

Problem 0: Homework checklist

- ✓I didn't talk with any one about this homework.
- ✓Source-code are included at the end of this document.

Problem 1: Direct Methods for Tridiagonal Systems

Problem 1: Sparse Matrices in Matlab

1. Code:

```
1 N=4;
2 A = sparse((N-1)*(N-1), (N-1)*(N-1));
3
4 for i=1:(N-1)*(N-1)
5     A(i,i) = -4;
6
7     col = mod(i,N-1)
8     if col==0
9         col = N-1;
10    end
11    row = ceil(i/(N-1))
12    if row-1>1
13        A(i, (row-2)*(N-1) + col) = 1; % UP
14    end
15    if row+1 <=N-1
16        A(i, (row)*(N-1) + col) = 1; % DOWN
17    end
18    if col-1>1
19        A(i, (row-1)*(N-1) + col-1) = 1; % LEFT
20    end
21    if col+1<=N-1
22        A(i, (row-1)*(N-1) + col+1) = 1; % RIGHT
23    end
24 end
```

2. Code:

```
1 N=4;
2 nz = (N-1)^2 + 4*(N-1)*(N-2);
3 I = zeros(nz,1);
4 J = zeros(nz,1);
5 V = zeros(nz,1);
6
7 index = 1;
8 for i=1:(N-1)*(N-1)
9     I(index) = i;
10    J(index) = i;
11    V(index) = -4;
12    index = index+1;
13
14    col = mod(i,N-1);
15    if col==0
16        col = N-1;
17    end
18    row = ceil(i/(N-1));
```

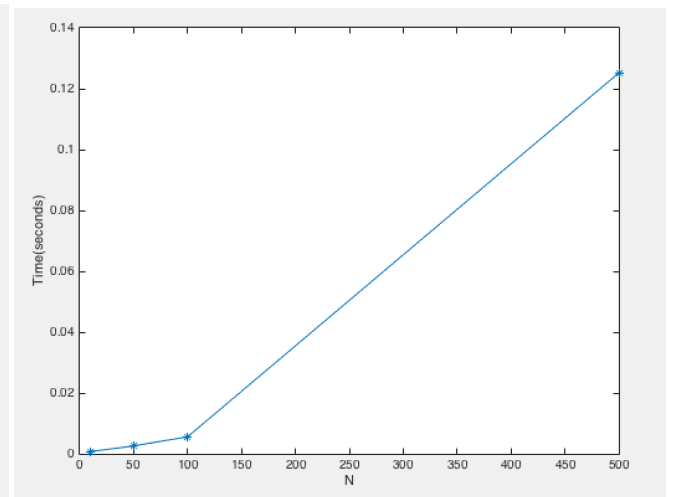
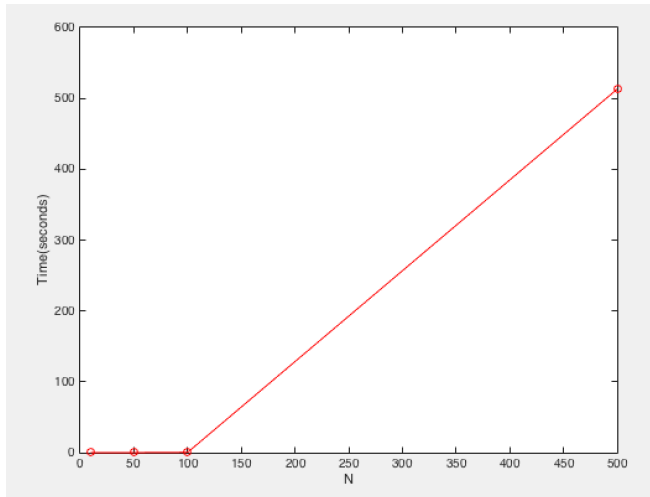
Table 1: My caption

N	Method_1	Method2
10	0.0086	0.0004
50	0.0438	0.0022
100	0.3845	0.0060
500	513.0644	0.1364

```

19     if row-1>1
20         % UP
21         I(index) = i;
22         J(index) = (row-2)*(N-1) + col;
23         V(index) = 1;
24         index = index+1;
25     end
26     if row+1 <=N-1
27         % DOWN
28         I(index) = i;
29         J(index) = (row)*(N-1) + col;
30         V(index) = 1;
31         index = index+1;
32     end
33     if col-1>1
34         % LEFT
35         I(index) = i;
36         J(index) = (row-1)*(N-1) + col-1;
37         V(index) = 1;
38         index = index+1;
39     end
40     if col+1<=N-1
41         % RIGHT
42         I(index) = i;
43         J(index) = (row-1)*(N-1) + col+1;
44         V(index) = 1;
45         index = index+1;
46     end
47 end
48
49 A = sparse(I,J,V,(N-1)*(N-1),(N-1)*(N-1));

```



- 3.
- 4.
5. Code:

Table 2: My caption

N	Iteration
10	258
50	
100	
500	

```

1  function U= jacobian(A, b)
2  [N,t] = size(b);
3  U = zeros(N,1) ;
4  size(A)
5  size(b)
6  true = A\b;
7  diff = 100;
8  iter = 0 ;
9  while diff > 1.0e-4
10     temp = U;
11     for i=1:N
12         sum = 0;
13         for j=1:N
14             if i≠j
15                 sum = sum + A(i,j)*temp(j);
16             end
17         end
18         U(i) = 1/A(i,i)*(b(i)-sum);
19     end
20     diff = norm(U- true) ;
21     iter = iter + 1 ;
22 end
23
24 end

```

6. For $f(x,y) = 1$:

For $f(x,y) = -1$:

For $f(x,y) = -(x - 0.5)^2 - (y - 0.5)^2$:

For $f(x,y) = \sin(100x)\cos(100y)$: