

Scilab Manual for
Data Compression and Encryption
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April 17, 2026

¹Funded by a grant from the National Mission on Education through ICT, <http://spoken-tutorial.org/NMEICT-Intro>. This Scilab Manual and Scilab codes written in it can be downloaded from the "Migrated Labs" section at the website <http://scilab.in>

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Experiment: 1

To implement Huffman coding.

Scilab code Solution 1.01 Huffman

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 printf("Enter the frequency of the 5 symbols in
    decreasing order (integer values only):"); //Input
    the frequency of the symbols sequentially as
    5,4,3,2,1 pressing enter after each frequency
6 s=[];r=[];
7 for i=1:5
8 s(i)=input("");
9 end
10 r(4)='0';r(5)='1';
11 if (s(4)+s(5))>=s(1) then
12 for i=1:3
13 temp(i+1)=s(i);
14 end
15 temp(1)=(s(4)+s(5));
16 for i=1:4
```

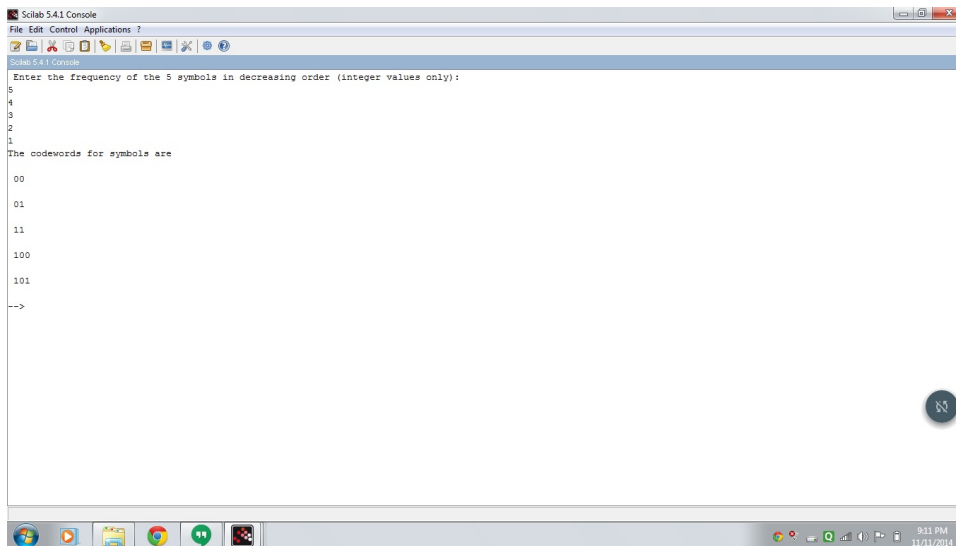


Figure 1.1: Huffman

```

17 s(i)=temp(i);
18 end
19 r(2)='0';r(3)='1';
20 if (s(3)+s(4))>=s(1) then
21 for i=1:2
22 temp(i+1)=s(i);
23 end
24 temp(1)=(s(3)+s(4));
25 for i=1:3
26 s(i)=temp(i);
27 end
28 r(1)='1';r(4)='00';r(5)='01';
29 if (s(2)+s(3))>=s(1) then
30     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
31     r(1)='01';r(2)='10';r(3)='11';r(4)='000';r
        (5)='001';
32 else s(2)=(s(2)+s(3));
33     r(1)='11';r(2)='00';r(3)='01';r(4)='100';r
        (5)='101';
34 end

```

```

35
36 elseif (s(3)+s(4))>=s(2) then
37     temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
38 r(1)='1';r(2)='00';r(3)='01';
39 if (s(2)+s(3))>=s(1) then
40     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
41     r(1)='01';r(2)='000';r(3)='001';r(4)='10';r
        (5)='11';
42 else s(2)=(s(2)+s(3));
43     r(1)='11';r(2)='100';r(3)='101';r(4)='00';r
        (5)='01';
44 end
45 else s(3)=(s(3)+s(4));
46 r(1)='0';r(2)='10';r(3)='11';
47 if (s(2)+s(3))>=s(1) then
48     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
49     r(1)='00';r(2)='010';r(3)='011';r(4)='10';r
        (5)='11';
50 else s(2)=(s(2)+s(3));
51     r(1)='10';r(2)='110';r(3)='111';r(4)='00';r
        (5)='01';
52 end
53 end
54 elseif (s(4)+s(5))>=s(2) then
55 for i=2:3
56     temp(i+1)=s(i);
57 end
58 temp(2)=(s(4)+s(5));
59 for i=3:4
60     s(i)=temp(i);
61 end
62 r(2)='0';r(3)='1';
63 if (s(3)+s(4))>=s(1) then
64 for i=1:2
65     temp(i+1)=s(i);
66 end
67 temp(1)=(s(3)+s(4));
68 for i=1:3

```

```

69 s(i)=temp(i);
70 end
71 r(1)='0';r(4)='10';r(5)='11';
72 if (s(2)+s(3))>=s(1) then
73     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
74     r(1)='00';r(2)='10';r(3)='11';r(4)='010';r
        (5)='011';
75 else s(2)=(s(2)+s(3));
76     r(1)='10';r(2)='00';r(3)='01';r(4)='110';r
        (5)='111';
77 end
78
79 elseif (s(3)+s(4))>=s(2) then
80     temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
81 r(1)='1';r(2)='00';r(3)='01';
82 if (s(2)+s(3))>=s(1) then
83     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
84     r(1)='01';r(2)='000';r(3)='001';r(4)='10';r
        (5)='11';
85 else s(2)=(s(2)+s(3));
86     r(1)='11';r(2)='100';r(3)='101';r(4)='00';r
        (5)='01';
87 end
88 else s(3)=(s(3)+s(4));
89     r(2)='10';r(3)='11';r(4)='00';r(5)='01';
90 if (s(2)+s(3))>=s(1) then
91     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
92     r(1)='1';r(2)='010';r(3)='011';r(4)='000';r
        (5)='001';
93 else s(2)=(s(2)+s(3));
94     r(1)='0';r(2)='110';r(3)='111';r(4)='100';r
        (5)='101';
95 end
96 end
97 elseif (s(4)+s(5))>=s(3) then
98     temp(3)=s(3);s(3)=(s(4)+s(5));s(4)=temp(3);
99 r(4)='00';r(5)='01';r(3)='1';
100 if (s(3)+s(4))>=s(1) then

```

```

101 for i=1:2
102 temp(i+1)=s(i);
103 end
104 temp(1)=(s(3)+s(4));
105 for i=1:3
106 s(i)=temp(i);
107 end
108 r(1)='0';r(2)='1';
109 if (s(2)+s(3))>=s(1) then
110     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
111     r(1)='00';r(2)='01';r(3)='11';r(4)='100';r
        (5)='101';
112 else s(2)=(s(2)+s(3));
113     r(1)='10';r(2)='11';r(3)='01';r(4)='000';r
        (5)='001';
114 end
115
116 elseif (s(3)+s(4))>=s(2) then
117     temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
118     r(2)='1';r(3)='01';r(4)='000';r(5)='001';
119 if (s(2)+s(3))>=s(1) then
120     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
121     r(1)='1';r(2)='01';r(3)='001';r(4)='0000';r
        (5)='0001';
122 else s(2)=(s(2)+s(3));
123     r(1)='0';r(2)='11';r(3)='101';r(4)='1000';r
        (5)='1001';
124 end
125 else s(3)=(s(3)+s(4));
126     r(2)='0';r(3)='11';r(4)='100';r(5)='101';
127 if (s(2)+s(3))>=s(1) then
128     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
129     r(1)='1';r(2)='00';r(3)='011';r(4)='0100';r
        (5)='0101';
130 else s(2)=(s(2)+s(3));
131     r(1)='0';r(2)='10';r(3)='111';r(4)='1100';r
        (5)='1101';
132 end

```

```

133 end
134 else s(4)=(s(4)+s(5));
135 r(3)='0';r(4)='10';r(5)='11';
136 if (s(3)+s(4))>=s(1) then
137 for i=1:2
138 temp(i+1)=s(i);
139 end
140 temp(1)=(s(3)+s(4));
141 for i=1:3
142 s(i)=temp(i);
143 end
144 r(1)='0';r(2)='1';
145 if (s(2)+s(3))>=s(1) then
146     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
147     r(1)='00';r(2)='01';r(3)='10';r(4)='110';r
        (5)='111';
148 else s(2)=(s(2)+s(3));
149     r(1)='10';r(2)='11';r(3)='00';r(4)='010';r
        (5)='011';
150 end
151
152 elseif (s(3)+s(4))>=s(2) then
153     temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
154     r(2)='1';r(3)='00';r(4)='010';r(5)='011';
155 if (s(2)+s(3))>=s(1) then
156     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
157     r(1)='1';r(2)='01';r(3)='000';r(4)='0010';r
        (5)='0011';
158 else s(2)=(s(2)+s(3));
159     r(1)='0';r(2)='11';r(3)='100';r(4)='1010';r
        (5)='1011';
160 end
161 else s(3)=(s(3)+s(4));
162     r(2)='0';r(3)='10';r(4)='110';r(5)='111';
163 if (s(2)+s(3))>=s(1) then
164     temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
165     r(1)='1';r(2)='00';r(3)='010';r(4)='0110';r
        (5)='0111';

```

```
166 else s(2)=(s(2)+s(3));
167     r(1)='0';r(2)='10';r(3)='110';r(4)='1110';r
        (5)='1111';
168 end
169 end
170 end
171 printf("The codewords for symbols are \n")
172 for i=1:5
173 disp(r(i));
174 end
175 //Output for ex:
176 //The codewords for symbols are :
177 //00
178 //01
179 //11
180 //100
181 //101
```

Experiment: 2

To implement Arithmetic Coding.

Scilab code Solution 2.02 arithmetic

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 n=input("Enter the no. of symbols : ");//Input:
    Taking the no. of symbols (ex 5)
6 //Note:The sum of probabilities of all symbols must
    be one(1)
7 for i = 1:n
8     printf("\\nEnter the probability(<=1) of symbol
        %d: ",i);//Input: Taking the probability of
        occurence
9 p(i)=input("");
10 end
11 //Sample Input for probability of symbols
12 // Symbol Probability
13 // 1 0.3
```

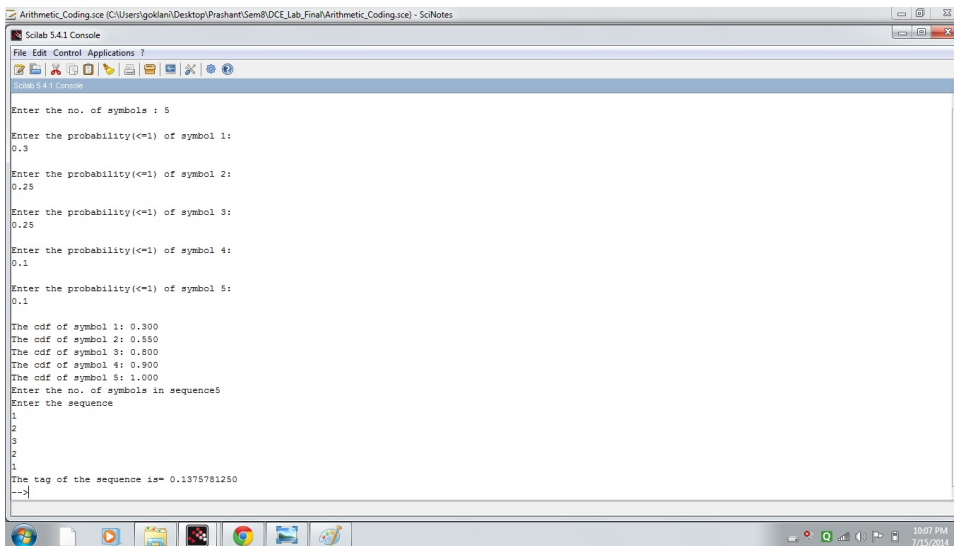


Figure 2.1: arithmetic

```

14 //      2           0.25
15 //      3           0.25
16 //      4           0.1
17 //      5           0.1
18 printf("\nThe cdf of symbol 1: %.3f ",p(1));
19 //Output CDF for example input
20 // Symbol          CDF
21 //      1           0.3
22 //      2           0.550
23 //      3           0.800
24 //      4           0.900
25 //      5           1.000
26
27 c(1)=p(1);
28 for i = 2:n
29     c(i)=p(i)+c(i-1);
30     printf("\nThe cdf of symbol %d: ",i);
31     printf("%.3f",c(i));
32 end
33 s=input("Enter the no. of symbols in sequence");//

```

```

    Input: No. of symbols(for ex if the sequence to
    be coded is: 1 2 3 2 1 where 1,2,3...are symbol
    numbers then no. of symbols are 5)
34 //ex No. of symbols in sequence=5
35 printf("Enter the sequence ");//Input: Sequence(For
    example to enter the sequence 1 2 3 2 1, press
    each symbol and then enter. So for our case,
    press 1 and then enter then similarly 2 then
    enter and so on)
36 //Input ex Sequence: 1 (press Enter)
37 //                2 (press Enter)
38 //                3 (press Enter)
39 //                2 (press Enter)
40 //                1 (press Enter)
41 for j = 1:s
42 b(j)=input("");//Inserting the sequence
43 end
44 //Setting the lower and upper limit for 1st stage
45 if b(1) == 1 then
46 l(1)=0;
47 u(1)=c(b(1));
48 else
49 l(1)=c(b(1)-1);
50 u(1)=c(b(1));
51 end
52 //Calculating lower and upper limits for 2nd stage
    and ahead
53 for k = 2:s
54 if b(k) == 1 then
55 l(k)=l(k-1);
56 u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)));
57 else
58 l(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)-1));
59 u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)));
60 end
61 end
62
63 tag=(l(s)+u(s))/2; //Generating tag

```

```
64 printf("The tag of the sequence is= %.10f",tag);//  
    Output: The tag of the sequence  
65 //Output for ex tag=0.1375781250
```

Experiment: 3

To implement μ law encoding

Scilab code Solution 3.03 ULAW

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 n=input("Enter the input sample(no. to be coded) : ")
   );//Input: Taking Input Sample from user
6 //Input ex. n=-656
7 if n<0 then
8     P=49;//ascii code for 1=49
9 else
10    P=48;//ascii code for 0=48
11 end
12 Pc=asciimat(P);//Sign Bit
13 printf("The encoded word is : ");//Output: The
   encoded word
14 printf("%c",Pc);
15 s1=abs(n)+33;
16 s1b=dec2bin(s1);
17 l=length(s1b);
18 s1bl=length(s1b)-1;
19 s1bls=s1bl-5;
```

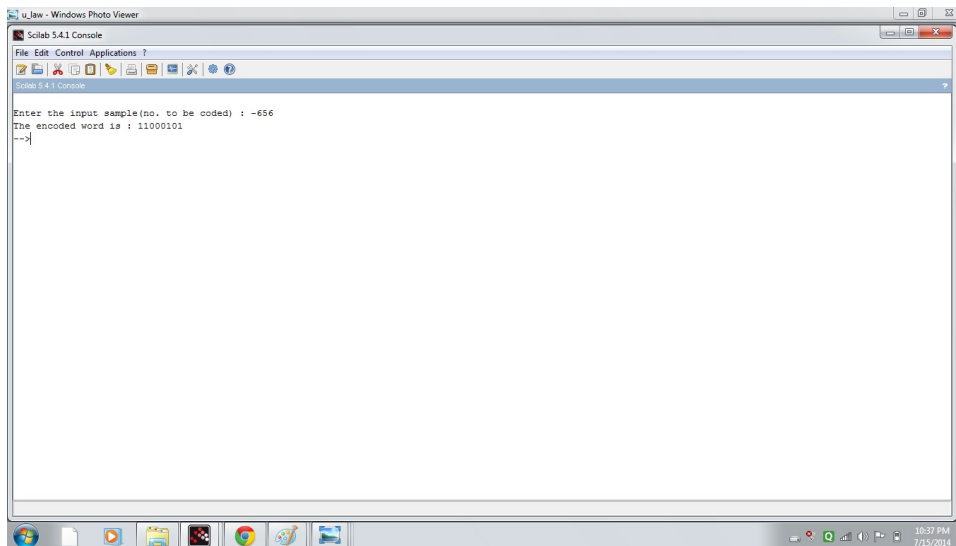


Figure 3.1: ULAW

```
20 segcod=dec2bin(s1bls,3); //segment code
21 printf("%s",dec2bin(s1bls,3));
22 qrev=part(s1b,1:4);
23 q=strev(qrev); //quantization code
24 printf("%s",q);
25 //Output for ex. 11000101
```

Experiment: 4

To implement one dimension DCT

Scilab code Solution 4.04 1DDCT

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 //one dimensional cosine transform
4 clc;
5 clear all;
6 f=[1 2 4 7]; //Input: A row matrix
7 //Input ex. f=[1 2 4 7]
8 N=length(f); //finding length of input sequence
9 F=zeros(1,N); //cosine transform of input
10 //C=zeros(N,N);
11 for k=1:N
12     for n=1:N
13         if (k-1)==0
14             C(k,n)=inv(sqrt(N)); //cosine transform
15                                     matrix
16         else
17             C(k,n)=sqrt(2)*inv(sqrt(N))*cos(%pi*(2*(n
18                 -1)+1)*(k-1)/(2*N));
19         end
20     end
21 end
```

```

18     end
19 end
20
21 for u=1:N
22     for x=1:N
23         if (u-1)==0
24             F(u)=F(u)+inv(sqrt(N))*f(x)*cos(%pi*(2*(x
                -1)+1)*(u-1)/(2*N));
25         else
26             F(u)=F(u)+sqrt(2)*inv(sqrt(N))*f(x)*cos(
                %pi*(2*(x-1)+1)*(u-1)/(2*N));
27         end
28     end
29 end
30
31 disp(F," is ",f," Discrete Cosine Transform of");//
    Output: The discrete cosine transform of 1D
    sequence
32 //Output for ex.: [7 -4.460885 1 -0.3170253]

```

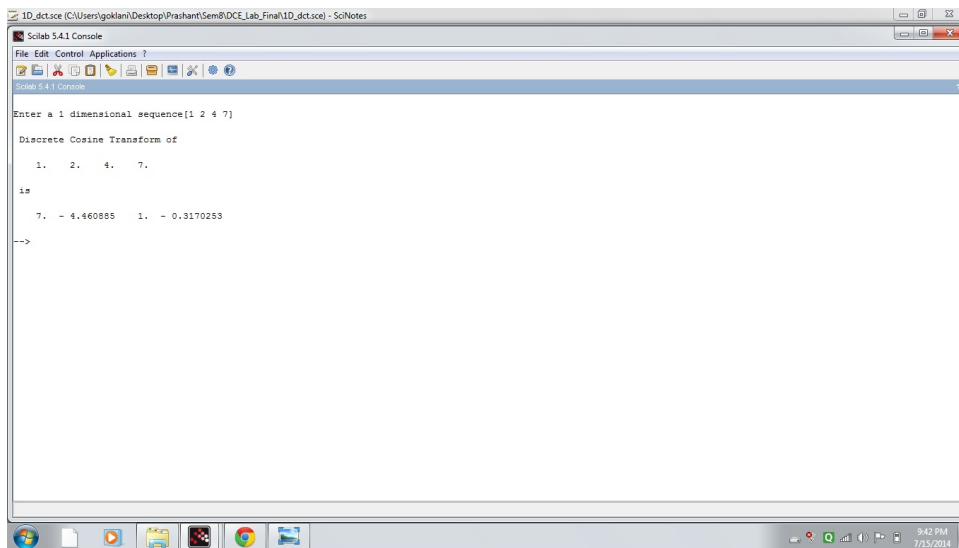


Figure 4.1: 1DDCT

Experiment: 5

To implement two dimension DCT

Scilab code Solution 5.05 2DDCT

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 //two dimensional cosine transform
4 clc;
5 clear all;
6 f=[2 4 4 2;4 6 8 3;2 8 10 4;3 8 6 2]; //Input: Enter
   a square matrix
7 //Input ex. f=[2 4 4 2;4 6 8 3;2 8 10 4;3 8 6 2]
8 [M N]=size(f); //finding length of input sequence
9 for k=1:N
10     for n=1:N
11         if (k-1)==0
12             C(k,n)=inv(sqrt(N)); //cosine transform
               matrix
13         else
14             C(k,n)=sqrt(2)*inv(sqrt(N))*cos(%pi*(2*(n
               -1)+1)*(k-1)/(2*N));
15         end
16     end
```

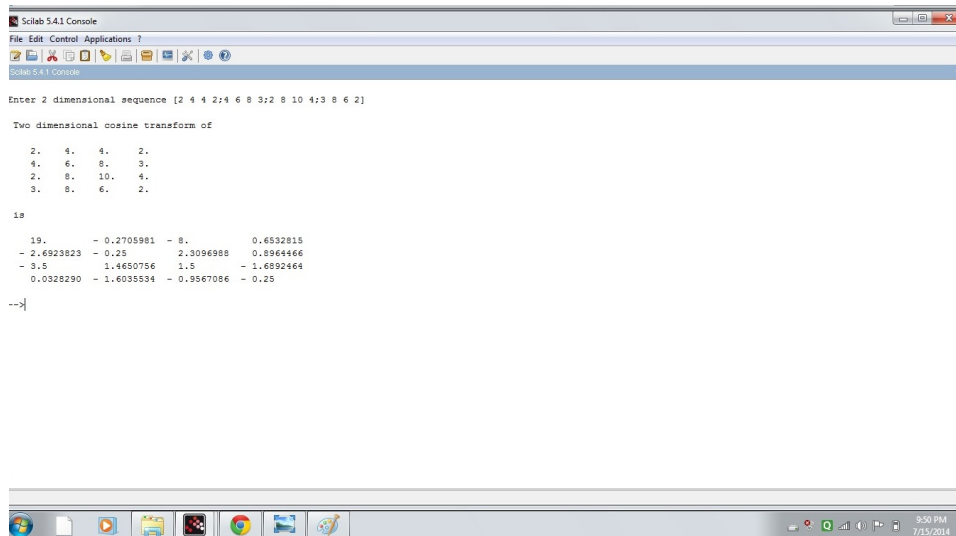


Figure 5.1: 2DDCT

```

17 end
18
19 F=C*f*C'; //discrete cosine transform of input for
    non-symmetric DCT
20 disp(F," is ",f,"Two dimensional cosine transform of")
    ;//Output: Two dimensional cosine transform of
    the matrix
21 //Output for ex. :
22 //      19.      - 0.2705981  - 8.
    0.6532815
23 // - 2.6923823  - 0.25      2.3096988
    0.8964466
24 // - 3.5      1.4650756  1.5      -
    1.6892464
25 //      0.0328290  - 1.6035534  - 0.9567086  - 0.25

```

Experiment: 6

To implement Chinese Remainder Theorem

Scilab code Solution 6.06 CRT

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 //Standard Equations for CRT
6 //x=a1 mod m1
7 //x=a2 mod m2
8 //x=a3 mod m3
9 //Taking the parameters of standard equation from
   the user
10 m1=[3];//input("Enter the value m1 : ");//Input:
   Value of m1 from equations
11 //Input ex. m1=3
12 m2=[4];//input("Enter the value m2 : ");//Input:
   Value of m2 from equations
13 //Input ex. m2=4
14 m3=[5];//("Enter the value m3 : ");//Input: Value of
```

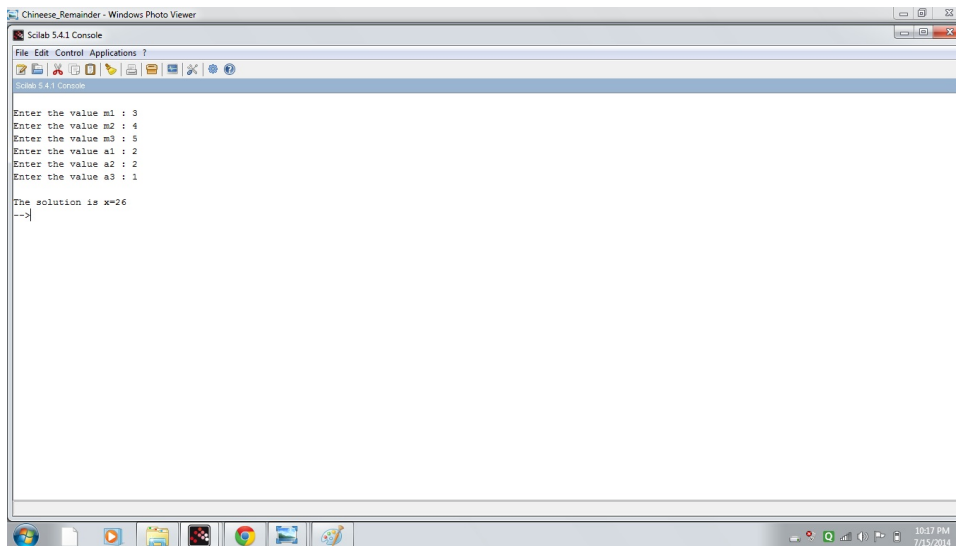


Figure 6.1: CRT

```

    m3 from equations
15 //Input ex. m3=5
16 a1=[2]; //input("Enter the value a1 : "); //Input:
    Value of a1 from equations
17 //Input ex. a1=2
18 a2=[2]; //input("Enter the value a2 : "); //Input:
    Value of a2 from equations
19 //Input ex. a2=2
20 a3=[1]; //("Enter the value a3 : "); //Input: Value of
    a3 from equations
21 //Input ex. a3=1
22 M=m1*m2*m3;
23 M1=M/m1;
24 M2=M/m2;
25 M3=M/m3;
26
27 for i = 1:10
28     if modulo(((M1*i)-1),m1) == 0 then
                                                //Calculating
    Mlinverse

```

```

29         M1in=i;
30         break;
31     end
32 end
33 for i = 1:10
34     if modulo(((M2*i)-1),m2) == 0 then
35         .....//
36         Calculating M2inverse
37         M2in=i;
38         break;
39     end
40     if modulo(((M3*i)-1),m3) == 0 then
41         .....//
42         Calculating M3inverse
43         M3in=i;
44         break;
45     end
46 x=modulo(((a1*M1*M1in)+(a2*M2*M2in)+(a3*M3*M3in)),M)
47     ;//Solution of equations
48 printf("\nThe solution is x=%d",x);// Output: The
49     solution for the set of equations
50 //Output for ex. x=26

```

Experiment: 7

To implement Ceaser Cipher Algorithm

Scilab code Solution 7.07 CCA

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 n=input("Enter the length of the text:");//Input:
    Taking the length of the text to be encoded from
    the user (for ex to encode abcde the length is 5)
6 //Input ex n=5
7 t=tokens(input("Please type string with a space in
    between alphabets:", "string"));//Input: Taking
    the string to be encoded
8 //Input ex. t=a b c d e
9 printf("The encrypted string is: ");//Output: The
    encrypted string
10 for i = 1:n
11     c(i)=ascii(t(i))+3;//Caeser Cipher encoding with
        offset=3
```

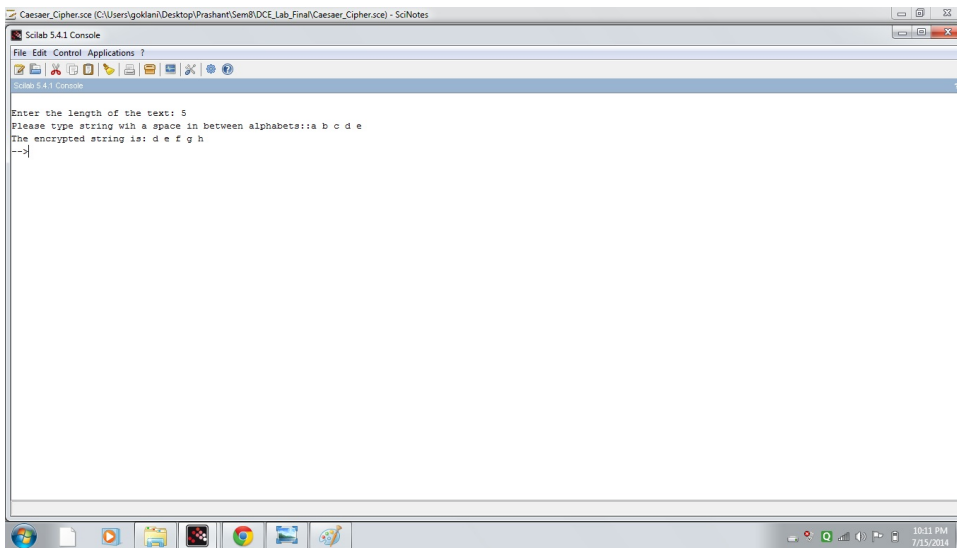


Figure 7.1: CCA

```
12     c1(i)=asciimat(c(i));
13     printf("%c ",c1(i)); //Printing the encoded word
14 end
15 //Output for ex. d e f g h
```

Experiment: 8

To implement RSA Algorithm

Scilab code Solution 8.08 RSA

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 p=input("Enter the 1st prime no.");//Input: Taking
   the first prime no. for RSA
6 //Input ex. p=11
7 q=input("Enter the 2nd prime no.");//Input: Taking
   the second prime no. for RSA
8 //Input ex. q=5
9 n=p*q;
10 phi=(p-1)*(q-1);//Tuotient Function
11 printf("Enter the value of e");//Input: value of e (
   such that phi and the no. entered by you are
   relatively prime)
12 //Input ex. phi=7
13 e=input("");
14 for i = 1:n
15     z=modulo((i*e),phi);
```

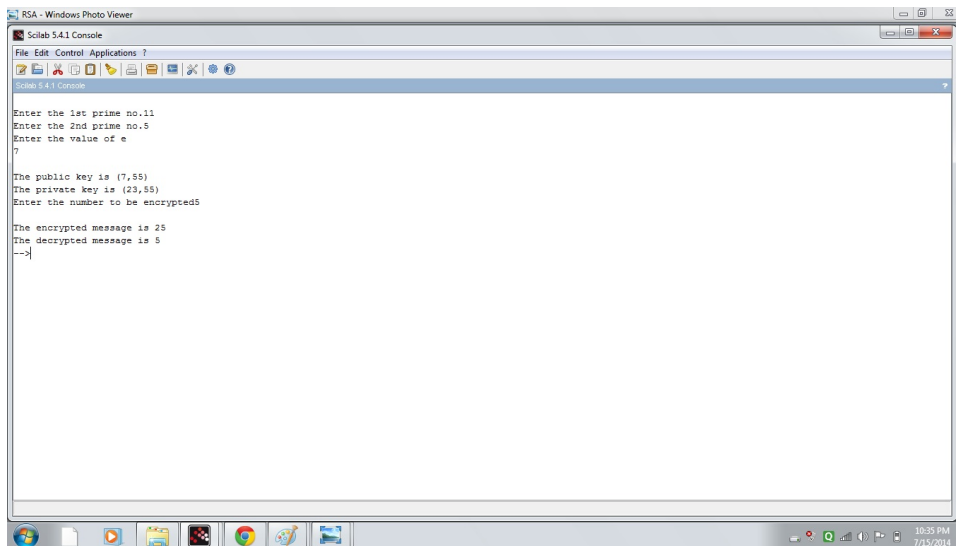


Figure 8.1: RSA

```

16     if z == 1 then
17 break;
18 end
19 end
20 printf("\nThe public key is (%.d",e);//Output: The
    public key is (e,n)
21 //Output for ex. public key (7,55)
22 printf(" ,%.d)",n);
23 printf("\nThe private key is (%.d",i);//Output:
    The private key is (i,n)
24 //Output ex. private key (23,55)
25 printf(" ,%.d)",n);
26 m=input("Enter the number to be encrypted");//Input
    : Taking the message to be encrypted
27 //Input ex. 5
28 a=m^e;
29 c=modulo(a,n);
30 printf("\nThe encrypted message is %.d ",c);//Output
    : Printing the encrypted message
31 //Output for ex. 25

```

```
32 b=c^i;
33 t=modulo(b,n);
34 printf("\nThe decrypted message is %.d ",m);//Output
    : Decrypted Message
35 //Output for ex. 5
```

Experiment: 9

To implement Diffie-Hellman Key exchange

Scilab code Solution 9.09 DIFFIE

```
1 //OS: Windows 7
2 //Scilab Version: Scilab 5.4.1
3 clc;
4 clear all;
5 p=[13]; //input("Enter the common prime number(p) ")
   //Input: taking common prime number as input
6 //Input ex. p=13
7 g=[6]; //input("Enter the primitive root(g) (any no.)
   //Input: taking primitive root as input
8 //Input ex. g=6
9 a=[3]; //input("Enter secret key of first user (any
   no.) "); //Input: Taking secret key for user 1
10 //Input ex. a=3
11 b=[10]; //input("Enter secret key of second user (any
   no.) "); //Input: Taking secret key for user 2
12 //Input ex. b=10
13 A=modulo(g^a,p); //public key of user 1
14 B=modulo(g^b,p); //public key of user 2
15 common_key=modulo(A^b,p); //common key
```

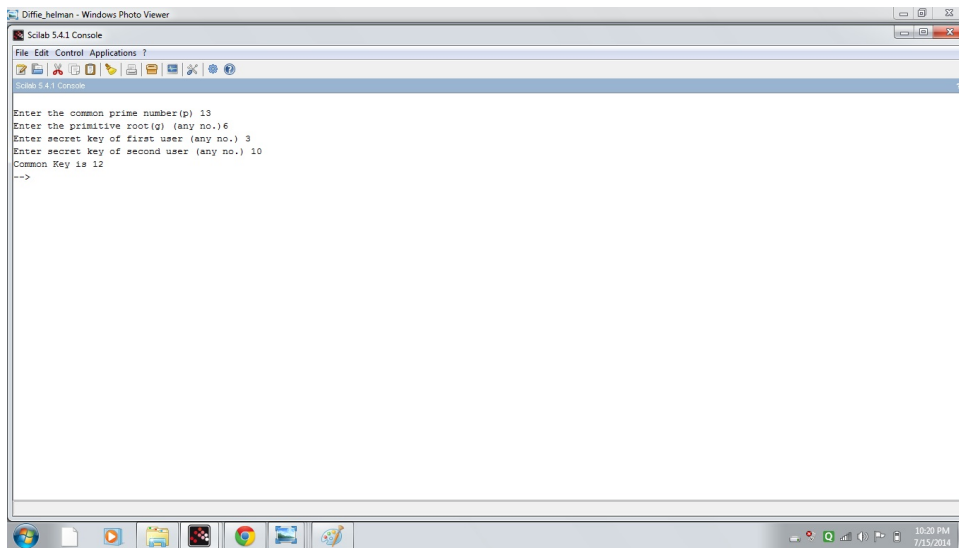


Figure 9.1: DIFFIE

```
16 printf("Common Key is %.d", common_key) ; //Output :  
    Produced common key  
17 //Output for ex. Common Key=12
```
