Elham Pilvar 260969214

MATH 579-
with 10 Linear Elements

Nodes along x axis:

```
0   0.000000
1   0.100000
2   0.200000
3   0.300000
4   0.400000
5   0.500000
6   0.600000
7   0.700000
8   0.800000
9   0.900000
10  1.000000
```

The elements, listing the nodes in counterclockwise order

```
0     1    12    11
1     2    13    12
2     3    14    13
3     4    15    14
4     5    16    15
5     6    17    16
6     7    18    17
7     8    19    18
8     9    20    19
9    10    21    20
11   12    23    22
12   13    24    23
13   14    25    24
14   15    26    25
15   16    27    26
16   17    28    27
17   18    29    28
18   19    30    29
19   20    31    30
20   21    32    31
22   23    34    33
23   24    35    34
24   25    36    35
25   26    37    36
26   27    38    37
27   28    39    38
28   29    40    39
29   30    41    40
30   31    42    41
```

31	32	43	42
33	34	45	44
34	35	46	45
35	36	47	46
36	37	48	47
37	38	49	48
38	39	50	49
39	40	51	50
40	41	52	51
41	42	53	52
42	43	54	53
44	45	56	55
45	46	57	56
46	47	58	57
47	48	59	58
48	49	60	59
49	50	61	60
50	51	62	61
51	52	63	62
52	53	64	63
53	54	65	64
55	56	67	66
56	57	68	67
57	58	69	68
58	59	70	69
59	60	71	70
60	61	72	71
61	62	73	72
62	63	74	73
63	64	75	74
64	65	76	75
66	67	78	77
67	68	79	78
68	69	80	79
69	70	81	80
70	71	82	81
71	72	83	82
72	73	84	83
73	74	85	84
74	75	86	85
75	76	87	86
77	78	89	88
78	79	90	89
79	80	91	90
80	81	92	91
81	82	93	92
82	83	94	93
83	84	95	94
84	85	96	95
85	86	97	96

```
 86    87    98    97
 88    89   100    99
 89    90   101   100
 90    91   102   101
 91    92   103   102
 92    93   104   103
 93    94   105   104
 94    95   106   105
 95    96   107   106
 96    97   108   107
 97    98   109   108
 99   100   111   110
100   101   112   111
101   102   113   112
102   103   114   113
103   104   115   114
104   105   116   115
105   106   117   116
106   107   118   117
107   108   119   118
108   109   120   119
```

Node	x	y	u	u_exact
0	0.000000	0.000000	0	0
1	0.100000	0.000000	0	0
2	0.200000	0.000000	0	0
3	0.300000	0.000000	0	0
4	0.400000	0.000000	0	0
5	0.500000	0.000000	0	0
6	0.600000	0.000000	0	0
7	0.700000	0.000000	0	0
8	0.800000	0.000000	0	0
9	0.900000	0.000000	0	0
10	1.000000	0.000000	0	0
11	0.000000	0.100000	0	0
12	0.100000	0.100000	0.00818943	0.0081
13	0.200000	0.100000	0.014541	0.0144
14	0.300000	0.100000	0.0190724	0.0189
15	0.400000	0.100000	0.0217896	0.0216
16	0.500000	0.100000	0.022695	0.0225
17	0.600000	0.100000	0.0217896	0.0216
18	0.700000	0.100000	0.0190724	0.0189
19	0.800000	0.100000	0.014541	0.0144
20	0.900000	0.100000	0.00818943	0.0081
21	1.000000	0.100000	0	0
22	0.000000	0.200000	0	0
23	0.100000	0.200000	0.014541	0.0144
24	0.200000	0.200000	0.0258335	0.0256
25	0.300000	0.200000	0.0338915	0.0336

26	0.400000	0.200000	0.0387236	0.0384
27	0.500000	0.200000	0.0403339	0.04
28	0.600000	0.200000	0.0387236	0.0384
29	0.700000	0.200000	0.0338915	0.0336
30	0.800000	0.200000	0.0258335	0.0256
31	0.900000	0.200000	0.014541	0.0144
32	1.000000	0.200000	0	0
33	0.000000	0.300000	0	0
34	0.100000	0.300000	0.0190724	0.0189
35	0.200000	0.300000	0.0338915	0.0336
36	0.300000	0.300000	0.0444687	0.0441
37	0.400000	0.300000	0.050812	0.0504
38	0.500000	0.300000	0.0529259	0.0525
39	0.600000	0.300000	0.050812	0.0504
40	0.700000	0.300000	0.0444687	0.0441
41	0.800000	0.300000	0.0338915	0.0336
42	0.900000	0.300000	0.0190724	0.0189
43	1.000000	0.300000	0	0
44	0.000000	0.400000	0	0
45	0.100000	0.400000	0.0217896	0.0216
46	0.200000	0.400000	0.0387236	0.0384
47	0.300000	0.400000	0.050812	0.0504
48	0.400000	0.400000	0.058062	0.0576
49	0.500000	0.400000	0.0604781	0.06
50	0.600000	0.400000	0.058062	0.0576
51	0.700000	0.400000	0.050812	0.0504
52	0.800000	0.400000	0.0387236	0.0384
53	0.900000	0.400000	0.0217896	0.0216
54	1.000000	0.400000	0	0
55	0.000000	0.500000	0	0
56	0.100000	0.500000	0.022695	0.0225
57	0.200000	0.500000	0.0403339	0.04
58	0.300000	0.500000	0.0529259	0.0525
59	0.400000	0.500000	0.0604781	0.06
60	0.500000	0.500000	0.0629951	0.0625
61	0.600000	0.500000	0.0604781	0.06
62	0.700000	0.500000	0.0529259	0.0525
63	0.800000	0.500000	0.0403339	0.04
64	0.900000	0.500000	0.022695	0.0225
65	1.000000	0.500000	0	0
66	0.000000	0.600000	0	0
67	0.100000	0.600000	0.0217896	0.0216
68	0.200000	0.600000	0.0387236	0.0384
69	0.300000	0.600000	0.050812	0.0504
70	0.400000	0.600000	0.058062	0.0576
71	0.500000	0.600000	0.0604781	0.06
72	0.600000	0.600000	0.058062	0.0576
73	0.700000	0.600000	0.050812	0.0504
74	0.800000	0.600000	0.0387236	0.0384
75	0.900000	0.600000	0.0217896	0.0216

76	1.000000	0.600000	0	0
77	0.000000	0.700000	0	0
78	0.100000	0.700000	0.0190724	0.0189
79	0.200000	0.700000	0.0338915	0.0336
80	0.300000	0.700000	0.0444687	0.0441
81	0.400000	0.700000	0.050812	0.0504
82	0.500000	0.700000	0.0529259	0.0525
83	0.600000	0.700000	0.050812	0.0504
84	0.700000	0.700000	0.0444687	0.0441
85	0.800000	0.700000	0.0338915	0.0336
86	0.900000	0.700000	0.0190724	0.0189
87	1.000000	0.700000	0	0
88	0.000000	0.800000	0	0
89	0.100000	0.800000	0.014541	0.0144
90	0.200000	0.800000	0.0258335	0.0256
91	0.300000	0.800000	0.0338915	0.0336
92	0.400000	0.800000	0.0387236	0.0384
93	0.500000	0.800000	0.0403339	0.04
94	0.600000	0.800000	0.0387236	0.0384
95	0.700000	0.800000	0.0338915	0.0336
96	0.800000	0.800000	0.0258335	0.0256
97	0.900000	0.800000	0.014541	0.0144
98	1.000000	0.800000	0	0
99	0.000000	0.900000	0	0
100	0.100000	0.900000	0.00818943	0.0081
101	0.200000	0.900000	0.014541	0.0144
102	0.300000	0.900000	0.0190724	0.0189
103	0.400000	0.900000	0.0217896	0.0216
104	0.500000	0.900000	0.022695	0.0225
105	0.600000	0.900000	0.0217896	0.0216
106	0.700000	0.900000	0.0190724	0.0189
107	0.800000	0.900000	0.014541	0.0144
108	0.900000	0.900000	0.00818943	0.0081
109	1.000000	0.900000	0	0
110	0.000000	1.000000	0	0
111	0.100000	1.000000	0	0
112	0.200000	1.000000	0	0
113	0.300000	1.000000	0	0
114	0.400000	1.000000	0	0
115	0.500000	1.000000	0	0
116	0.600000	1.000000	0	0
117	0.700000	1.000000	0	0
118	0.800000	1.000000	0	0
119	0.900000	1.000000	0	0
120	1.000000	1.000000	0	0

The Stiffness Matrix
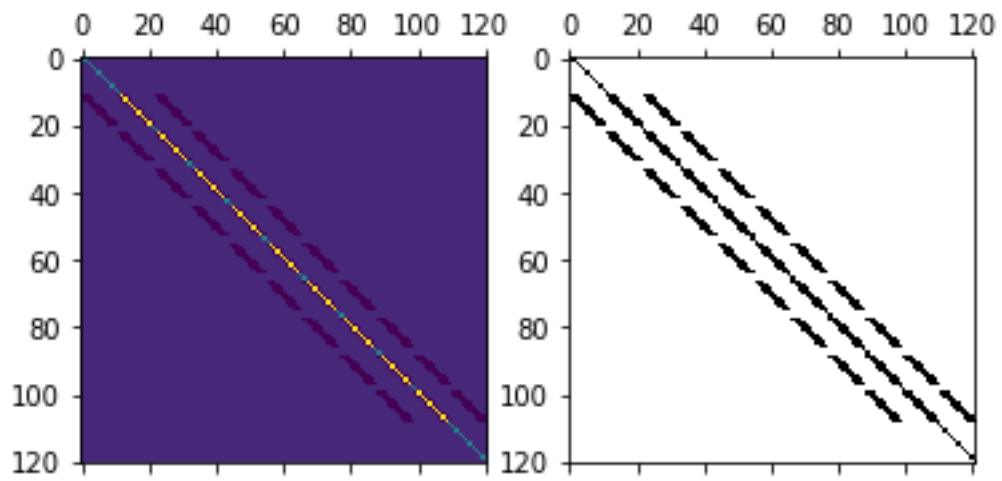
The Stiffness Matrix with BC contribution

The solution U

The solution U from above

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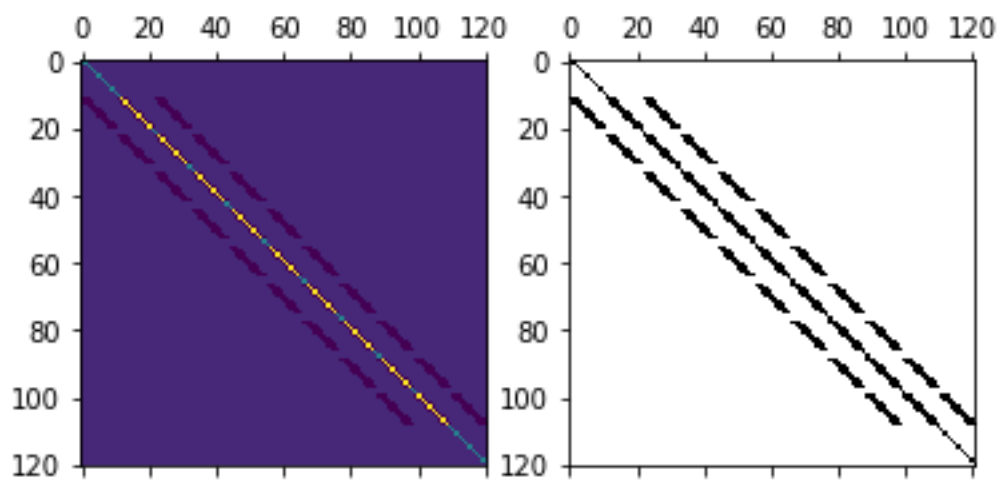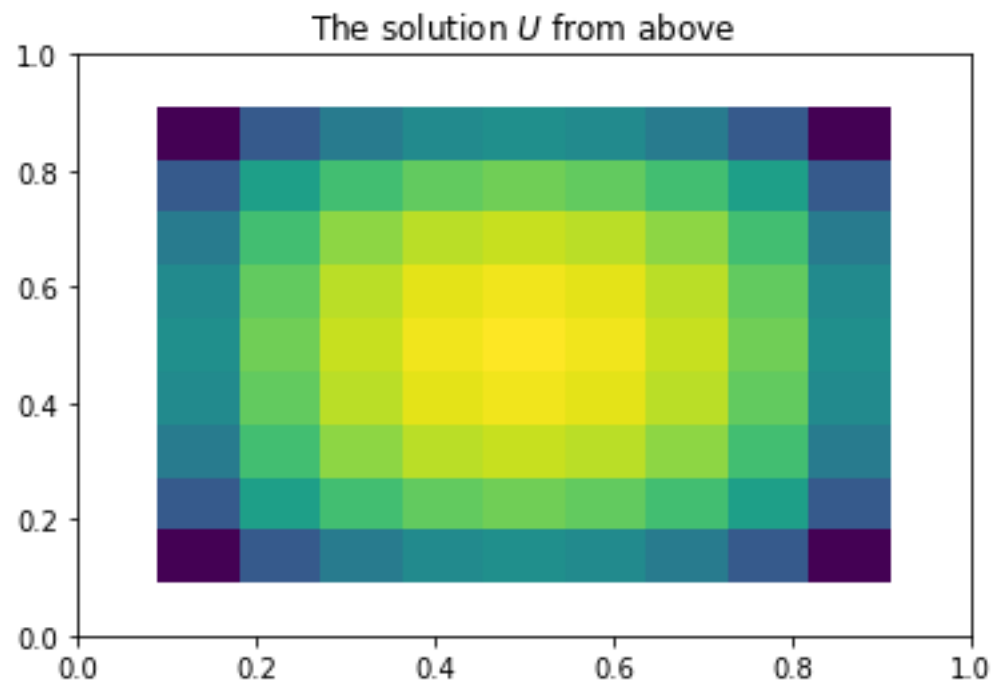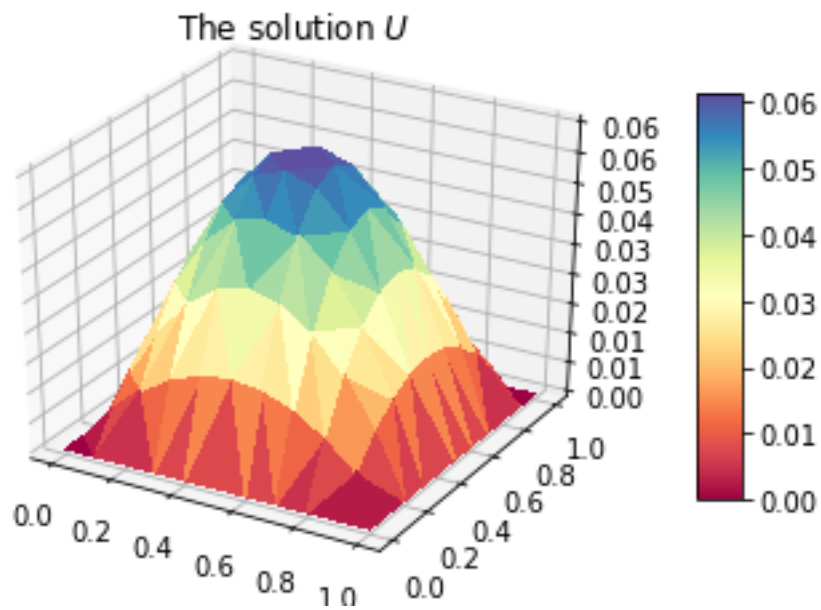
The Exact Solution
    U_exact = xy(1–x)(1–y)
evaluated on each node is

The exact solution U_{exact}

##
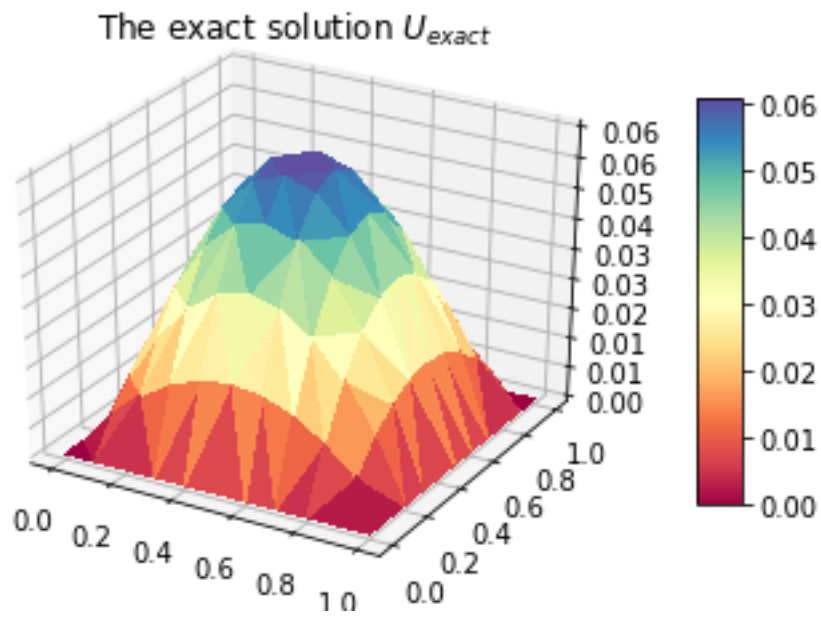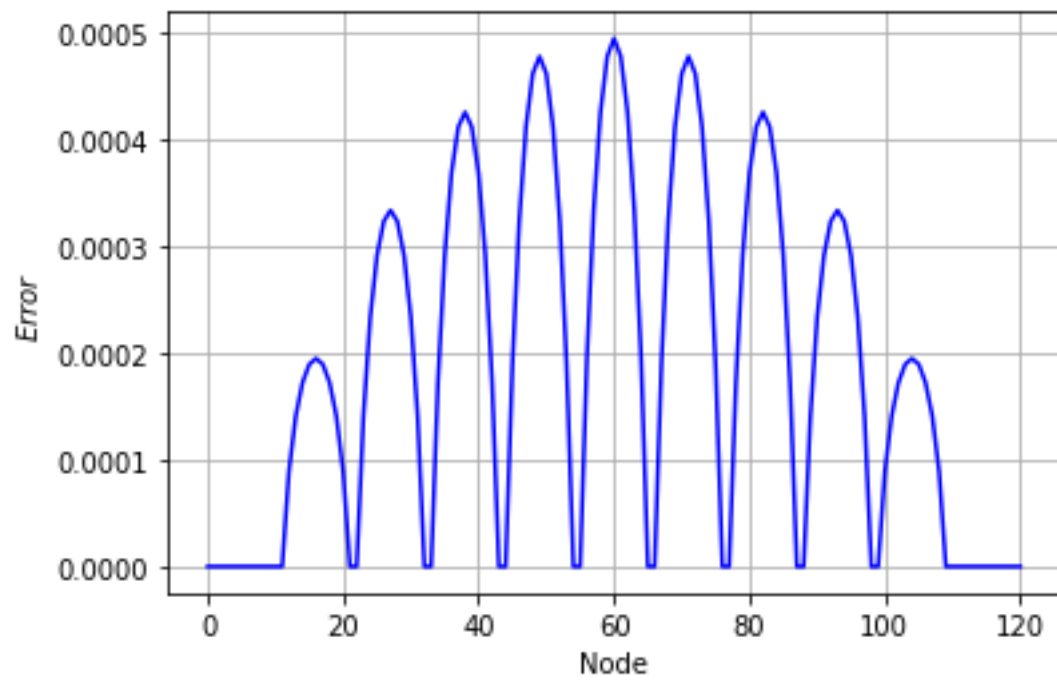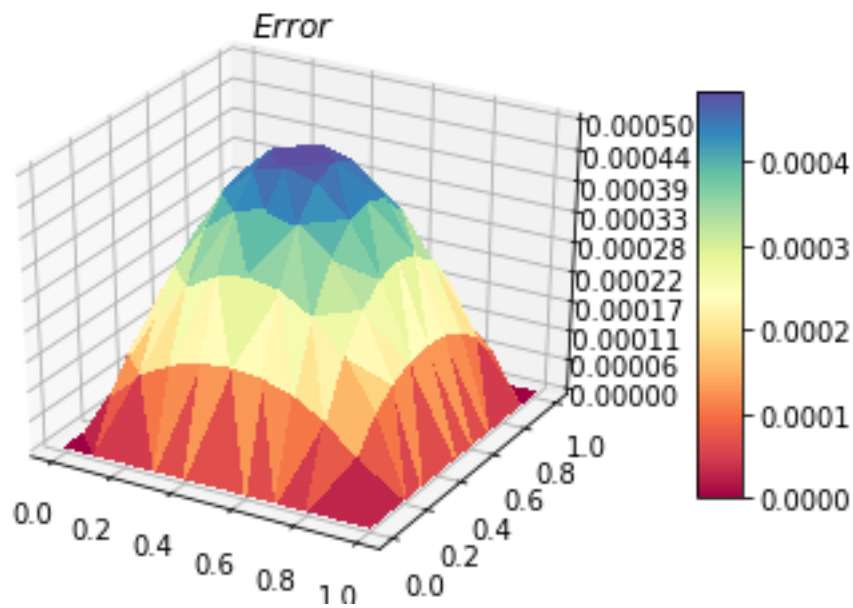
The L2 error = 0.0003794744390722252

The H1 error = 0.014929279549913868

###

  >> Normal end of execution.

In [2]: