PURDUE UNIVERSITY · CS 51500
MATRIX COMPUTATIONS

HOMEWORK
*Jun Cheng*
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## 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:

1. Function backsolve.m

```
function x = backsolve(A, b)
    % Assume matrix A is n by n upper triangular matrix;
    % Vector b is n by 1.
    n = length(b) ;          %% Get the length of the vector b
    x = zeros(n,1);          %% initiate solution Xl
    x(n) = b(n)/A(n,n);      %% For the base case, x(n) = ...
        b(n)/A(n,n);
    for i=n-1:-1:1
        temp = 0;
        for j = i:n
            temp = temp + A(i, j)*x(j);    %% Accumulate all ...
                the other terms
        end
        x(i) = (b(i)-temp)/A(i,i);    %%  solve X(i)
    end
end
```

Function forwardsolve.m:

```
function x = forwardsolve(A, b)
    % Assume matrix A is n by n upper triangular matrix;
    % Vector b is n by 1.
    n = length(b) ;          %% Get the length of the vector b
    x = zeros(n,1);          %% Initiate solution Xl
    x(1) = b(1)/A(1,1);      %% For the base case, x(1) = ...
        b(1)/A(1,1);
    for i=2:n
        temp = 0;
        for j = 1:i
            temp = temp + A(i, j)*x(j); %% Accumulate all ...
                the other terms
        end
        x(i) = (b(i)-temp)/A(i,i);  %%  solve X(i)
    end
end
```

2. I set $n = 1000$ and repeat the procedure for 100 times. The time elapses for Matlab backslash method is around 3.210974 seconds. My backsolve method will spend around 4.733596 seconds. Matlab backslash has better performance than mine.

   For the accuaracy:

$$\frac{\|X_{matlab} - X_{mine}\|}{\|X_{matlab}\|} = 7.2165e - 16 \tag{1}$$

3.