Numerical Analysis
homework 11: Diode Networks

Due on Tuesday, May 16, 2017

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1 Introduction

To calculate the current of a diode, the formula is:

$$i_d = I_s(e^{\frac{v_d}{\phi}} - 1) \tag{1}$$

$$\phi = \frac{\phi_0 T}{300} \tag{2}$$

where I_s is 1 Amps, ϕ_0 is 0.026 Volts and v_d is the cross-voltage of diode.
In this homework, we will build a Non-linear System to analyze the following diode network.

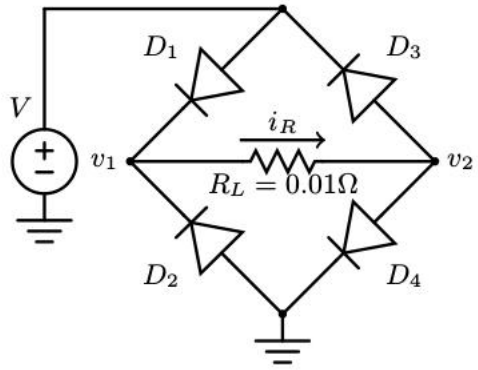

Figure 1: Simple Diode Network

To build a robust function to solve any non-linear system, I use **Finite Difference Approximation** to calculate Jacobian matrix

$$\frac{\partial F}{\partial x} = \frac{F(x+h) - F(x)}{h} \tag{3}$$

1.1 Problems

In this homework, we need to solve two problems:

1. With temperature fixed at 300k, find $v1$, $v2$, i_{D1} , i_{D2}, i_{D3}, i_{D4} and i_R when V = -1.0, -0.98,....., 1 Volt.

2. With initial tamperature is 300k and $v1$, $v2$ are 0 Volt. Find $v1$, $v2$, i_{D1} , i_{D2}, i_{D3}, i_{D4}, i_R, T_{D1}, T_{D2}, T_{D3}, T_{D4} when V = -1.0, -0.99,....., 1 Volt. And the temperature will increase with this formula:

$$T_d = 300 + 2 * i_d * v_d \tag{4}$$

Because Newton Method is sensitive to the initial guess, so we can start solve the system at V = 0 and then solve V = 0.02 which inital guess is the result from V = 0 and so on.

2 Implementation

Algorithm 1 Cyclic Jacobian Updates

Given initial guess x0 and tol
k = 0
while error > tol **do**
  evaluate $F(x0)$
  if k % p == 0 **then**
    calculate Jacobian matrix
  end if
  $J_F(x0)\delta x = -F(x0)$
  $x0 = x0 + \delta x$
  k++
  error = $\|F(x0)\|$
end while

3 Discussion

4 Appendix

Table 1: Problem 1 result

V	v1	v2	Id1	Id2	Id3	Id4	Ir
0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.02	1.053E-02	9.469E-03	4.393E-01	-3.331E-01	-3.331E-01	4.393E-01	1.063E-01
0.04	2.209E-02	1.791E-02	9.912E-01	-5.725E-01	-5.725E-01	9.912E-01	4.187E-01
0.06	3.460E-02	2.540E-02	1.656E+00	-7.357E-01	-7.357E-01	1.656E+00	9.203E-01
0.08	4.795E-02	3.205E-02	2.431E+00	-8.418E-01	-8.418E-01	2.431E+00	1.589E+00
0.1	6.201E-02	3.799E-02	3.310E+00	-9.079E-01	-9.079E-01	3.310E+00	2.403E+00
0.12	7.670E-02	4.330E-02	4.288E+00	-9.477E-01	-9.477E-01	4.288E+00	3.340E+00
0.14	9.192E-02	4.808E-02	5.355E+00	-9.709E-01	-9.709E-01	5.355E+00	4.384E+00
0.16	1.076E-01	5.240E-02	6.504E+00	-9.841E-01	-9.841E-01	6.504E+00	5.520E+00
0.18	1.237E-01	5.633E-02	7.726E+00	-9.914E-01	-9.914E-01	7.726E+00	6.735E+00
0.2	1.401E-01	5.990E-02	9.014E+00	-9.954E-01	-9.954E-01	9.014E+00	8.019E+00
0.22	1.568E-01	6.318E-02	1.036E+01	-9.976E-01	-9.976E-01	1.036E+01	9.363E+00
0.24	1.738E-01	6.620E-02	1.176E+01	-9.987E-01	-9.987E-01	1.176E+01	1.076E+01
0.26	1.910E-01	6.899E-02	1.320E+01	-9.994E-01	-9.994E-01	1.320E+01	1.220E+01
0.28	2.084E-01	7.157E-02	1.469E+01	-9.997E-01	-9.997E-01	1.469E+01	1.369E+01
0.3	2.260E-01	7.397E-02	1.620E+01	-9.998E-01	-9.998E-01	1.620E+01	1.521E+01
0.32	2.438E-01	7.622E-02	1.776E+01	-9.999E-01	-9.999E-01	1.776E+01	1.676E+01
0.34	2.617E-01	7.832E-02	1.934E+01	-1.000E+00	-1.000E+00	1.934E+01	1.834E+01
0.36	2.797E-01	8.030E-02	2.094E+01	-1.000E+00	-1.000E+00	2.094E+01	1.994E+01
0.38	2.978E-01	8.216E-02	2.257E+01	-1.000E+00	-1.000E+00	2.257E+01	2.157E+01
0.4	3.161E-01	8.392E-02	2.422E+01	-1.000E+00	-1.000E+00	2.422E+01	2.322E+01
0.42	3.344E-01	8.558E-02	2.588E+01	-1.000E+00	-1.000E+00	2.588E+01	2.488E+01
0.44	3.528E-01	8.716E-02	2.757E+01	-1.000E+00	-1.000E+00	2.757E+01	2.657E+01

0.46	3.713E-01	8.866E-02	2.927E+01	-1.000E+00	-1.000E+00	2.927E+01	2.827E+01
0.48	3.899E-01	9.009E-02	3.098E+01	-1.000E+00	-1.000E+00	3.098E+01	2.998E+01
0.5	4.085E-01	9.146E-02	3.271E+01	-1.000E+00	-1.000E+00	3.271E+01	3.171E+01
0.52	4.272E-01	9.277E-02	3.445E+01	-1.000E+00	-1.000E+00	3.445E+01	3.345E+01
0.54	4.460E-01	9.402E-02	3.620E+01	-1.000E+00	-1.000E+00	3.620E+01	3.520E+01
0.56	4.648E-01	9.522E-02	3.796E+01	-1.000E+00	-1.000E+00	3.796E+01	3.696E+01
0.58	4.836E-01	9.638E-02	3.972E+01	-1.000E+00	-1.000E+00	3.972E+01	3.872E+01
0.6	5.025E-01	9.749E-02	4.150E+01	-1.000E+00	-1.000E+00	4.150E+01	4.050E+01
0.62	5.214E-01	9.856E-02	4.329E+01	-1.000E+00	-1.000E+00	4.329E+01	4.229E+01
0.64	5.404E-01	9.959E-02	4.508E+01	-1.000E+00	-1.000E+00	4.508E+01	4.408E+01
0.66	5.594E-01	1.006E-01	4.688E+01	-1.000E+00	-1.000E+00	4.688E+01	4.588E+01
0.68	5.784E-01	1.016E-01	4.869E+01	-1.000E+00	-1.000E+00	4.869E+01	4.769E+01
0.7	5.975E-01	1.025E-01	5.050E+01	-1.000E+00	-1.000E+00	5.050E+01	4.950E+01
0.72	6.166E-01	1.034E-01	5.232E+01	-1.000E+00	-1.000E+00	5.232E+01	5.132E+01
0.74	6.357E-01	1.043E-01	5.415E+01	-1.000E+00	-1.000E+00	5.415E+01	5.315E+01
0.76	6.549E-01	1.051E-01	5.598E+01	-1.000E+00	-1.000E+00	5.598E+01	5.498E+01
0.78	6.741E-01	1.059E-01	5.781E+01	-1.000E+00	-1.000E+00	5.781E+01	5.681E+01
0.8	6.933E-01	1.067E-01	5.965E+01	-1.000E+00	-1.000E+00	5.965E+01	5.865E+01
0.82	7.125E-01	1.075E-01	6.150E+01	-1.000E+00	-1.000E+00	6.150E+01	6.050E+01
0.84	7.317E-01	1.083E-01	6.335E+01	-1.000E+00	-1.000E+00	6.335E+01	6.235E+01
0.86	7.510E-01	1.090E-01	6.520E+01	-1.000E+00	-1.000E+00	6.520E+01	6.420E+01
0.88	7.703E-01	1.097E-01	6.705E+01	-1.000E+00	-1.000E+00	6.705E+01	6.605E+01
0.9	7.896E-01	1.104E-01	6.891E+01	-1.000E+00	-1.000E+00	6.891E+01	6.791E+01
0.92	8.089E-01	1.111E-01	7.078E+01	-1.000E+00	-1.000E+00	7.078E+01	6.978E+01
0.94	8.282E-01	1.118E-01	7.264E+01	-1.000E+00	-1.000E+00	7.264E+01	7.164E+01
0.96	8.476E-01	1.124E-01	7.451E+01	-1.000E+00	-1.000E+00	7.451E+01	7.351E+01
0.98	8.669E-01	1.131E-01	7.639E+01	-1.000E+00	-1.000E+00	7.639E+01	7.539E+01
1	8.863E-01	1.137E-01	7.826E+01	-1.000E+00	-1.000E+00	7.826E+01	7.726E+01
0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
-0.02	-9.469E-03	-1.053E-02	-3.331E-01	4.393E-01	4.393E-01	-3.331E-01	1.063E-01
-0.04	-1.791E-02	-2.209E-02	-5.725E-01	9.912E-01	9.912E-01	-5.725E-01	4.187E-01
-0.06	-2.540E-02	-3.460E-02	-7.357E-01	1.656E+00	1.656E+00	-7.357E-01	9.203E-01
-0.08	-3.205E-02	-4.795E-02	-8.418E-01	2.431E+00	2.431E+00	-8.418E-01	1.589E+00
-0.1	-3.799E-02	-6.201E-02	-9.079E-01	3.310E+00	3.310E+00	-9.079E-01	2.403E+00
-0.12	-4.330E-02	-7.670E-02	-9.477E-01	4.288E+00	4.288E+00	-9.477E-01	3.340E+00
-0.14	-4.808E-02	-9.192E-02	-9.709E-01	5.355E+00	5.355E+00	-9.709E-01	4.384E+00
-0.16	-5.240E-02	-1.076E-01	-9.841E-01	6.504E+00	6.504E+00	-9.841E-01	5.520E+00
-0.18	-5.633E-02	-1.237E-01	-9.914E-01	7.726E+00	7.726E+00	-9.914E-01	6.735E+00
-0.2	-5.990E-02	-1.401E-01	-9.954E-01	9.014E+00	9.014E+00	-9.954E-01	8.019E+00
-0.22	-6.318E-02	-1.568E-01	-9.976E-01	1.036E+01	1.036E+01	-9.976E-01	9.363E+00
-0.24	-6.620E-02	-1.738E-01	-9.987E-01	1.176E+01	1.176E+01	-9.987E-01	1.076E+01
-0.26	-6.899E-02	-1.910E-01	-9.994E-01	1.320E+01	1.320E+01	-9.994E-01	1.220E+01
-0.28	-7.157E-02	-2.084E-01	-9.997E-01	1.469E+01	1.469E+01	-9.997E-01	1.369E+01
-0.3	-7.397E-02	-2.260E-01	-9.998E-01	1.620E+01	1.620E+01	-9.998E-01	1.521E+01
-0.32	-7.622E-02	-2.438E-01	-9.999E-01	1.776E+01	1.776E+01	-9.999E-01	1.676E+01
-0.34	-7.832E-02	-2.617E-01	-1.000E+00	1.934E+01	1.934E+01	-1.000E+00	1.834E+01
-0.36	-8.030E-02	-2.797E-01	-1.000E+00	2.094E+01	2.094E+01	-1.000E+00	1.994E+01

-0.38	-8.216E-02	-2.978E-01	-1.000E+00	2.257E+01	2.257E+01	-1.000E+00	2.157E+01
-0.4	-8.392E-02	-3.161E-01	-1.000E+00	2.422E+01	2.422E+01	-1.000E+00	2.322E+01
-0.42	-8.558E-02	-3.344E-01	-1.000E+00	2.588E+01	2.588E+01	-1.000E+00	2.488E+01
-0.44	-8.716E-02	-3.528E-01	-1.000E+00	2.757E+01	2.757E+01	-1.000E+00	2.657E+01
-0.46	-8.866E-02	-3.713E-01	-1.000E+00	2.927E+01	2.927E+01	-1.000E+00	2.827E+01
-0.48	-9.009E-02	-3.899E-01	-1.000E+00	3.098E+01	3.098E+01	-1.000E+00	2.998E+01
-0.5	-9.146E-02	-4.085E-01	-1.000E+00	3.271E+01	3.271E+01	-1.000E+00	3.171E+01
-0.52	-9.277E-02	-4.272E-01	-1.000E+00	3.445E+01	3.445E+01	-1.000E+00	3.345E+01
-0.54	-9.402E-02	-4.460E-01	-1.000E+00	3.620E+01	3.620E+01	-1.000E+00	3.520E+01
-0.56	-9.522E-02	-4.648E-01	-1.000E+00	3.796E+01	3.796E+01	-1.000E+00	3.696E+01
-0.58	-9.638E-02	-4.836E-01	-1.000E+00	3.972E+01	3.972E+01	-1.000E+00	3.872E+01
-0.6	-9.749E-02	-5.025E-01	-1.000E+00	4.150E+01	4.150E+01	-1.000E+00	4.050E+01
-0.62	-9.856E-02	-5.214E-01	-1.000E+00	4.329E+01	4.329E+01	-1.000E+00	4.229E+01
-0.64	-9.959E-02	-5.404E-01	-1.000E+00	4.508E+01	4.508E+01	-1.000E+00	4.408E+01
-0.66	-1.006E-01	-5.594E-01	-1.000E+00	4.688E+01	4.688E+01	-1.000E+00	4.588E+01
-0.68	-1.016E-01	-5.784E-01	-1.000E+00	4.869E+01	4.869E+01	-1.000E+00	4.769E+01
-0.7	-1.025E-01	-5.975E-01	-1.000E+00	5.050E+01	5.050E+01	-1.000E+00	4.950E+01
-0.72	-1.034E-01	-6.166E-01	-1.000E+00	5.232E+01	5.232E+01	-1.000E+00	5.132E+01
-0.74	-1.043E-01	-6.357E-01	-1.000E+00	5.415E+01	5.415E+01	-1.000E+00	5.315E+01
-0.76	-1.051E-01	-6.549E-01	-1.000E+00	5.598E+01	5.598E+01	-1.000E+00	5.498E+01
-0.78	-1.059E-01	-6.741E-01	-1.000E+00	5.781E+01	5.781E+01	-1.000E+00	5.681E+01
-0.8	-1.067E-01	-6.933E-01	-1.000E+00	5.965E+01	5.965E+01	-1.000E+00	5.865E+01
-0.82	-1.075E-01	-7.125E-01	-1.000E+00	6.150E+01	6.150E+01	-1.000E+00	6.050E+01
-0.84	-1.083E-01	-7.317E-01	-1.000E+00	6.335E+01	6.335E+01	-1.000E+00	6.235E+01
-0.86	-1.090E-01	-7.510E-01	-1.000E+00	6.520E+01	6.520E+01	-1.000E+00	6.420E+01
-0.88	-1.097E-01	-7.703E-01	-1.000E+00	6.705E+01	6.705E+01	-1.000E+00	6.605E+01
-0.9	-1.104E-01	-7.896E-01	-1.000E+00	6.891E+01	6.891E+01	-1.000E+00	6.791E+01
-0.92	-1.111E-01	-8.089E-01	-1.000E+00	7.078E+01	7.078E+01	-1.000E+00	6.978E+01
-0.94	-1.118E-01	-8.282E-01	-1.000E+00	7.264E+01	7.264E+01	-1.000E+00	7.164E+01
-0.96	-1.124E-01	-8.476E-01	-1.000E+00	7.451E+01	7.451E+01	-1.000E+00	7.351E+01
-0.98	-1.131E-01	-8.669E-01	-1.000E+00	7.639E+01	7.639E+01	-1.000E+00	7.539E+01
-1	-1.137E-01	-8.863E-01	-1.000E+00	7.826E+01	7.826E+01	-1.000E+00	7.726E+01

Table 2: Problem 2 result(voltage and current)

V	v1	v2	Id1	Id2	Id3	Id4	Ir
0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
0.01	5.133E-03	4.867E-03	2.058E-01	-1.792E-01	-1.792E-01	2.058E-01	2.667E-02
0.02	1.053E-02	9.469E-03	4.393E-01	-3.331E-01	-3.331E-01	4.393E-01	1.063E-01
0.03	1.619E-02	1.381E-02	7.010E-01	-4.634E-01	-4.634E-01	7.010E-01	2.375E-01
0.04	2.209E-02	1.791E-02	9.910E-01	-5.724E-01	-5.724E-01	9.910E-01	4.186E-01
0.05	2.823E-02	2.177E-02	1.309E+00	-6.624E-01	-6.624E-01	1.309E+00	6.470E-01
0.06	3.460E-02	2.540E-02	1.656E+00	-7.357E-01	-7.357E-01	1.656E+00	9.199E-01
0.07	4.117E-02	2.883E-02	2.029E+00	-7.947E-01	-7.947E-01	2.029E+00	1.235E+00
0.08	4.794E-02	3.206E-02	2.430E+00	-8.417E-01	-8.417E-01	2.430E+00	1.588E+00

0.09	5.489E-02	3.511E-02	2.856E+00	-8.788E-01	-8.788E-01	2.856E+00	1.977E+00
0.1	6.200E-02	3.800E-02	3.308E+00	-9.078E-01	-9.078E-01	3.308E+00	2.400E+00
0.11	6.927E-02	4.073E-02	3.783E+00	-9.303E-01	-9.303E-01	3.783E+00	2.853E+00
0.12	7.667E-02	4.333E-02	4.282E+00	-9.475E-01	-9.475E-01	4.282E+00	3.335E+00
0.13	8.421E-02	4.579E-02	4.803E+00	-9.607E-01	-9.607E-01	4.803E+00	3.843E+00
0.14	9.188E-02	4.812E-02	5.346E+00	-9.707E-01	-9.707E-01	5.346E+00	4.375E+00
0.15	9.965E-02	5.035E-02	5.908E+00	-9.783E-01	-9.783E-01	5.908E+00	4.930E+00
0.16	1.075E-01	5.247E-02	6.490E+00	-9.840E-01	-9.840E-01	6.490E+00	5.506E+00
0.17	1.155E-01	5.449E-02	7.089E+00	-9.882E-01	-9.882E-01	7.089E+00	6.101E+00
0.18	1.236E-01	5.643E-02	7.706E+00	-9.913E-01	-9.913E-01	7.706E+00	6.715E+00
0.19	1.317E-01	5.828E-02	8.338E+00	-9.937E-01	-9.937E-01	8.338E+00	7.345E+00
0.2	1.400E-01	6.005E-02	8.986E+00	-9.954E-01	-9.954E-01	8.986E+00	7.991E+00
0.21	1.483E-01	6.174E-02	9.648E+00	-9.966E-01	-9.966E-01	9.648E+00	8.651E+00
0.22	1.566E-01	6.337E-02	1.032E+01	-9.976E-01	-9.976E-01	1.032E+01	9.325E+00
0.23	1.651E-01	6.494E-02	1.101E+01	-9.982E-01	-9.982E-01	1.101E+01	1.001E+01
0.24	1.736E-01	6.644E-02	1.171E+01	-9.987E-01	-9.987E-01	1.171E+01	1.071E+01
0.25	1.821E-01	6.790E-02	1.242E+01	-9.991E-01	-9.991E-01	1.242E+01	1.142E+01
0.26	1.907E-01	6.929E-02	1.314E+01	-9.993E-01	-9.993E-01	1.314E+01	1.214E+01
0.27	1.994E-01	7.064E-02	1.387E+01	-9.995E-01	-9.995E-01	1.387E+01	1.287E+01
0.28	2.081E-01	7.195E-02	1.461E+01	-9.997E-01	-9.997E-01	1.461E+01	1.361E+01
0.29	2.168E-01	7.321E-02	1.536E+01	-9.998E-01	-9.998E-01	1.536E+01	1.436E+01
0.3	2.256E-01	7.443E-02	1.611E+01	-9.998E-01	-9.998E-01	1.611E+01	1.511E+01
0.31	2.344E-01	7.561E-02	1.688E+01	-9.999E-01	-9.999E-01	1.688E+01	1.588E+01
0.32	2.432E-01	7.676E-02	1.765E+01	-9.999E-01	-9.999E-01	1.765E+01	1.665E+01
0.33	2.521E-01	7.787E-02	1.843E+01	-9.999E-01	-9.999E-01	1.843E+01	1.743E+01
0.34	2.610E-01	7.895E-02	1.921E+01	-1.000E+00	-1.000E+00	1.921E+01	1.821E+01
0.35	2.700E-01	8.000E-02	2.000E+01	-1.000E+00	-1.000E+00	2.000E+01	1.900E+01
0.36	2.790E-01	8.102E-02	2.080E+01	-1.000E+00	-1.000E+00	2.080E+01	1.980E+01
0.37	2.880E-01	8.202E-02	2.160E+01	-1.000E+00	-1.000E+00	2.160E+01	2.060E+01
0.38	2.970E-01	8.299E-02	2.240E+01	-1.000E+00	-1.000E+00	2.240E+01	2.140E+01
0.39	3.061E-01	8.394E-02	2.321E+01	-1.000E+00	-1.000E+00	2.321E+01	2.221E+01
0.4	3.151E-01	8.486E-02	2.403E+01	-1.000E+00	-1.000E+00	2.403E+01	2.303E+01
0.41	3.242E-01	8.576E-02	2.485E+01	-1.000E+00	-1.000E+00	2.485E+01	2.385E+01
0.42	3.334E-01	8.664E-02	2.567E+01	-1.000E+00	-1.000E+00	2.567E+01	2.467E+01
0.43	3.425E-01	8.750E-02	2.650E+01	-1.000E+00	-1.000E+00	2.650E+01	2.550E+01
0.44	3.517E-01	8.834E-02	2.733E+01	-1.000E+00	-1.000E+00	2.733E+01	2.633E+01
0.45	3.608E-01	8.917E-02	2.817E+01	-1.000E+00	-1.000E+00	2.817E+01	2.717E+01
0.46	3.700E-01	8.997E-02	2.901E+01	-1.000E+00	-1.000E+00	2.901E+01	2.801E+01
0.47	3.792E-01	9.077E-02	2.985E+01	-1.000E+00	-1.000E+00	2.985E+01	2.885E+01
0.48	3.885E-01	9.154E-02	3.069E+01	-1.000E+00	-1.000E+00	3.069E+01	2.969E+01
0.49	3.977E-01	9.230E-02	3.154E+01	-1.000E+00	-1.000E+00	3.154E+01	3.054E+01
0.5	4.070E-01	9.305E-02	3.239E+01	-1.000E+00	-1.000E+00	3.239E+01	3.139E+01
0.51	4.162E-01	9.378E-02	3.324E+01	-1.000E+00	-1.000E+00	3.324E+01	3.224E+01
0.52	4.255E-01	9.450E-02	3.410E+01	-1.000E+00	-1.000E+00	3.410E+01	3.310E+01
0.53	4.348E-01	9.521E-02	3.496E+01	-1.000E+00	-1.000E+00	3.496E+01	3.396E+01
0.54	4.441E-01	9.590E-02	3.582E+01	-1.000E+00	-1.000E+00	3.582E+01	3.482E+01
0.55	4.534E-01	9.659E-02	3.668E+01	-1.000E+00	-1.000E+00	3.668E+01	3.568E+01

0.56	4.627E-01	9.726E-02	3.755E+01	-1.000E+00	-1.000E+00	3.755E+01	3.655E+01
0.57	4.721E-01	9.792E-02	3.842E+01	-1.000E+00	-1.000E+00	3.842E+01	3.742E+01
0.58	4.814E-01	9.858E-02	3.928E+01	-1.000E+00	-1.000E+00	3.928E+01	3.828E+01
0.59	4.908E-01	9.922E-02	4.016E+01	-1.000E+00	-1.000E+00	4.016E+01	3.916E+01
0.6	5.001E-01	9.985E-02	4.103E+01	-1.000E+00	-1.000E+00	4.103E+01	4.003E+01
0.61	5.095E-01	1.005E-01	4.190E+01	-1.000E+00	-1.000E+00	4.190E+01	4.090E+01
0.62	5.189E-01	1.011E-01	4.278E+01	-1.000E+00	-1.000E+00	4.278E+01	4.178E+01
0.63	5.283E-01	1.017E-01	4.366E+01	-1.000E+00	-1.000E+00	4.366E+01	4.266E+01
0.64	5.377E-01	1.023E-01	4.454E+01	-1.000E+00	-1.000E+00	4.454E+01	4.354E+01
0.65	5.471E-01	1.029E-01	4.542E+01	-1.000E+00	-1.000E+00	4.542E+01	4.442E+01
0.66	5.565E-01	1.035E-01	4.631E+01	-1.000E+00	-1.000E+00	4.631E+01	4.531E+01
0.67	5.659E-01	1.041E-01	4.719E+01	-1.000E+00	-1.000E+00	4.719E+01	4.619E+01
0.68	5.754E-01	1.046E-01	4.808E+01	-1.000E+00	-1.000E+00	4.808E+01	4.708E+01
0.69	5.848E-01	1.052E-01	4.896E+01	-1.000E+00	-1.000E+00	4.896E+01	4.796E+01
0.7	5.943E-01	1.057E-01	4.985E+01	-1.000E+00	-1.000E+00	4.985E+01	4.885E+01
0.71	6.037E-01	1.063E-01	5.074E+01	-1.000E+00	-1.000E+00	5.074E+01	4.974E+01
0.72	6.132E-01	1.068E-01	5.163E+01	-1.000E+00	-1.000E+00	5.163E+01	5.063E+01
0.73	6.226E-01	1.074E-01	5.253E+01	-1.000E+00	-1.000E+00	5.253E+01	5.153E+01
0.74	6.321E-01	1.079E-01	5.342E+01	-1.000E+00	-1.000E+00	5.342E+01	5.242E+01
0.75	6.416E-01	1.084E-01	5.431E+01	-1.000E+00	-1.000E+00	5.431E+01	5.331E+01
0.76	6.510E-01	1.090E-01	5.521E+01	-1.000E+00	-1.000E+00	5.521E+01	5.421E+01
0.77	6.605E-01	1.095E-01	5.611E+01	-1.000E+00	-1.000E+00	5.611E+01	5.511E+01
0.78	6.700E-01	1.100E-01	5.700E+01	-1.000E+00	-1.000E+00	5.700E+01	5.600E+01
0.79	6.795E-01	1.105E-01	5.790E+01	-1.000E+00	-1.000E+00	5.790E+01	5.690E+01
0.8	6.890E-01	1.110E-01	5.880E+01	-1.000E+00	-1.000E+00	5.880E+01	5.780E+01
0.81	6.985E-01	1.115E-01	5.970E+01	-1.000E+00	-1.000E+00	5.970E+01	5.870E+01
0.82	7.080E-01	1.120E-01	6.060E+01	-1.000E+00	-1.000E+00	6.060E+01	5.960E+01
0.83	7.175E-01	1.125E-01	6.151E+01	-1.000E+00	-1.000E+00	6.151E+01	6.051E+01
0.84	7.270E-01	1.130E-01	6.241E+01	-1.000E+00	-1.000E+00	6.241E+01	6.141E+01
0.85	7.366E-01	1.134E-01	6.331E+01	-1.000E+00	-1.000E+00	6.331E+01	6.231E+01
0.86	7.461E-01	1.139E-01	6.422E+01	-1.000E+00	-1.000E+00	6.422E+01	6.322E+01
0.87	7.556E-01	1.144E-01	6.512E+01	-1.000E+00	-1.000E+00	6.512E+01	6.412E+01
0.88	7.651E-01	1.149E-01	6.603E+01	-1.000E+00	-1.000E+00	6.603E+01	6.503E+01
0.89	7.747E-01	1.153E-01	6.693E+01	-1.000E+00	-1.000E+00	6.693E+01	6.593E+01
0.9	7.842E-01	1.158E-01	6.784E+01	-1.000E+00	-1.000E+00	6.784E+01	6.684E+01
0.91	7.938E-01	1.162E-01	6.875E+01	-1.000E+00	-1.000E+00	6.875E+01	6.775E+01
0.92	8.033E-01	1.167E-01	6.966E+01	-1.000E+00	-1.000E+00	6.966E+01	6.866E+01
0.93	8.128E-01	1.172E-01	7.057E+01	-1.000E+00	-1.000E+00	7.057E+01	6.957E+01
0.94	8.224E-01	1.176E-01	7.148E+01	-1.000E+00	-1.000E+00	7.148E+01	7.048E+01
0.95	8.319E-01	1.181E-01	7.239E+01	-1.000E+00	-1.000E+00	7.239E+01	7.139E+01
0.96	8.415E-01	1.185E-01	7.330E+01	-1.000E+00	-1.000E+00	7.330E+01	7.230E+01
0.97	8.511E-01	1.189E-01	7.421E+01	-1.000E+00	-1.000E+00	7.421E+01	7.321E+01
0.98	8.606E-01	1.194E-01	7.512E+01	-1.000E+00	-1.000E+00	7.512E+01	7.412E+01
0.99	8.702E-01	1.198E-01	7.604E+01	-1.000E+00	-1.000E+00	7.604E+01	7.504E+01
1	8.798E-01	1.202E-01	7.695E+01	-1.000E+00	-1.000E+00	7.695E+01	7.595E+01
0	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
-0.01	-4.867E-03	-5.133E-03	-1.792E-01	2.058E-01	2.058E-01	-1.792E-01	2.667E-02

-0.02	-9.469E-03	-1.053E-02	-3.331E-01	4.393E-01	4.393E-01	-3.331E-01	1.063E-01
-0.03	-1.381E-02	-1.619E-02	-4.634E-01	7.010E-01	7.010E-01	-4.634E-01	2.375E-01
-0.04	-1.791E-02	-2.209E-02	-5.724E-01	9.910E-01	9.910E-01	-5.724E-01	4.186E-01
-0.05	-2.177E-02	-2.823E-02	-6.624E-01	1.309E+00	1.309E+00	-6.624E-01	6.470E-01
-0.06	-2.540E-02	-3.460E-02	-7.357E-01	1.656E+00	1.656E+00	-7.357E-01	9.199E-01
-0.07	-2.883E-02	-4.117E-02	-7.947E-01	2.029E+00	2.029E+00	-7.947E-01	1.235E+00
-0.08	-3.206E-02	-4.794E-02	-8.417E-01	2.430E+00	2.430E+00	-8.417E-01	1.588E+00
-0.09	-3.511E-02	-5.489E-02	-8.788E-01	2.856E+00	2.856E+00	-8.788E-01	1.977E+00
-0.1	-3.800E-02	-6.200E-02	-9.078E-01	3.308E+00	3.308E+00	-9.078E-01	2.400E+00
-0.11	-4.073E-02	-6.927E-02	-9.303E-01	3.783E+00	3.783E+00	-9.303E-01	2.853E+00
-0.12	-4.333E-02	-7.667E-02	-9.475E-01	4.282E+00	4.282E+00	-9.475E-01	3.335E+00
-0.13	-4.579E-02	-8.421E-02	-9.607E-01	4.803E+00	4.803E+00	-9.607E-01	3.843E+00
-0.14	-4.812E-02	-9.188E-02	-9.707E-01	5.346E+00	5.346E+00	-9.707E-01	4.375E+00
-0.15	-5.035E-02	-9.965E-02	-9.783E-01	5.908E+00	5.908E+00	-9.783E-01	4.930E+00
-0.16	-5.247E-02	-1.075E-01	-9.840E-01	6.490E+00	6.490E+00	-9.840E-01	5.506E+00
-0.17	-5.449E-02	-1.155E-01	-9.882E-01	7.089E+00	7.089E+00	-9.882E-01	6.101E+00
-0.18	-5.643E-02	-1.236E-01	-9.913E-01	7.706E+00	7.706E+00	-9.913E-01	6.715E+00
-0.19	-5.828E-02	-1.317E-01	-9.937E-01	8.338E+00	8.338E+00	-9.937E-01	7.345E+00
-0.2	-6.005E-02	-1.400E-01	-9.954E-01	8.986E+00	8.986E+00	-9.954E-01	7.991E+00
-0.21	-6.174E-02	-1.483E-01	-9.966E-01	9.648E+00	9.648E+00	-9.966E-01	8.651E+00
-0.22	-6.337E-02	-1.566E-01	-9.976E-01	1.032E+01	1.032E+01	-9.976E-01	9.325E+00
-0.23	-6.494E-02	-1.651E-01	-9.982E-01	1.101E+01	1.101E+01	-9.982E-01	1.001E+01
-0.24	-6.644E-02	-1.736E-01	-9.987E-01	1.171E+01	1.171E+01	-9.987E-01	1.071E+01
-0.25	-6.790E-02	-1.821E-01	-9.991E-01	1.242E+01	1.242E+01	-9.991E-01	1.142E+01
-0.26	-6.929E-02	-1.907E-01	-9.993E-01	1.314E+01	1.314E+01	-9.993E-01	1.214E+01
-0.27	-7.064E-02	-1.994E-01	-9.995E-01	1.387E+01	1.387E+01	-9.995E-01	1.287E+01
-0.28	-7.195E-02	-2.081E-01	-9.997E-01	1.461E+01	1.461E+01	-9.997E-01	1.361E+01
-0.29	-7.321E-02	-2.168E-01	-9.998E-01	1.536E+01	1.536E+01	-9.998E-01	1.436E+01
-0.3	-7.443E-02	-2.256E-01	-9.998E-01	1.611E+01	1.611E+01	-9.998E-01	1.511E+01
-0.31	-7.561E-02	-2.344E-01	-9.999E-01	1.688E+01	1.688E+01	-9.999E-01	1.588E+01
-0.32	-7.676E-02	-2.432E-01	-9.999E-01	1.765E+01	1.765E+01	-9.999E-01	1.665E+01
-0.33	-7.787E-02	-2.521E-01	-9.999E-01	1.843E+01	1.843E+01	-9.999E-01	1.743E+01
-0.34	-7.895E-02	-2.610E-01	-1.000E+00	1.921E+01	1.921E+01	-1.000E+00	1.821E+01
-0.35	-8.000E-02	-2.700E-01	-1.000E+00	2.000E+01	2.000E+01	-1.000E+00	1.900E+01
-0.36	-8.102E-02	-2.790E-01	-1.000E+00	2.080E+01	2.080E+01	-1.000E+00	1.980E+01
-0.37	-8.202E-02	-2.880E-01	-1.000E+00	2.160E+01	2.160E+01	-1.000E+00	2.060E+01
-0.38	-8.299E-02	-2.970E-01	-1.000E+00	2.240E+01	2.240E+01	-1.000E+00	2.140E+01
-0.39	-8.394E-02	-3.061E-01	-1.000E+00	2.321E+01	2.321E+01	-1.000E+00	2.221E+01
-0.4	-8.486E-02	-3.151E-01	-1.000E+00	2.403E+01	2.403E+01	-1.000E+00	2.303E+01
-0.41	-8.576E-02	-3.242E-01	-1.000E+00	2.485E+01	2.485E+01	-1.000E+00	2.385E+01
-0.42	-8.664E-02	-3.334E-01	-1.000E+00	2.567E+01	2.567E+01	-1.000E+00	2.467E+01
-0.43	-8.750E-02	-3.425E-01	-1.000E+00	2.650E+01	2.650E+01	-1.000E+00	2.550E+01
-0.44	-8.834E-02	-3.517E-01	-1.000E+00	2.733E+01	2.733E+01	-1.000E+00	2.633E+01
-0.45	-8.917E-02	-3.608E-01	-1.000E+00	2.817E+01	2.817E+01	-1.000E+00	2.717E+01
-0.46	-8.997E-02	-3.700E-01	-1.000E+00	2.901E+01	2.901E+01	-1.000E+00	2.801E+01
-0.47	-9.077E-02	-3.792E-01	-1.000E+00	2.985E+01	2.985E+01	-1.000E+00	2.885E+01
-0.48	-9.154E-02	-3.885E-01	-1.000E+00	3.069E+01	3.069E+01	-1.000E+00	2.969E+01

-0.49	-9.230E-02	-3.977E-01	-1.000E+00	3.154E+01	3.154E+01	-1.000E+00	3.054E+01
-0.5	-9.305E-02	-4.070E-01	-1.000E+00	3.239E+01	3.239E+01	-1.000E+00	3.139E+01
-0.51	-9.378E-02	-4.162E-01	-1.000E+00	3.324E+01	3.324E+01	-1.000E+00	3.224E+01
-0.52	-9.450E-02	-4.255E-01	-1.000E+00	3.410E+01	3.410E+01	-1.000E+00	3.310E+01
-0.53	-9.521E-02	-4.348E-01	-1.000E+00	3.496E+01	3.496E+01	-1.000E+00	3.396E+01
-0.54	-9.590E-02	-4.441E-01	-1.000E+00	3.582E+01	3.582E+01	-1.000E+00	3.482E+01
-0.55	-9.659E-02	-4.534E-01	-1.000E+00	3.668E+01	3.668E+01	-1.000E+00	3.568E+01
-0.56	-9.726E-02	-4.627E-01	-1.000E+00	3.755E+01	3.755E+01	-1.000E+00	3.655E+01
-0.57	-9.792E-02	-4.721E-01	-1.000E+00	3.842E+01	3.842E+01	-1.000E+00	3.742E+01
-0.58	-9.858E-02	-4.814E-01	-1.000E+00	3.928E+01	3.928E+01	-1.000E+00	3.828E+01
-0.59	-9.922E-02	-4.908E-01	-1.000E+00	4.016E+01	4.016E+01	-1.000E+00	3.916E+01
-0.6	-9.985E-02	-5.001E-01	-1.000E+00	4.103E+01	4.103E+01	-1.000E+00	4.003E+01
-0.61	-1.005E-01	-5.095E-01	-1.000E+00	4.190E+01	4.190E+01	-1.000E+00	4.090E+01
-0.62	-1.011E-01	-5.189E-01	-1.000E+00	4.278E+01	4.278E+01	-1.000E+00	4.178E+01
-0.63	-1.017E-01	-5.283E-01	-1.000E+00	4.366E+01	4.366E+01	-1.000E+00	4.266E+01
-0.64	-1.023E-01	-5.377E-01	-1.000E+00	4.454E+01	4.454E+01	-1.000E+00	4.354E+01
-0.65	-1.029E-01	-5.471E-01	-1.000E+00	4.542E+01	4.542E+01	-1.000E+00	4.442E+01
-0.66	-1.035E-01	-5.565E-01	-1.000E+00	4.631E+01	4.631E+01	-1.000E+00	4.531E+01
-0.67	-1.041E-01	-5.659E-01	-1.000E+00	4.719E+01	4.719E+01	-1.000E+00	4.619E+01
-0.68	-1.046E-01	-5.754E-01	-1.000E+00	4.808E+01	4.808E+01	-1.000E+00	4.708E+01
-0.69	-1.052E-01	-5.848E-01	-1.000E+00	4.896E+01	4.896E+01	-1.000E+00	4.796E+01
-0.7	-1.057E-01	-5.943E-01	-1.000E+00	4.985E+01	4.985E+01	-1.000E+00	4.885E+01
-0.71	-1.063E-01	-6.037E-01	-1.000E+00	5.074E+01	5.074E+01	-1.000E+00	4.974E+01
-0.72	-1.068E-01	-6.132E-01	-1.000E+00	5.163E+01	5.163E+01	-1.000E+00	5.063E+01
-0.73	-1.074E-01	-6.226E-01	-1.000E+00	5.253E+01	5.253E+01	-1.000E+00	5.153E+01
-0.74	-1.079E-01	-6.321E-01	-1.000E+00	5.342E+01	5.342E+01	-1.000E+00	5.242E+01
-0.75	-1.084E-01	-6.416E-01	-1.000E+00	5.431E+01	5.431E+01	-1.000E+00	5.331E+01
-0.76	-1.090E-01	-6.510E-01	-1.000E+00	5.521E+01	5.521E+01	-1.000E+00	5.421E+01
-0.77	-1.095E-01	-6.605E-01	-1.000E+00	5.611E+01	5.611E+01	-1.000E+00	5.511E+01
-0.78	-1.100E-01	-6.700E-01	-1.000E+00	5.700E+01	5.700E+01	-1.000E+00	5.600E+01
-0.79	-1.105E-01	-6.795E-01	-1.000E+00	5.790E+01	5.790E+01	-1.000E+00	5.690E+01
-0.8	-1.110E-01	-6.890E-01	-1.000E+00	5.880E+01	5.880E+01	-1.000E+00	5.780E+01
-0.81	-1.115E-01	-6.985E-01	-1.000E+00	5.970E+01	5.970E+01	-1.000E+00	5.870E+01
-0.82	-1.120E-01	-7.080E-01	-1.000E+00	6.060E+01	6.060E+01	-1.000E+00	5.960E+01
-0.83	-1.125E-01	-7.175E-01	-1.000E+00	6.151E+01	6.151E+01	-1.000E+00	6.051E+01
-0.84	-1.130E-01	-7.270E-01	-1.000E+00	6.241E+01	6.241E+01	-1.000E+00	6.141E+01
-0.85	-1.134E-01	-7.366E-01	-1.000E+00	6.331E+01	6.331E+01	-1.000E+00	6.231E+01
-0.86	-1.139E-01	-7.461E-01	-1.000E+00	6.422E+01	6.422E+01	-1.000E+00	6.322E+01
-0.87	-1.144E-01	-7.556E-01	-1.000E+00	6.512E+01	6.512E+01	-1.000E+00	6.412E+01
-0.88	-1.149E-01	-7.651E-01	-1.000E+00	6.603E+01	6.603E+01	-1.000E+00	6.503E+01
-0.89	-1.153E-01	-7.747E-01	-1.000E+00	6.693E+01	6.693E+01	-1.000E+00	6.593E+01
-0.9	-1.158E-01	-7.842E-01	-1.000E+00	6.784E+01	6.784E+01	-1.000E+00	6.684E+01
-0.91	-1.162E-01	-7.938E-01	-1.000E+00	6.875E+01	6.875E+01	-1.000E+00	6.775E+01
-0.92	-1.167E-01	-8.033E-01	-1.000E+00	6.966E+01	6.966E+01	-1.000E+00	6.866E+01
-0.93	-1.172E-01	-8.128E-01	-1.000E+00	7.057E+01	7.057E+01	-1.000E+00	6.957E+01
-0.94	-1.176E-01	-8.224E-01	-1.000E+00	7.148E+01	7.148E+01	-1.000E+00	7.048E+01
-0.95	-1.181E-01	-8.319E-01	-1.000E+00	7.239E+01	7.239E+01	-1.000E+00	7.139E+01

-0.96	-1.185E-01	-8.415E-01	-1.000E+00	7.330E+01	7.330E+01	-1.000E+00	7.230E+01
-0.97	-1.189E-01	-8.511E-01	-1.000E+00	7.421E+01	7.421E+01	-1.000E+00	7.321E+01
-0.98	-1.194E-01	-8.606E-01	-1.000E+00	7.512E+01	7.512E+01	-1.000E+00	7.412E+01
-0.99	-1.198E-01	-8.702E-01	-1.000E+00	7.604E+01	7.604E+01	-1.000E+00	7.504E+01
-1	-1.202E-01	-8.798E-01	-1.000E+00	7.695E+01	7.695E+01	-1.000E+00	7.595E+01

Table 3: Problem 2 result(temperature)

V	Td1	Td2	Td3	Td4
0	3.000E+02	3.000E+02	3.000E+02	3.000E+02
0.01	3.000E+02	3.000E+02	3.000E+02	3.000E+02
0.02	3.000E+02	3.000E+02	3.000E+02	3.000E+02
0.03	3.000E+02	3.000E+02	3.000E+02	3.000E+02
0.04	3.000E+02	3.000E+02	3.000E+02	3.000E+02
0.05	3.001E+02	3.000E+02	3.000E+02	3.001E+02
0.06	3.001E+02	3.001E+02	3.001E+02	3.001E+02
0.07	3.001E+02	3.001E+02	3.001E+02	3.001E+02
0.08	3.002E+02	3.001E+02	3.001E+02	3.002E+02
0.09	3.002E+02	3.001E+02	3.001E+02	3.002E+02
0.1	3.003E+02	3.001E+02	3.001E+02	3.003E+02
0.11	3.003E+02	3.001E+02	3.001E+02	3.003E+02
0.12	3.004E+02	3.001E+02	3.001E+02	3.004E+02
0.13	3.004E+02	3.002E+02	3.002E+02	3.004E+02
0.14	3.005E+02	3.002E+02	3.002E+02	3.005E+02
0.15	3.006E+02	3.002E+02	3.002E+02	3.006E+02
0.16	3.007E+02	3.002E+02	3.002E+02	3.007E+02
0.17	3.008E+02	3.002E+02	3.002E+02	3.008E+02
0.18	3.009E+02	3.002E+02	3.002E+02	3.009E+02
0.19	3.010E+02	3.003E+02	3.003E+02	3.010E+02
0.2	3.011E+02	3.003E+02	3.003E+02	3.011E+02
0.21	3.012E+02	3.003E+02	3.003E+02	3.012E+02
0.22	3.013E+02	3.003E+02	3.003E+02	3.013E+02
0.23	3.014E+02	3.003E+02	3.003E+02	3.014E+02
0.24	3.016E+02	3.003E+02	3.003E+02	3.016E+02
0.25	3.017E+02	3.004E+02	3.004E+02	3.017E+02
0.26	3.018E+02	3.004E+02	3.004E+02	3.018E+02
0.27	3.020E+02	3.004E+02	3.004E+02	3.020E+02
0.28	3.021E+02	3.004E+02	3.004E+02	3.021E+02
0.29	3.022E+02	3.004E+02	3.004E+02	3.022E+02
0.3	3.024E+02	3.005E+02	3.005E+02	3.024E+02
0.31	3.026E+02	3.005E+02	3.005E+02	3.026E+02
0.32	3.027E+02	3.005E+02	3.005E+02	3.027E+02
0.33	3.029E+02	3.005E+02	3.005E+02	3.029E+02
0.34	3.030E+02	3.005E+02	3.005E+02	3.030E+02
0.35	3.032E+02	3.005E+02	3.005E+02	3.032E+02

0.36	3.034E+02	3.006E+02	3.006E+02	3.034E+02
0.37	3.035E+02	3.006E+02	3.006E+02	3.035E+02
0.38	3.037E+02	3.006E+02	3.006E+02	3.037E+02
0.39	3.039E+02	3.006E+02	3.006E+02	3.039E+02
0.4	3.041E+02	3.006E+02	3.006E+02	3.041E+02
0.41	3.043E+02	3.006E+02	3.006E+02	3.043E+02
0.42	3.044E+02	3.007E+02	3.007E+02	3.044E+02
0.43	3.046E+02	3.007E+02	3.007E+02	3.046E+02
0.44	3.048E+02	3.007E+02	3.007E+02	3.048E+02
0.45	3.050E+02	3.007E+02	3.007E+02	3.050E+02
0.46	3.052E+02	3.007E+02	3.007E+02	3.052E+02
0.47	3.054E+02	3.008E+02	3.008E+02	3.054E+02
0.48	3.056E+02	3.008E+02	3.008E+02	3.056E+02
0.49	3.058E+02	3.008E+02	3.008E+02	3.058E+02
0.5	3.060E+02	3.008E+02	3.008E+02	3.060E+02
0.51	3.062E+02	3.008E+02	3.008E+02	3.062E+02
0.52	3.064E+02	3.009E+02	3.009E+02	3.064E+02
0.53	3.067E+02	3.009E+02	3.009E+02	3.067E+02
0.54	3.069E+02	3.009E+02	3.009E+02	3.069E+02
0.55	3.071E+02	3.009E+02	3.009E+02	3.071E+02
0.56	3.073E+02	3.009E+02	3.009E+02	3.073E+02
0.57	3.075E+02	3.009E+02	3.009E+02	3.075E+02
0.58	3.077E+02	3.010E+02	3.010E+02	3.077E+02
0.59	3.080E+02	3.010E+02	3.010E+02	3.080E+02
0.6	3.082E+02	3.010E+02	3.010E+02	3.082E+02
0.61	3.084E+02	3.010E+02	3.010E+02	3.084E+02
0.62	3.086E+02	3.010E+02	3.010E+02	3.086E+02
0.63	3.089E+02	3.011E+02	3.011E+02	3.089E+02
0.64	3.091E+02	3.011E+02	3.011E+02	3.091E+02
0.65	3.093E+02	3.011E+02	3.011E+02	3.093E+02
0.66	3.096E+02	3.011E+02	3.011E+02	3.096E+02
0.67	3.098E+02	3.011E+02	3.011E+02	3.098E+02
0.68	3.101E+02	3.012E+02	3.012E+02	3.101E+02
0.69	3.103E+02	3.012E+02	3.012E+02	3.103E+02
0.7	3.105E+02	3.012E+02	3.012E+02	3.105E+02
0.71	3.108E+02	3.012E+02	3.012E+02	3.108E+02
0.72	3.110E+02	3.012E+02	3.012E+02	3.110E+02
0.73	3.113E+02	3.012E+02	3.012E+02	3.113E+02
0.74	3.115E+02	3.013E+02	3.013E+02	3.115E+02
0.75	3.118E+02	3.013E+02	3.013E+02	3.118E+02
0.76	3.120E+02	3.013E+02	3.013E+02	3.120E+02
0.77	3.123E+02	3.013E+02	3.013E+02	3.123E+02
0.78	3.125E+02	3.013E+02	3.013E+02	3.125E+02
0.79	3.128E+02	3.014E+02	3.014E+02	3.128E+02
0.8	3.131E+02	3.014E+02	3.014E+02	3.131E+02
0.81	3.133E+02	3.014E+02	3.014E+02	3.133E+02
0.82	3.136E+02	3.014E+02	3.014E+02	3.136E+02

0.83	3.138E+02	3.014E+02	3.014E+02	3.138E+02
0.84	3.141E+02	3.015E+02	3.015E+02	3.141E+02
0.85	3.144E+02	3.015E+02	3.015E+02	3.144E+02
0.86	3.146E+02	3.015E+02	3.015E+02	3.146E+02
0.87	3.149E+02	3.015E+02	3.015E+02	3.149E+02
0.88	3.152E+02	3.015E+02	3.015E+02	3.152E+02
0.89	3.154E+02	3.015E+02	3.015E+02	3.154E+02
0.9	3.157E+02	3.016E+02	3.016E+02	3.157E+02
0.91	3.160E+02	3.016E+02	3.016E+02	3.160E+02
0.92	3.163E+02	3.016E+02	3.016E+02	3.163E+02
0.93	3.165E+02	3.016E+02	3.016E+02	3.165E+02
0.94	3.168E+02	3.016E+02	3.016E+02	3.168E+02
0.95	3.171E+02	3.017E+02	3.017E+02	3.171E+02
0.96	3.174E+02	3.017E+02	3.017E+02	3.174E+02
0.97	3.177E+02	3.017E+02	3.017E+02	3.177E+02
0.98	3.179E+02	3.017E+02	3.017E+02	3.179E+02
0.99	3.182E+02	3.017E+02	3.017E+02	3.182E+02
1	3.185E+02	3.018E+02	3.018E+02	3.185E+02
0	3.000E+02	3.000E+02	3.000E+02	3.000E+02
-0.01	3.000E+02	3.000E+02	3.000E+02	3.000E+02
-0.02	3.000E+02	3.000E+02	3.000E+02	3.000E+02
-0.03	3.000E+02	3.000E+02	3.000E+02	3.000E+02
-0.04	3.000E+02	3.000E+02	3.000E+02	3.000E+02
-0.05	3.000E+02	3.001E+02	3.001E+02	3.000E+02
-0.06	3.001E+02	3.001E+02	3.001E+02	3.001E+02
-0.07	3.001E+02	3.001E+02	3.001E+02	3.001E+02
-0.08	3.001E+02	3.002E+02	3.002E+02	3.001E+02
-0.09	3.001E+02	3.002E+02	3.002E+02	3.001E+02
-0.1	3.001E+02	3.003E+02	3.003E+02	3.001E+02
-0.11	3.001E+02	3.003E+02	3.003E+02	3.001E+02
-0.12	3.001E+02	3.004E+02	3.004E+02	3.001E+02
-0.13	3.002E+02	3.004E+02	3.004E+02	3.002E+02
-0.14	3.002E+02	3.005E+02	3.005E+02	3.002E+02
-0.15	3.002E+02	3.006E+02	3.006E+02	3.002E+02
-0.16	3.002E+02	3.007E+02	3.007E+02	3.002E+02
-0.17	3.002E+02	3.008E+02	3.008E+02	3.002E+02
-0.18	3.002E+02	3.009E+02	3.009E+02	3.002E+02
-0.19	3.003E+02	3.010E+02	3.010E+02	3.003E+02
-0.2	3.003E+02	3.011E+02	3.011E+02	3.003E+02
-0.21	3.003E+02	3.012E+02	3.012E+02	3.003E+02
-0.22	3.003E+02	3.013E+02	3.013E+02	3.003E+02
-0.23	3.003E+02	3.014E+02	3.014E+02	3.003E+02
-0.24	3.003E+02	3.016E+02	3.016E+02	3.003E+02
-0.25	3.004E+02	3.017E+02	3.017E+02	3.004E+02
-0.26	3.004E+02	3.018E+02	3.018E+02	3.004E+02
-0.27	3.004E+02	3.020E+02	3.020E+02	3.004E+02
-0.28	3.004E+02	3.021E+02	3.021E+02	3.004E+02

-0.29	3.004E+02	3.022E+02	3.022E+02	3.004E+02
-0.3	3.005E+02	3.024E+02	3.024E+02	3.005E+02
-0.31	3.005E+02	3.026E+02	3.026E+02	3.005E+02
-0.32	3.005E+02	3.027E+02	3.027E+02	3.005E+02
-0.33	3.005E+02	3.029E+02	3.029E+02	3.005E+02
-0.34	3.005E+02	3.030E+02	3.030E+02	3.005E+02
-0.35	3.005E+02	3.032E+02	3.032E+02	3.005E+02
-0.36	3.006E+02	3.034E+02	3.034E+02	3.006E+02
-0.37	3.006E+02	3.035E+02	3.035E+02	3.006E+02
-0.38	3.006E+02	3.037E+02	3.037E+02	3.006E+02
-0.39	3.006E+02	3.039E+02	3.039E+02	3.006E+02
-0.4	3.006E+02	3.041E+02	3.041E+02	3.006E+02
-0.41	3.006E+02	3.043E+02	3.043E+02	3.006E+02
-0.42	3.007E+02	3.044E+02	3.044E+02	3.007E+02
-0.43	3.007E+02	3.046E+02	3.046E+02	3.007E+02
-0.44	3.007E+02	3.048E+02	3.048E+02	3.007E+02
-0.45	3.007E+02	3.050E+02	3.050E+02	3.007E+02
-0.46	3.007E+02	3.052E+02	3.052E+02	3.007E+02
-0.47	3.008E+02	3.054E+02	3.054E+02	3.008E+02
-0.48	3.008E+02	3.056E+02	3.056E+02	3.008E+02
-0.49	3.008E+02	3.058E+02	3.058E+02	3.008E+02
-0.5	3.008E+02	3.060E+02	3.060E+02	3.008E+02
-0.51	3.008E+02	3.062E+02	3.062E+02	3.008E+02
-0.52	3.009E+02	3.064E+02	3.064E+02	3.009E+02
-0.53	3.009E+02	3.067E+02	3.067E+02	3.009E+02
-0.54	3.009E+02	3.069E+02	3.069E+02	3.009E+02
-0.55	3.009E+02	3.071E+02	3.071E+02	3.009E+02
-0.56	3.009E+02	3.073E+02	3.073E+02	3.009E+02
-0.57	3.009E+02	3.075E+02	3.075E+02	3.009E+02
-0.58	3.010E+02	3.077E+02	3.077E+02	3.010E+02
-0.59	3.010E+02	3.080E+02	3.080E+02	3.010E+02
-0.6	3.010E+02	3.082E+02	3.082E+02	3.010E+02
-0.61	3.010E+02	3.084E+02	3.084E+02	3.010E+02
-0.62	3.010E+02	3.086E+02	3.086E+02	3.010E+02
-0.63	3.011E+02	3.089E+02	3.089E+02	3.011E+02
-0.64	3.011E+02	3.091E+02	3.091E+02	3.011E+02
-0.65	3.011E+02	3.093E+02	3.093E+02	3.011E+02
-0.66	3.011E+02	3.096E+02	3.096E+02	3.011E+02
-0.67	3.011E+02	3.098E+02	3.098E+02	3.011E+02
-0.68	3.012E+02	3.101E+02	3.101E+02	3.012E+02
-0.69	3.012E+02	3.103E+02	3.103E+02	3.012E+02
-0.7	3.012E+02	3.105E+02	3.105E+02	3.012E+02
-0.71	3.012E+02	3.108E+02	3.108E+02	3.012E+02
-0.72	3.012E+02	3.110E+02	3.110E+02	3.012E+02
-0.73	3.012E+02	3.113E+02	3.113E+02	3.012E+02
-0.74	3.013E+02	3.115E+02	3.115E+02	3.013E+02
-0.75	3.013E+02	3.118E+02	3.118E+02	3.013E+02

-0.76	3.013E+02	3.120E+02	3.120E+02	3.013E+02
-0.77	3.013E+02	3.123E+02	3.123E+02	3.013E+02
-0.78	3.013E+02	3.125E+02	3.125E+02	3.013E+02
-0.79	3.014E+02	3.128E+02	3.128E+02	3.014E+02
-0.8	3.014E+02	3.131E+02	3.131E+02	3.014E+02
-0.81	3.014E+02	3.133E+02	3.133E+02	3.014E+02
-0.82	3.014E+02	3.136E+02	3.136E+02	3.014E+02
-0.83	3.014E+02	3.138E+02	3.138E+02	3.014E+02
-0.84	3.015E+02	3.141E+02	3.141E+02	3.015E+02
-0.85	3.015E+02	3.144E+02	3.144E+02	3.015E+02
-0.86	3.015E+02	3.146E+02	3.146E+02	3.015E+02
-0.87	3.015E+02	3.149E+02	3.149E+02	3.015E+02
-0.88	3.015E+02	3.152E+02	3.152E+02	3.015E+02
-0.89	3.015E+02	3.154E+02	3.154E+02	3.015E+02
-0.9	3.016E+02	3.157E+02	3.157E+02	3.016E+02
-0.91	3.016E+02	3.160E+02	3.160E+02	3.016E+02
-0.92	3.016E+02	3.163E+02	3.163E+02	3.016E+02
-0.93	3.016E+02	3.165E+02	3.165E+02	3.016E+02
-0.94	3.016E+02	3.168E+02	3.168E+02	3.016E+02
-0.95	3.017E+02	3.171E+02	3.171E+02	3.017E+02
-0.96	3.017E+02	3.174E+02	3.174E+02	3.017E+02
-0.97	3.017E+02	3.177E+02	3.177E+02	3.017E+02
-0.98	3.017E+02	3.179E+02	3.179E+02	3.017E+02
-0.99	3.017E+02	3.182E+02	3.182E+02	3.017E+02
-1	3.018E+02	3.185E+02	3.185E+02	3.018E+02