Table of Contents

3a)

```
N = [8 9 10 11 12];
% Calculating A,b and condition number for N = 8
hilbM8 = hilb(8);
b8 = sum(hilbM8,2);
cond_num(1) = cond(hilbM8);

% Calculating A,b and condition number for N = 9
hilbM9 = hilb(9);
b9 = sum(hilbM9,2);
cond_num(2) = cond(hilbM9);

% Calculating A,b and condition number for N = 10
hilbM10 = hilb(10);
b10 = sum(hilbM10,2);
cond_num(3) = cond(hilbM10);

% Calculating A,b and condition number for N = 11
hilbM11 = hilb(11);
b11 = sum(hilbM11,2);
cond_num(4) = cond(hilbM11);

% Calculating A,b and condition number for N = 12
hilbM12 = hilb(12);
b12 = sum(hilbM12,2);
cond_num(5) = cond(hilbM12);

% Tabulating the calculated values
T1 = table;
T1.N = N';
T1.Conditional_Number = cond_num'
```

T1 =

N	Conditional_Number
8.00000000000000e+00	1.52575755666280e+10
9.00000000000000e+00	4.93153404551012e+11
1.00000000000000e+01	1.60250281681132e+13
1.10000000000000e+01	5.22020733204515e+14
1.20000000000000e+01	1.62116390474750e+16

3d

Using blackslash operator for the linear solve

```
format long e
%For N = 8
X8 = hilbM8\b8

%For N = 9
X9 = hilbM9\b9

%For N = 10
X10 = hilbM10\b10

%For N = 11
X11 = hilbM11\b11

%For N = 12
X12 = hilbM12\b12
```

```
X8 =

     1.000000000007887e+00
     9.999999996257741e-01
     1.000000004419112e+00
     9.999999780253649e-01
     1.000000055026897e+00
     9.999999268851272e-01
     1.000000049236258e+00
     9.999999867722260e-01


X9 =

     9.999999995904920e-01
     1.000000028193115e+00
     9.999995233705710e-01
     1.000003400560367e+00
     9.999875302409305e-01
     1.000025458990295e+00
     9.999707608437256e-01
     1.000017662428185e+00
     9.999956354941144e-01


X10 =

     1.000000000500572e+00
     9.999999550889661e-01
     1.000000983331519e+00
     9.999908694955801e-01
```

```
    1.000044286525340e+00
    9.998765881458510e-01
    1.000204778517930e+00
    9.998002151022510e-01
    1.000105740566398e+00
    9.999765822757334e-01


X11 =

    9.999999972495801e-01
    1.000000293664734e+00
    9.999922436539485e-01
    1.000088119806983e+00
    9.994675223535791e-01
    1.001895823247601e+00
    9.958257781103617e-01
    1.005747608766034e+00
    9.951830040145673e-01
    1.002246625533805e+00
    9.995529813712234e-01


X12 =

    9.999999761812168e-01
    1.000003015336616e+00
    9.999051601195813e-01
    1.001293139945377e+00
    9.905104370156915e-01
    1.041742893131150e+00
    8.835566785150567e-01
    1.211020926052178e+00
    7.523304821185070e-01
    1.181578509467286e+00
    9.244305007071151e-01
    1.013628298113950e+00
```

3f)

Initializing the true value for X

```
X_t8 = ones(8,1);
X_t9 = ones(9,1);
X_t10 = ones(10,1);
X_t11 = ones(11,1);
X_t12 = ones(12,1);

N =[8 9 10 11 12];

% Finding the relative error for different value of N
relative_error(1) = norm(X_t8-X8,2)/norm(X_t8,2);
```

```
relative_error(2) = norm(X_t9-X9,2)/norm(X_t9,2);
relative_error(3) = norm(X_t10-X10,2)/norm(X_t10,2);
relative_error(4) = norm(X_t11-X11,2)/norm(X_t11,2);
relative_error(5) = norm(X_t12-X12,2)/norm(X_t12,2);

% Finding relative residual for different value of N
residual(1) = norm(b8-(hilbM8*X8),2)/norm(b8,2);
residual(2) = norm(b9-(hilbM9*X9),2)/norm(b9,2);
residual(3) = norm(b10-(hilbM10*X10),2)/norm(b10,2);
residual(4) = norm(b11-(hilbM11*X11),2)/norm(b11,2);
residual(5) = norm(b12-(hilbM12*X12),2)/norm(b12,2);

% Tabulating the calculted values
T2 = table;
T2.Error = relative_error';
T2.Residual = residual'
```

T2 =

Error	Residual
3.78739363225416e-08	1.03694946275004e-16
1.49122820378786e-05	1.64098634880787e-16
1.05287141240815e-04	1.10564447573724e-16
2.74350871490302e-03	9.99171092492730e-17
1.15517136325613e-01	1.47453616047910e-16

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