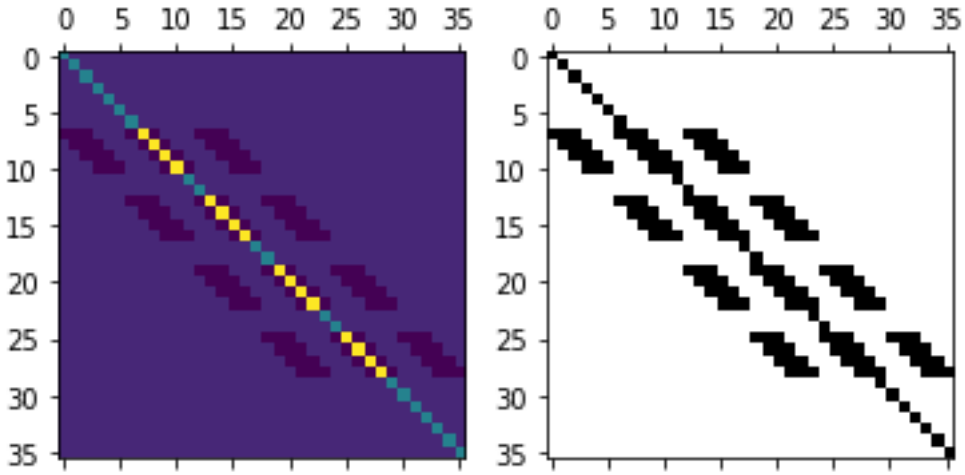
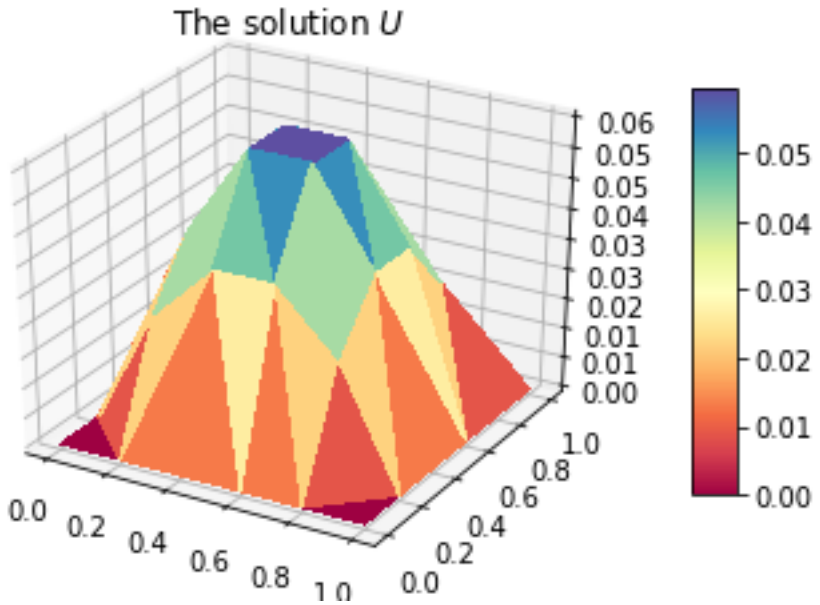

2	0.400000	0.000000	0	0
3	0.600000	0.000000	0	0
4	0.800000	0.000000	0	0
5	1.000000	0.000000	0	0
6	0.000000	0.200000	0	0
7	0.200000	0.200000	0.0265684	0.0256
8	0.400000	0.200000	0.0397263	0.0384
9	0.600000	0.200000	0.0397263	0.0384
10	0.800000	0.200000	0.0265684	0.0256
11	1.000000	0.200000	0	0
12	0.000000	0.400000	0	0
13	0.200000	0.400000	0.0397263	0.0384
14	0.400000	0.400000	0.0594947	0.0576
15	0.600000	0.400000	0.0594947	0.0576
16	0.800000	0.400000	0.0397263	0.0384
17	1.000000	0.400000	0	0
18	0.000000	0.600000	0	0
19	0.200000	0.600000	0.0397263	0.0384
20	0.400000	0.600000	0.0594947	0.0576
21	0.600000	0.600000	0.0594947	0.0576
22	0.800000	0.600000	0.0397263	0.0384
23	1.000000	0.600000	0	0
24	0.000000	0.800000	0	0
25	0.200000	0.800000	0.0265684	0.0256
26	0.400000	0.800000	0.0397263	0.0384
27	0.600000	0.800000	0.0397263	0.0384
28	0.800000	0.800000	0.0265684	0.0256
29	1.000000	0.800000	0	0
30	0.000000	1.000000	0	0
31	0.200000	1.000000	0	0
32	0.400000	1.000000	0	0
33	0.600000	1.000000	0	0
34	0.800000	1.000000	0	0
35	1.000000	1.000000	0	0

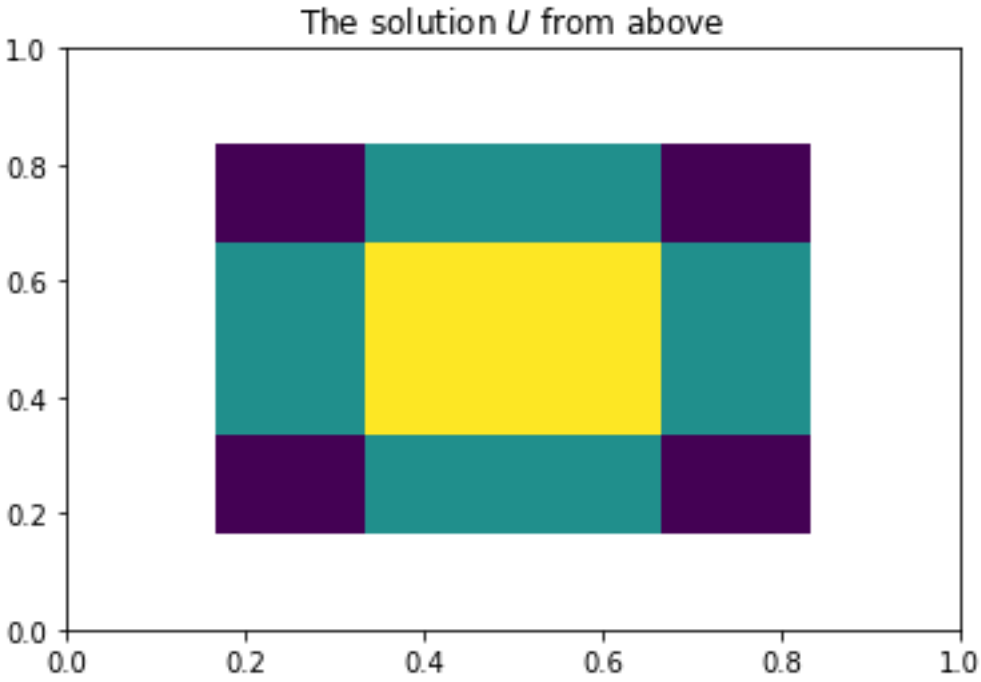
The Stiffness Matrix



The Stiffness Matrix with BC contribution

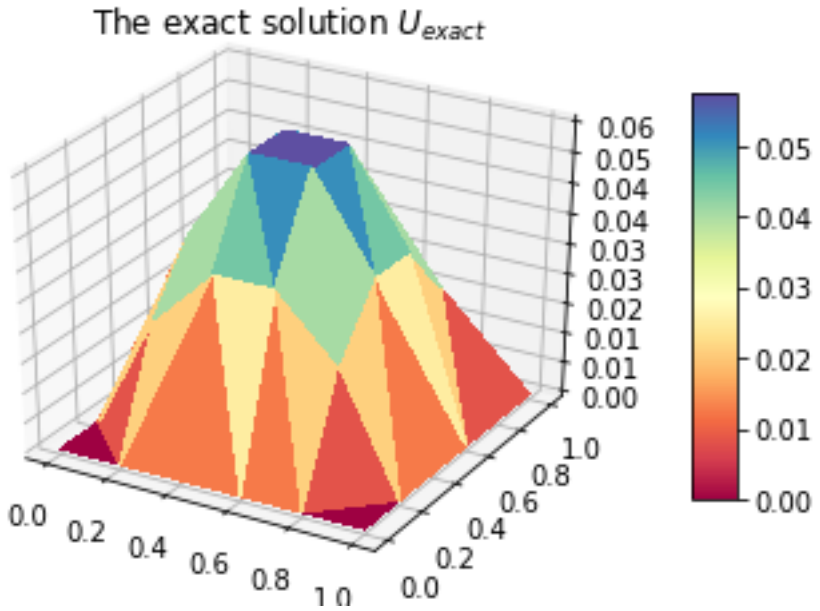




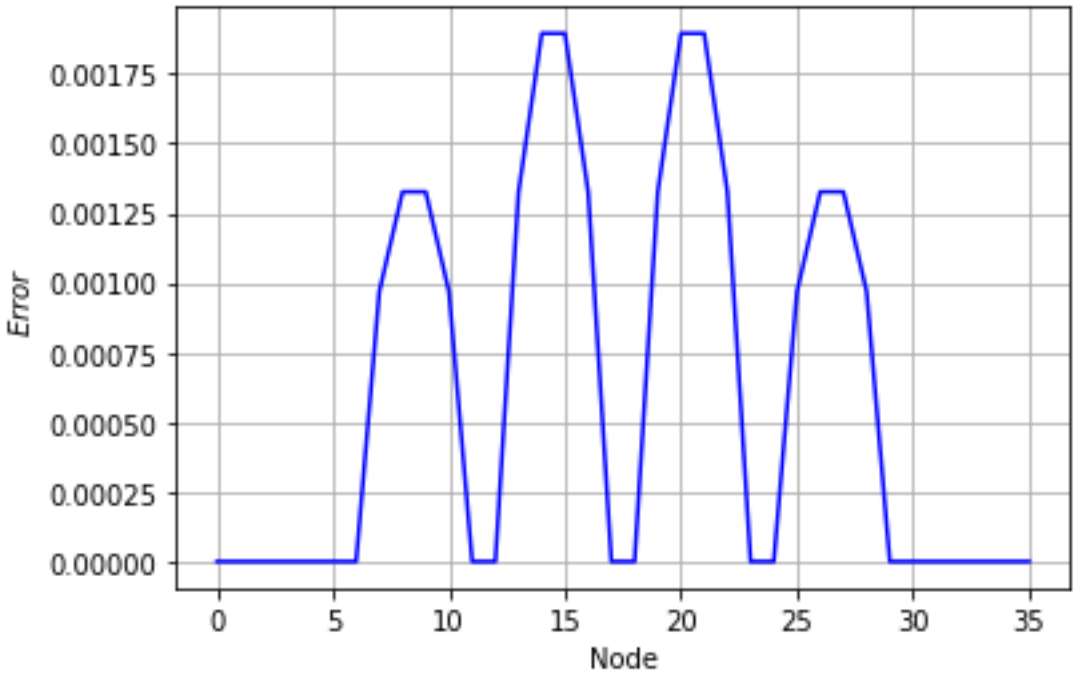


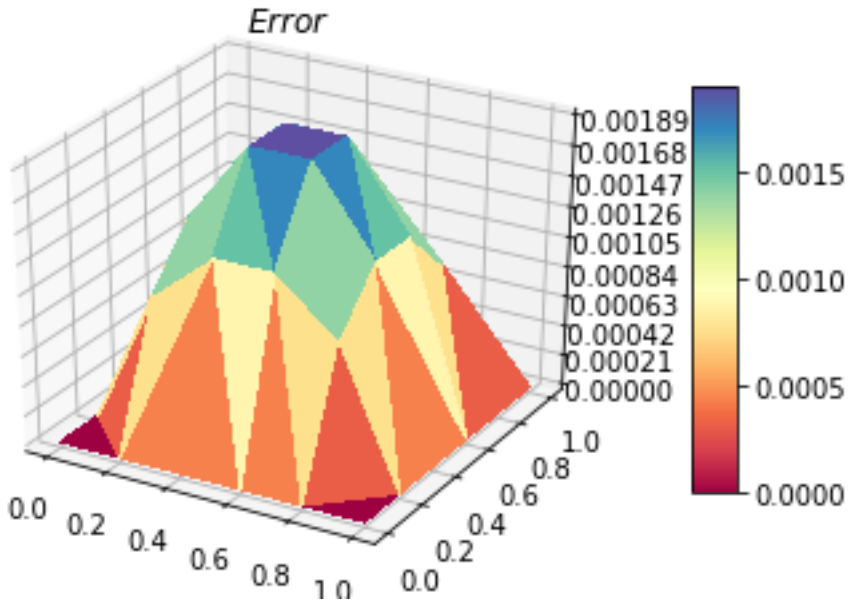
##

The Exact Solution
U_exact = xy(1-x)(1-y)
evaluated on each node is


The exact solution U_{exact}
0.06
0.05
0.04
0.04
0.03
0.03
0.02
0.01
0.01
0.00
0.0
0.2
0.4
0.6
0.8
1.0
0.0
0.2
0.4
0.6
0.8
1.0
0.05
0.04
0.03
0.02
0.01
0.00

##


0.00175
0.00150
0.00125
0.00100
0.00075
0.00050
0.00025
0.00000
Error
0
5
10
15
20
25
30
35
Node




```
        The L2 error =  0.0015243643100346918

        The H1 error =  0.029991468572487474
```

```
############################################################
```

```
  >> Normal end of execution.
```

In [2]: