Scilab Manual for
Data Compression and Encryption
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VESIT[1]

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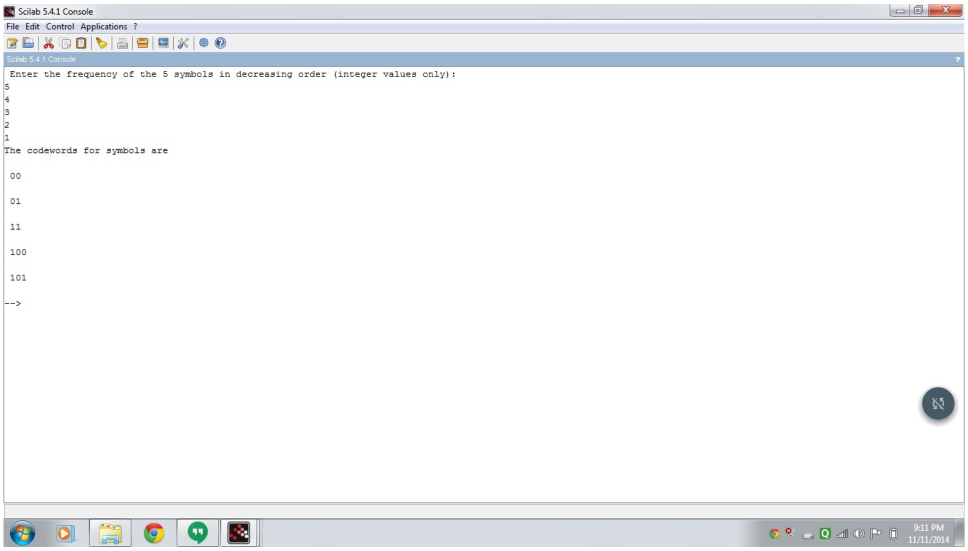
Experiment: 1

To implement Huffman coding.

Scilab code Solution 1.01 Huffman

```
//OS: Windows 7
//Scilab Version: Scilab 5.4.1
clc;
clear all;
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
s=[];r=[];
for i=1:5
s(i)=input("");
end
r(4)='0';r(5)='1';
if (s(4)+s(5))>=s(1) then
for i=1:3
temp(i+1)=s(i);
end
temp(1)=(s(4)+s(5));
for i=1:4
```



```
 Enter the frequency of the 5 symbols in decreasing order (integer values only):
5
4
3
2
1
The codewords for symbols are

 00

 01

 11

 100

 101

-->
```

Figure 1.1: Huffman

```
s(i)=temp(i);
end
r(2)='0';r(3)='1';
if (s(3)+s(4))>=s(1) then
for i=1:2
temp(i+1)=s(i);
end
temp(1)=(s(3)+s(4));
for i=1:3
s(i)=temp(i);
end
r(1)='1';r(4)='00';r(5)='01';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='01';r(2)='10';r(3)='11';r(4)='000';r
           (5)='001';
else s(2)=(s(2)+s(3));
        r(1)='11';r(2)='00';r(3)='01';r(4)='100';r
           (5)='101';
end
```

```

elseif (s(3)+s(4))>=s(2) then
    temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
r(1)='1';r(2)='00';r(3)='01';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='01';r(2)='000';r(3)='001';r(4)='10';r(5)='11';
else s(2)=(s(2)+s(3));
        r(1)='11';r(2)='100';r(3)='101';r(4)='00';r(5)='01';
end
else s(3)=(s(3)+s(4));
r(1)='0';r(2)='10';r(3)='11';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='00';r(2)='010';r(3)='011';r(4)='10';r(5)='11';
else s(2)=(s(2)+s(3));
        r(1)='10';r(2)='110';r(3)='111';r(4)='00';r(5)='01';
end
end
elseif (s(4)+s(5))>=s(2) then
for i=2:3
temp(i+1)=s(i);
end
temp(2)=(s(4)+s(5));
for i=3:4
s(i)=temp(i);
end
r(2)='0';r(3)='1';
if (s(3)+s(4))>=s(1) then
for i=1:2
temp(i+1)=s(i);
end
temp(1)=(s(3)+s(4));
for i=1:3
```

```
s(i)=temp(i);
end
r(1)='0';r(4)='10';r(5)='11';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='00';r(2)='10';r(3)='11';r(4)='010';r(5)='011';
else s(2)=(s(2)+s(3));
        r(1)='10';r(2)='00';r(3)='01';r(4)='110';r(5)='111';
end

elseif (s(3)+s(4))>=s(2) then
    temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
r(1)='1';r(2)='00';r(3)='01';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='01';r(2)='000';r(3)='001';r(4)='10';r(5)='11';
else s(2)=(s(2)+s(3));
        r(1)='11';r(2)='100';r(3)='101';r(4)='00';r(5)='01';
end
else s(3)=(s(3)+s(4));
    r(2)='10';r(3)='11';r(4)='00';r(5)='01';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='1';r(2)='010';r(3)='011';r(4)='000';r(5)='001';
else s(2)=(s(2)+s(3));
        r(1)='0';r(2)='110';r(3)='111';r(4)='100';r(5)='101';
end
end
elseif (s(4)+s(5))>=s(3) then
    temp(3)=s(3);s(3)=(s(4)+s(5));s(4)=temp(3);
r(4)='00';r(5)='01';r(3)='1';
if (s(3)+s(4))>=s(1) then
```

```
for i=1:2
temp(i+1)=s(i);
end
temp(1)=(s(3)+s(4));
for i=1:3
s(i)=temp(i);
end
r(1)='0';r(2)='1';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='00';r(2)='01';r(3)='11';r(4)='100';r(5)='101';
else s(2)=(s(2)+s(3));
        r(1)='10';r(2)='11';r(3)='01';r(4)='000';r(5)='001';
end

elseif (s(3)+s(4))>=s(2) then
    temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
    r(2)='1';r(3)='01';r(4)='000';r(5)='001';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='1';r(2)='01';r(3)='001';r(4)='0000';r(5)='0001';
else s(2)=(s(2)+s(3));
        r(1)='0';r(2)='11';r(3)='101';r(4)='1000';r(5)='1001';
end
else s(3)=(s(3)+s(4));
    r(2)='0';r(3)='11';r(4)='100';r(5)='101';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='1';r(2)='00';r(3)='011';r(4)='0100';r(5)='0101';
else s(2)=(s(2)+s(3));
        r(1)='0';r(2)='10';r(3)='111';r(4)='1100';r(5)='1101';
end
```

```
end
else s(4)=(s(4)+s(5));
r(3)='0';r(4)='10';r(5)='11';
if (s(3)+s(4))>=s(1) then
for i=1:2
temp(i+1)=s(i);
end
temp(1)=(s(3)+s(4));
for i=1:3
s(i)=temp(i);
end
r(1)='0';r(2)='1';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='00';r(2)='01';r(3)='10';r(4)='110';r(5)='111';
else s(2)=(s(2)+s(3));
        r(1)='10';r(2)='11';r(3)='00';r(4)='010';r(5)='011';
end

elseif (s(3)+s(4))>=s(2) then
    temp(2)=s(2);s(2)=(s(3)+s(4));s(3)=temp(2);
    r(2)='1';r(3)='00';r(4)='010';r(5)='011';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='1';r(2)='01';r(3)='000';r(4)='0010';r(5)='0011';
else s(2)=(s(2)+s(3));
        r(1)='0';r(2)='11';r(3)='100';r(4)='1010';r(5)='1011';
end
else s(3)=(s(3)+s(4));
    r(2)='0';r(3)='10';r(4)='110';r(5)='111';
if (s(2)+s(3))>=s(1) then
        temp(1)=s(1);s(1)=(s(2)+s(3));s(2)=temp(1);
        r(1)='1';r(2)='00';r(3)='010';r(4)='0110';r(5)='0111';
```

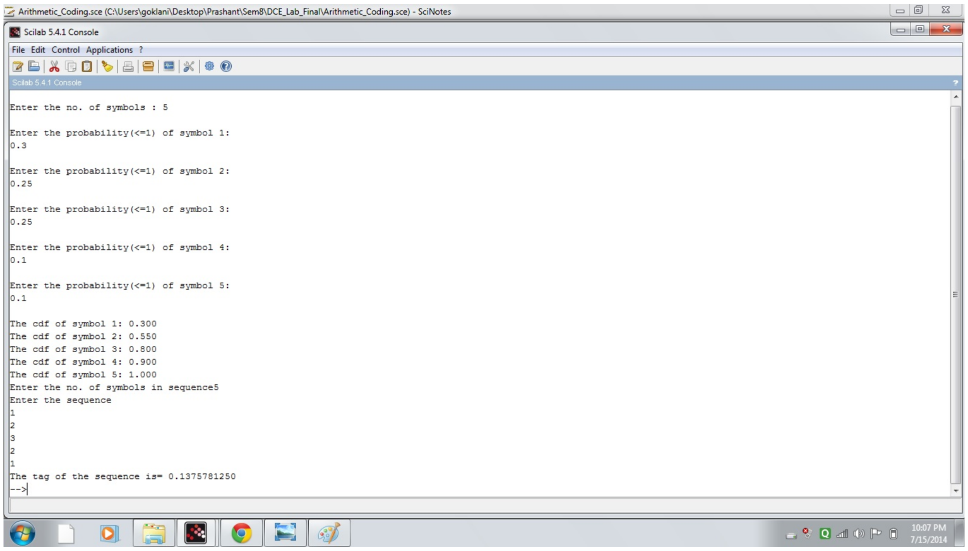
```
else s(2)=(s(2)+s(3));
        r(1)='0';r(2)='10';r(3)='110';r(4)='1110';r(5)='1111';
end
end
end
printf("The codewords for symbols are \n")
for i=1:5
disp(r(i));
end
//Output for ex:
//The codewords for symbols are :
//00
//01
//11
//100
//101
```

Experiment: 2

To implement Arithmetic Coding.

Scilab code Solution 2.02 arithmetic

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


Arithmetic_Coding.sce (C:\Users\goklani\Desktop\Prashant\Sem8\DCE_Lab_Final\Arithmetic_Coding.sce) - SciNotes
Scilab 5.4.1 Console
File Edit Control Applications ?
Scilab 5.4.1 Console
10:07 PM
7/15/2014

```
Enter the no. of symbols : 5

Enter the probability(<=1) of symbol 1:
0.3

Enter the probability(<=1) of symbol 2:
0.25

Enter the probability(<=1) of symbol 3:
0.25

Enter the probability(<=1) of symbol 4:
0.1

Enter the probability(<=1) of symbol 5:
0.1

The cdf of symbol 1: 0.300
The cdf of symbol 2: 0.550
The cdf of symbol 3: 0.800
The cdf of symbol 4: 0.900
The cdf of symbol 5: 1.000
Enter the no. of symbols in sequence5
Enter the sequence
1
2
3
2
1
The tag of the sequence is= 0.1375781250
-->
```

Figure 2.1: arithmetic

```
//      2                                    0.25
//      3                                    0.25
//      4                                    0.1
//      5                                    0.1
printf("\nThe cdf of symbol 1: %.3f ",p(1));
//Output CDF for example input
// Symbol                                   CDF
//     1                                     0.3
//     2                                     0.550
//     3                                     0.800
//     4                                     0.900
//     5                                     1.000

c(1)=p(1);
for i = 2:n
    c(i)=p(i)+c(i-1);
    printf("\nThe cdf of symbol %d: ",i);
    printf("%.3f",c(i));
end
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)
//ex No. of symbols in sequence=5
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)
//Input ex Sequence: 1 (press Enter)
//                   2 (press Enter)
//                   3 (press Enter)
//                   2 (press Enter)
//                   1 (press Enter)
for j = 1:s
b(j)=input("");//Inserting the sequence
end
//Setting the lower and upper limit for 1st stage
if b(1) == 1 then
l(1)=0;
u(1)=c(b(1));
else
l(1)=c(b(1)-1);
u(1)=c(b(1));
end
//Calculating lower and upper limits for 2nd stage and ahead
for k = 2:s
if b(k) == 1 then
l(k)=l(k-1);
u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)));
else
l(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)-1));
u(k)=l(k-1)+((u(k-1)-l(k-1))*c(b(k)));
end
end

tag=(l(s)+u(s))/2;//Generating tag
```

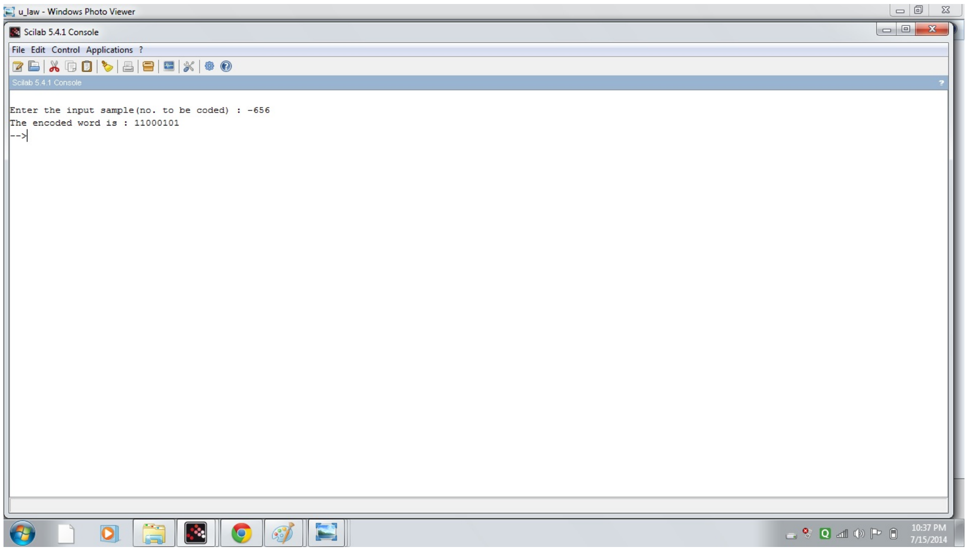
```
printf(”The tag of the sequence is= %.10f”,tag);//Output: The tag of the sequence
//Output for ex tag=0.1375781250
```

Experiment: 3

To implement μ law encoding

Scilab code Solution 3.03 ULAW

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


u_law - Windows Photo Viewer
Scilab 5.4.1 Console
File Edit Control Applications ?
Scilab 5.4.1 Console
10:37 PM
7/15/2014

```
Enter the input sample(no. to be coded) : -656
The encoded word is : 11000101
-->
```

Figure 3.1: ULAW

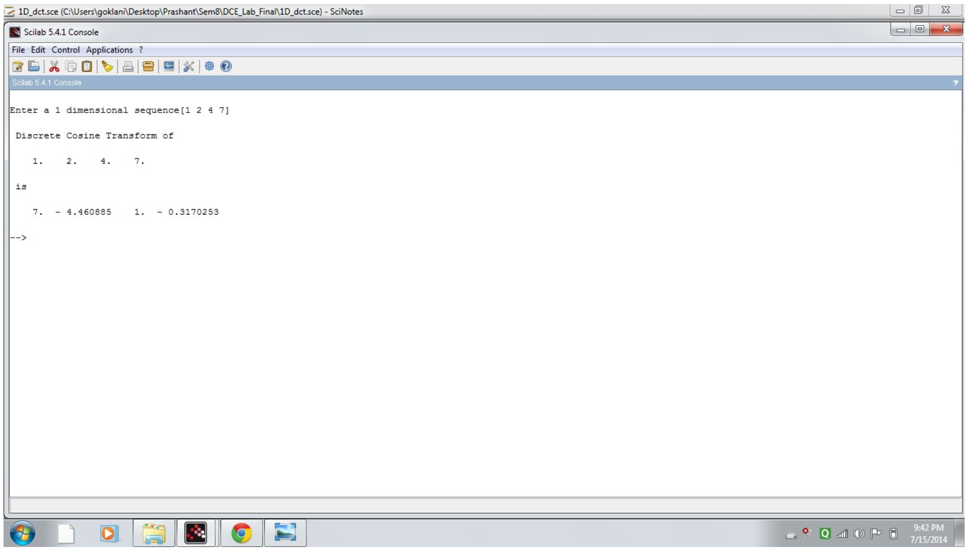
```
segcod=dec2bin(s1bls,3);//segment code
printf("%s",dec2bin(s1bls,3));
qrev=part(s1b,1:4);
q=strrev(qrev);//quantization code
printf("%s",q);
//Output for ex. 11000101
```

Experiment: 4

To implement one dimension DCT

Scilab code Solution 4.04 1DDCT

```
//OS: Windows 7
//Scilab Version: Scilab 5.4.1
//one dimensional cosine transform
clc;
clear all;
f=[1 2 4 7];//Input: A row matrix
//Input ex. f=[1 2 4 7]
N=length(f);//finding length ofinput sequence
F=zeros(1,N);//cosine transform of input
//C=zeros(N,N);
for k=1:N
    for n=1:N
        if (k-1)==0
           C(k,n)=inv(sqrt(N));//cosine transform matrix
        else
           C(k,n)=sqrt(2)*inv(sqrt(N))*cos(%pi*(2*(n-1)+1)*(k-1)/(2*N));
        end
    end
end

for u=1:N
    for x=1:N
      if (u-1)==0
          F(u)=F(u)+inv(sqrt(N))*f(x)*cos(%pi*(2*(x-1)+1)*(u-1)/(2*N));
        else
           F(u)=F(u)+sqrt(2)*inv(sqrt(N))*f(x)*cos(%pi*(2*(x-1)+1)*(u-1)/(2*N));
        end
     end
end

disp(F,"is",f,"Discrete Cosine Transform of");//Output: The discrete cosine transform of 1D sequence
//Output for ex.:[7 -4.460885 1 -0.3170253]
```



1D_dct.sce (C:\Users\goklani\Desktop\Prashant\Sem8\DCE_Lab_Final\1D_dct.sce) - SciNotes
Scilab 5.4.1 Console
File Edit Control Applications ?
Scilab 5.4.1 Console
9:42 PM
7/15/2014

```
Enter a 1 dimensional sequence[1 2 4 7]

 Discrete Cosine Transform of

   1.    2.    4.    7.

 is

   7.  - 4.460885    1.  - 0.3170253

-->
```

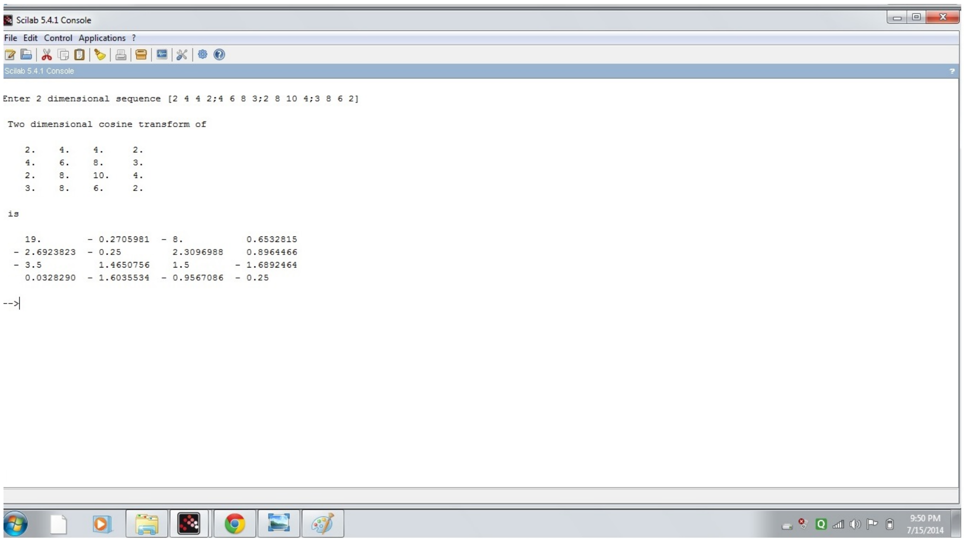
Figure 4.1: 1DDCT

Experiment: 5

To implement two dimension DCT

Scilab code Solution 5.05 2DDCT

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



```
Enter 2 dimensional sequence [2 4 4 2;4 6 8 3;2 8 10 4;3 8 6 2]

 Two dimensional cosine transform of

    2.    4.    4.     2.
    4.    6.    8.     3.
    2.    8.    10.    4.
    3.    8.    6.     2.

 is

    19.        - 0.2705981  - 8.          0.6532815
  - 2.6923823  - 0.25         2.3096988   0.8964466
  - 3.5          1.4650756    1.5       - 1.6892464
    0.0328290  - 1.6035534  - 0.9567086 - 0.25

-->
```

Figure 5.1: 2DDCT

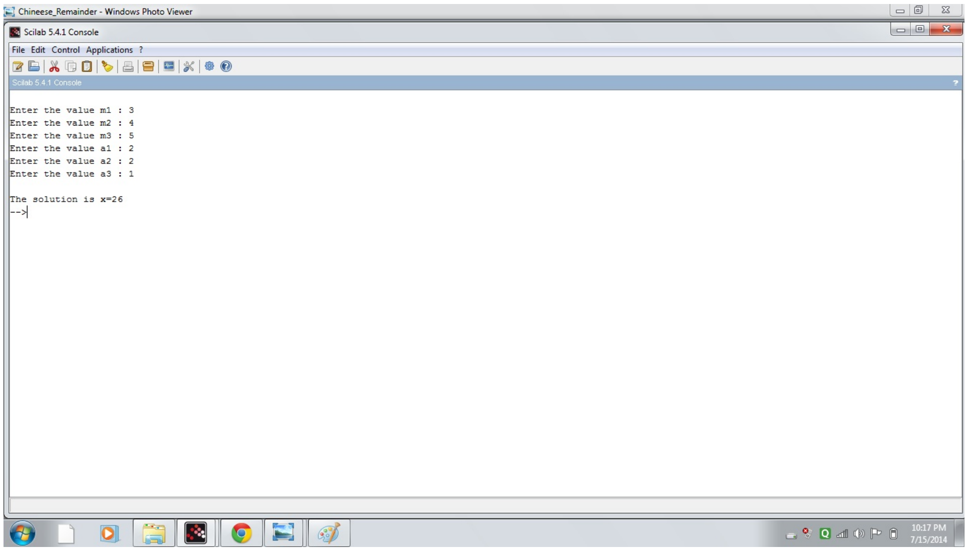
```
end

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

Experiment: 6

To implement Chinese Remainder Theorem

Scilab code Solution 6.06 CRT

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


Chineese_Remainder - Windows Photo Viewer
Scilab 5.4.1 Console
File Edit Control Applications ?
Scilab 5.4.1 Console
10:17 PM
7/15/2014

```
Enter the value m1 : 3
Enter the value m2 : 4
Enter the value m3 : 5
Enter the value a1 : 2
Enter the value a2 : 2
Enter the value a3 : 1

The solution is x=26
-->
```

Figure 6.1: CRT

```
    m3 from equations
//Input ex. m3=5
a1=[2];//input("Enter the value a1 : ");//Input: Value of a1 from equations
//Input ex. a1=2
a2=[2];//input("Enter the value a2 : ");//Input: Value of a2 from equations
//Input ex. a2=2
a3=[1];//("Enter the value a3 : ");//Input: Value of a3 from equations
//Input ex. a3=1
M=m1*m2*m3;
M1=M/m1;
M2=M/m2;
M3=M/m3;

for i = 1:10
    if modulo(((M1*i)-1),m1) == 0 then                    //Calculating M1inverse
```

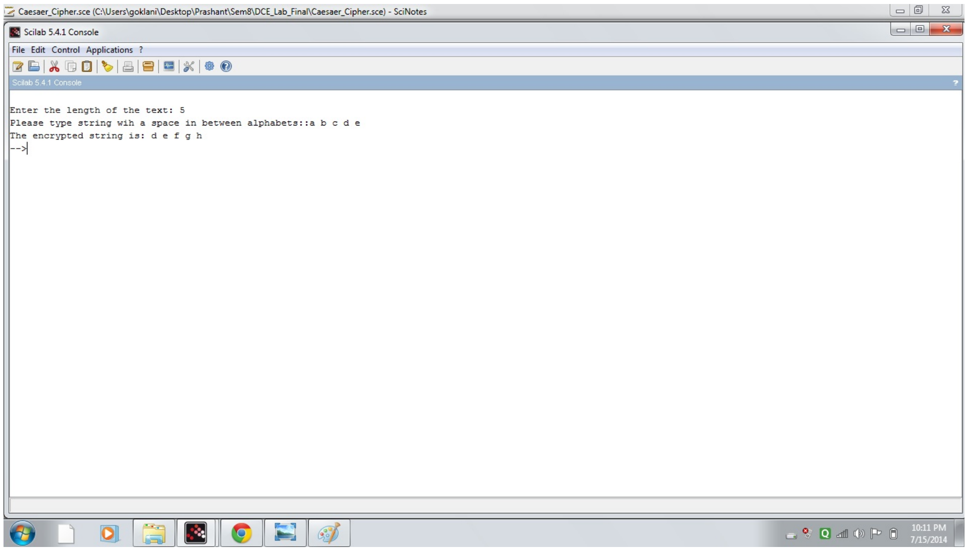
```
        M1in=i;
        break;
        end
end
for i = 1:10
    if modulo(((M2*i)-1),m2) == 0 then .....................................//Calculating M2inverse
        M2in=i;
        break;
        end
end
for i = 1:10
    if modulo(((M3*i)-1),m3) == 0 then .....................................//Calculating M3inverse
        M3in=i;
        break;
        end
end
x=modulo(((a1*M1*M1in)+(a2*M2*M2in)+(a3*M3*M3in)),M);//Solution of equations
printf("\nThe solution is x=%d",x);// Output: The solution for the set of equations
//Output for ex. x=26
```

Experiment: 7

To implement Ceaser Cipher Algorithm

Scilab code Solution 7.07 CCA

```
//OS: Windows 7
//Scilab Version: Scilab 5.4.1
clc;
clear all;
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)
//Input ex n=5
t=tokens(input(”Please type string wih a space in between alphabets:”,”string”));//Input: Taking the string to be encoded
//Inpu ex. t=a b c d e
printf(”The encrypted string is: ”);//Output: The encrypted string
for i = 1:n
   c(i)=ascii(t(i))+3;//Caeser Cipher encoding with offset=3
```


Caesaer_Cipher.sce (C:\Users\goklani\Desktop\Prashant\Sem8\DCE_Lab_Final\Caesaer_Cipher.sce) - SciNotes
Scilab 5.4.1 Console
File Edit Control Applications ?
Scilab 5.4.1 Console
10:11 PM
7/15/2014

```
Enter the length of the text: 5
Please type string wih a space in between alphabets::a b c d e
The encrypted string is: d e f g h
-->
```

Figure 7.1: CCA

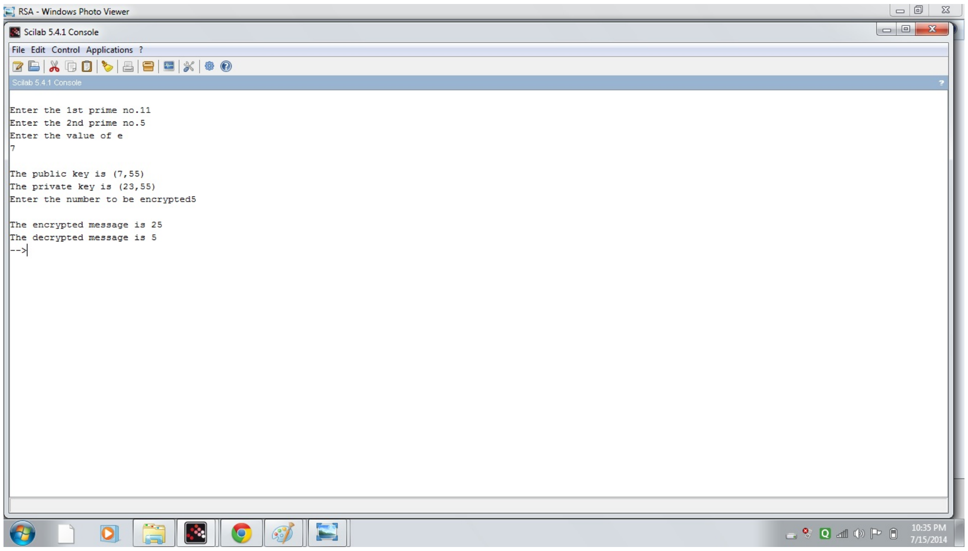
```
    c1(i)=asciimat(c(i));
    printf("%.c ",c1(i));//Printing the encoded word
end
//Output for ex. d e f g h
```

Experiment: 8

To implement RSA Algorithm

Scilab code Solution 8.08 RSA

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



```
Enter the 1st prime no.11
Enter the 2nd prime no.5
Enter the value of e
7

The public key is (7,55)
The private key is (23,55)
Enter the number to be encrypted5

The encrypted message is 25
The decrypted message is 5
-->
```

Figure 8.1: RSA

```
    if z == 1 then
break;
end
end
 printf(”\nThe public key is (%.d”,e);//Output: The public key is (e,n)
 //Output for ex. public key (7,55)
 printf(”,%.d)”,n);
  printf(”\nThe private key is (%.d”,i);//Output: The private key is (i,n)
  //Output ex. private key (23,55)
 printf(”,%.d)”,n);
 m=input(”Enter the number to be encrypted”);//Input: Taking the message to be encrypted
 //Input ex. 5
a=m^e;
c=modulo(a,n);
printf(”\nThe encrypted message is %.d ”,c);//Output: Printing the encrypted message
//Output for ex. 25
```

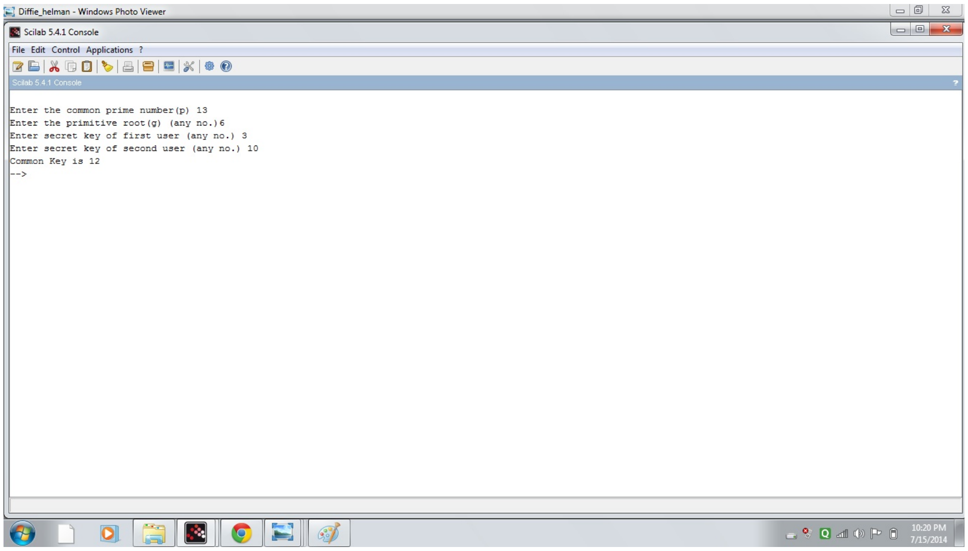
```
b=c^i;
t=modulo(b,n);
printf("\nThe decrypted message is %.d ",m);//Output : Decrypted Message
//Output for ex. 5
```

Experiment: 9

To implement Diffie-Hellman Key exchange

Scilab code Solution 9.09 DIFFIE

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



Diffie_helman - Windows Photo Viewer
Scilab 5.4.1 Console
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Scilab 5.4.1 Console
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```
Enter the common prime number(p) 13
Enter the primitive root(g) (any no.)6
Enter secret key of first user (any no.) 3
Enter secret key of second user (any no.) 10
Common Key is 12
-->
```

Figure 9.1: DIFFIE

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