Scilab Manual for Computer Communication Networks by Dr Sujata Shekhar Kulkarni Others Spit Mumbai[1]

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Experiment: 1

HAMMING CODE

Scilab code Solution 1.1 Hamming code for error detection and correction

```
1  //Note: Details of scilab software version and OS
       version used:
2  //Tested on OS: Ubuntu 14.04 LTS, 64 bit
3  //Scilab version: 5.5.0 (Tested on 64 bit version)
4  //Program Title: Study and calculate HAMMING CODE
       GENERATION AND CORRECTION
5  clear;
6  clc;
7  clear all;
8  close;
9  x=input('Enter 8 bit data : ');
10 p=[0 0 0 0];
11 p1=[0 0 0 0];
12 error_pos=0;
13 d=[p(1) p(2) x(1) p(3) x(2) x(3) x(4) p(4) x(5) x(6)
       x(7) x(8)];
14 p(1)=modulo((d(1)+d(3)+d(5)+d(7)+d(9)+d(11)),2);
15 p(2)=modulo((d(2)+d(3)+d(6)+d(7)+d(10)+d(11)),2);
16 p(3)=modulo((d(4)+d(5)+d(6)+d(7)+d(12)),2);
17 p(4)=modulo((d(8)+d(9)+d(10)+d(11)+d(12)),2);
```

```
18 d=[p(1) p(2) x(1) p(3) x(2) x(3) x(4) p(4) x(5) x(6)
       x(7) x(8)];
19 disp('Hamming code is : ');
20 disp(d);
21 d1=input('Enter 12 bit received data : ');
22 p1(1)=modulo((d1(1)+d1(3)+d1(5)+d1(7)+d1(9)+d1(11))
      ,2);
23 p1(2)=modulo((d1(2)+d1(3)+d1(6)+d1(7)+d1(10)+d1(11))
      ,2);
24 p1(3)=modulo((d1(4)+d1(5)+d1(6)+d1(7)+d1(12)),2);
25 p1(4)=modulo((d1(8)+d1(9)+d1(10)+d1(11)+d1(12)),2);
26 //disp("p is:");
27 //disp(p);
28 for i=1:4
29     if p1(i)==1 then
30        error_pos= error_pos+(2^(i-1) );
31     end
32 end
33 disp('error is in bit position-');
34 disp(error_pos);
35
36 d2=bitxor(d,d1);
37 disp('correct codeword is-');
38 d3=bitxor(d1,d2);
39 disp(d3);
40
41
42
43 //INPUT
44 //Enter 8 bit data[1 1 0 0 1 1 0 0]
45 //Enter 12 bit received data[ 1 1 1 1 1 0 0 0 1 1 0
      0]
46
47 //OUTPUT
48 //Enter 8 bit data : [1 1 0 0 1 1 0 0 ]
49 //
50 // Hamming code is :
51 //
```

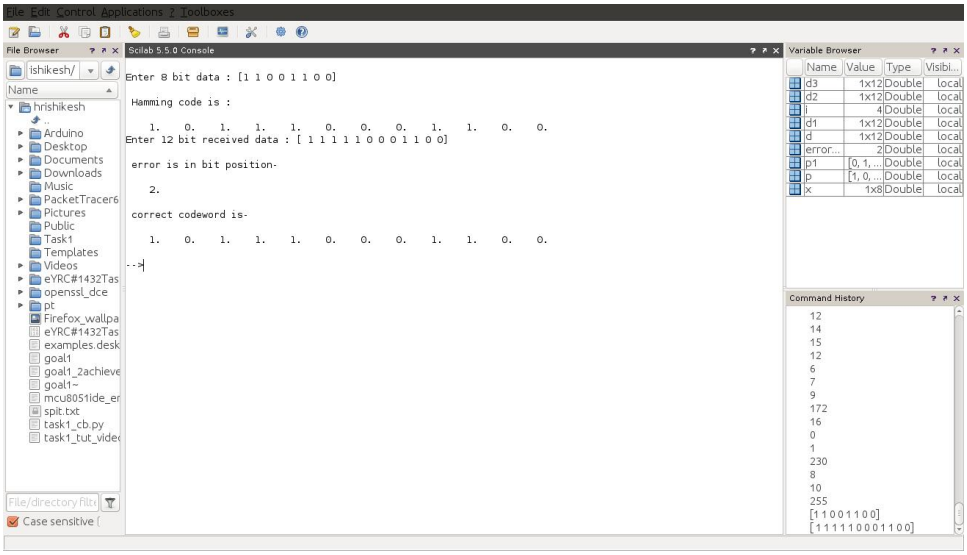


Figure 1.1: Hamming code for error detection and correction

```
52 //     1.     0.     1.     1.     1.     0.     0.     0.
       1.     1.     0.     0.
53 //Enter 12 bit received data : [1 1 1 1 1 0 0 0 1 1
   0 0 ]
54 //
55 // error is in bit position-
56 //
57 //     2.
58 //
59 // correct codeword is-
60 //
61 //     1.     0.     1.     1.     1.     0.     0.     0.
       1.     1.     0.     0.
62 //
```

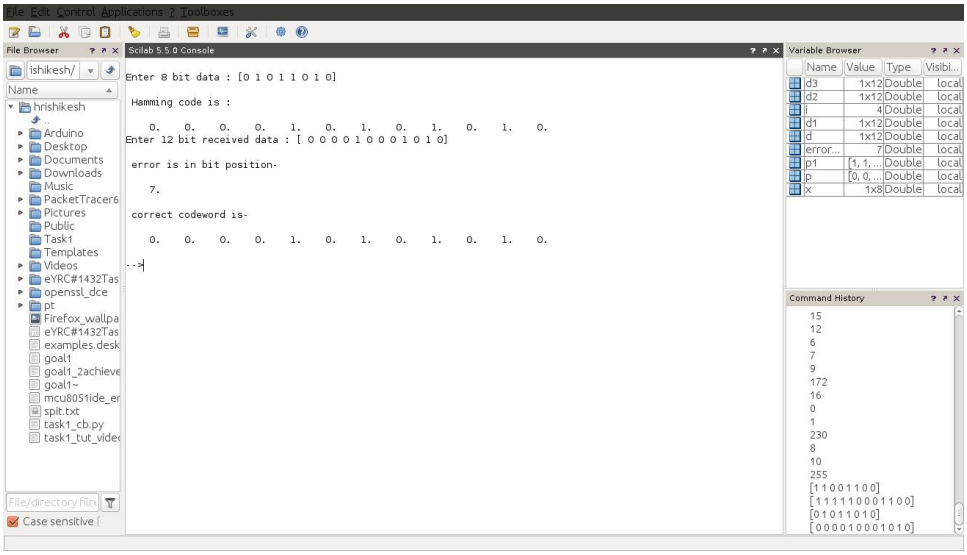


Figure 1.2: Hamming code for error detection and correction

Experiment: 2

IP CHECKSUM

Scilab code Solution 2.2 Calculation of IP Header Checksum

```
1  //Note: Details of scilab software version and OS
       version used:
2  //Tested on OS: Ubuntu 14.04 LTS, 64 bit
3  //Scilab version: 5.5.0 (Tested on 64 bit version)
4  //Program Title: HEADER CHECKSUM OF INTERNET
       PROTOCOL(IP)
5  clear;
6  clc;
7  ve = input('Enter the version number ')
8  hlen = input('Enter header length ')
9  ds = input('Enter DS ')
10 tl = input('Enter the total length ')
11 inum = input('Enter the identification number ')
12 flag = input('Enter Flag bits ')
13 frag = input('Enter Fragmentation offset bits ')
14 ttl =input('Enter Time to Live bits')
15 prot = input('Enter Protocol Bits')
16 hech = input('Enter Header checksum bits ')
17 sip1 =input('Enter the 1st part of Source IP : ')
```

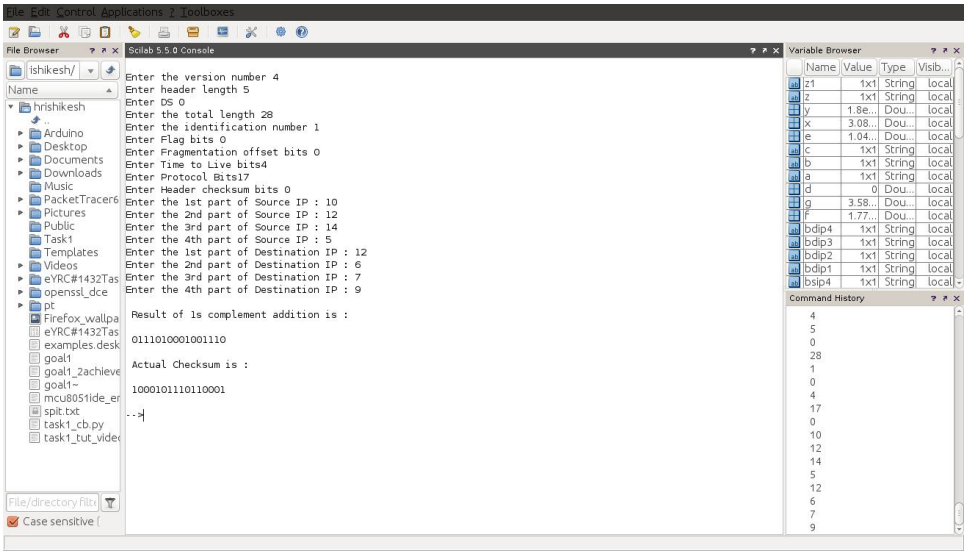


Figure 2.1: Calculation of IP Header Checksum

```
18 sip2 =input('Enter the 2nd part of Source IP : ')
19 sip3 =input('Enter the 3rd part of Source IP : ')
20 sip4 =input('Enter the 4th part of Source IP : ')
21 dip1 =input('Enter the 1st part of Destination IP :
     ')
22 dip2 =input('Enter the 2nd part of Destination IP :
     ')
23 dip3 =input('Enter the 3rd part of Destination IP :
     ')
24 dip4 =input('Enter the 4th part of Destination IP :
     ')
25
26 bver=dec2bin(ve,4);
27 bhlen=dec2bin(hlen,4);
28 bds=dec2bin(ds,8);
29 btl=dec2bin(tl,16);
30 binum=dec2bin(inum,16);
31 bflag=dec2bin(flag,3);
32 bfrag=dec2bin(frag,13);
33 bttl=dec2bin(ttl,8);
```

```
34 bprot=dec2bin(prot,8);
35 bhech=dec2bin(hech,16);
36 bsip1=dec2bin(sip1,8);
37 bsip2=dec2bin(sip2,8);
38 bsip3=dec2bin(sip3,8);
39 bsip4=dec2bin(sip4,8);
40 bdip1=dec2bin(dip1,8);
41 bdip2=dec2bin(dip2,8);
42 bdip3=dec2bin(dip3,8);
43 bdip4=dec2bin(dip4,8);
44
45 a=string(bver);
46 b=string(bhlen);
47 c=string(bds);
48 d=strcat([a,b,c]);//line 1
49
50 f=bin2dec(d);//line 1 dec
51 g=f+tl+inum+hech;
52 a=string(bflag);
53 b=string(bfrag);
54 c=strcat(a,b);
55
56 d=bin2dec(c);
57 a=string(bttl);
58 b=string(bprot);
59 c=strcat([a,b]);
60
61 e=bin2dec(c);
62 g=g+d+e;
63
64 a=string(bsip1);
65 b=string(bsip2);
66 c=strcat([a,b]);
67 x=bin2dec(c);
68 a=string(bsip3);
69 b=string(bsip4);
70 c=strcat([a,b]);
71 y=bin2dec(c);
```

```
g=g+x+y;

a=string(bdip1);
b=string(bdip2);
c=strcat([a,b]);
x=bin2dec(c);
a=string(bdip3);
b=string(bdip4);
c=strcat([a,b]);
y=bin2dec(c);

g=g+x+y;

z=dec2bin(g,16);
disp("Result of 1s complement addition is : ");
disp(z);
g=bitxor(g,65535);
z1=dec2bin(g,16);
disp("Actual Checksum is : ");
disp(z1);

//INPUT
//Enter the version number 4
//Enter header length 5
//Enter DS 0
//Enter the total length 28
//Enter the identification number 1
//Enter Flag bits 0
//Enter Fragmentation offset bits 0
//Enter Time to Live bits4
//Enter Protocol Bits17
//Enter Header checksum bits 0
//Enter the 1st part of sip10
//Enter the 2nd part of sip12
//Enter the 3rd part of sip14
//Enter the 4th part of sip5
//Enter the 1st part of dip12
//Enter the 2nd part of dip6
```

```
110 //Enter the 3rd part of dip7
111 //Enter the 4th part of dip9
112 //
113 // OUTPUT
114 //Result of 1s complement addition is :
      0111010001001110
115 //
116 // Actual checksum-1000101110110001
```

Experiment: 3

SHORTEST PATH DISTANCE ALGORITHM

Scilab code Solution 3.3 Study and calculate shortest path distance using Dijkstras Algorithm

```
1 //Note: Details of scilab software version and OS
     version used:
2 //Tested on OS: Ubuntu 14.04 LTS, 64 bit
3 //Scilab version: 5.5.0 (Tested on 64 bit version)
4 //Program Title: Study and calculate shortest path
     distance using Dijkstra's Algorithm
5 clear;
6 clc;
7 printf("B . .\n. .  .\n .  .  .\n  .
     .\n  .  A.....D\n  .  .  ..\n  .
      .  . .\n  .  .  .  .  \n  .  .
       .\n  .. .  .\n  C.....E")
8 //Topology
9 // B . .
10 //. .  .
11 // .  .  .
12 //  .  .  .
13 //  .  A.....D
```

```
14 //     .     .      ..
15 //      .    .     . .
16 //       .   .    .   .
17 //        . .  .    .
18 //         .. .     .
19 //           C.....E
20 // Here Node A is the source node
21 disp('Here Node A is the source node');
22 ds=input('select the destination node from b c d e :
       ','s');//a is the source node
23 d1=input('enter  the distance from a-b: ');//metric
      from respective node
24 d2=input('enter  the distance from a-c: ');
25 d3=input('enter  the distance from a-d: ');
26 d5=input('enter  the distance from b-c: ');
27 d6=input('enter  the distance from b-d: ');
28 d7=input('enter  the distance from c-e: ');
29 d8=input('enter  the distance from d-e: ');
30 d9=input('enter  the distance from c-d: ');
31 if(ds=='b')
32     disp('There are 6 possible path and the shortest
           path is ');//paths available and the
         shortest path alongwith intermediate node for
           b
33     b1=d1;
34     b2=d2+d5;
35     b3=d3+d6;
36     b4=d3+d8+d7+d5;
37     b5=d3+d9+d5;
38     b6=d2+d9+d6;
39     if b1<b2& b1<b3& b1<b4& b1<b5& b1<b6
40         disp('Path from a to b');
41     else
42         if b2<b3& b2<b4& b2<b5& b2<b6
43             disp('Path from a to b via c');
44         else
45             if b3<b4& b3<b5& b3<b6
46             disp('Path from a to b via d');
```

```
47          else
48              if b4<b5& b4<b6
49                  disp('Path from a to b via d - e - c
                        ');
50              else
51                  if b5<b6
52                  disp('Path from a to b via d - c');
53              else
54                  disp('Path from a to b via c - d');
55              end
56          end
57      end
58  end
59  end
60  end
61  if(ds=='c')
62      disp('There are 4 possible path and the shortest
            path is');//paths available and the shortest
            path alongwith intermediate node for c
63      c1=d2;
64      c2=d1+d5;
65      c3=d3+d9;
66      c4=d3+d8+d7;
67      if c1<c2& c1<c3& c1<c4
68          disp('Path from a to c');
69      else
70          if c2<c3& c2<c4
71              disp('Path from a to c via b');
72          else
73              if c3<c4
74              disp('Path from a to c via d');
75          else
76              disp('Path from a to c via d - e');
77          end
78      end
79  end
80  end
81  if(ds=='e')
```

```
82      disp('There are 5 possible path and the shortest
            path is');//paths available and the shortest
            path alongwith intermediate node for e
83      e1=d3+d8;
84      e2=d2+d7;
85      e3=d1+d5+d7;
86      e4=d2+d9+d8;
87      e5=d3+d7+d9;
88      if e1<e2& e1<e3 & e1<e4& e1<e5
89          disp('Path from a to e via d');
90      else
91          if e2<e3 & e2<e4& e2<e5
92              disp('Path from a to e via c ');
93          else
94              if e3<e4& e3<e5
95                  disp('Path from a to e via b - c');
96              else
97                  if e4<e5
98                  disp('Path from a to e via c - d');
99              else
100                 disp('Path from a to e via d - c');
101             end
102         end
103     end
104 end
105 end
106 if(ds=='d')
107     disp('There are 6 possible path and the shortest
            path is ');//paths available and the
           shortest path alongwith intermediate node for
            b
108     x1=d3;
109     x2=d1+d6;
110     x3=d2+d9;
111     x4=d2+d7+d8;
112     x6=d1+d7+d5+d8;
113     x5=d1+d5+d9;
114     if x1<x2& x1<x3& x1<x4& x1<x5& x1<x6
```

```
115         disp('Path from a to d');
116     else
117         if x2<x3& x2<x4& x2<x5& x2<x6
118             disp('Path from a to d via b');
119         else
120             if x3<x4& x3<x5& x3<x6
121             disp('Path from a to d via c');
122         else
123             if x4<x5& x4<x6
124                 disp('Path from a to d via c - e ');
125             else
126                 if x5<x6
127                 disp('Path from a to d via b - c');
128             else
129                 disp('Path from a to d via b - c - e
                        ');
130             end
131         end
132     end
133 end
134 end
135 end
136
137
138
139 //INPUT
140 //select the destination node from b c d e : e
141 //enter  the distance from a-b: 1
142 //enter  the distance from a-c: 2
143 //enter  the distance from a-d: 1
144 //enter  the distance from b-c: 1
145 //enter  the distance from b-d: 2
146 //enter  the distance from c-e: 1
147 //enter  the distance from d-e: 2
148 //enter  the distance from c-d: 1
149 //
150 //OUTPUT
151 // There are 5 possible path and the shortest path
```

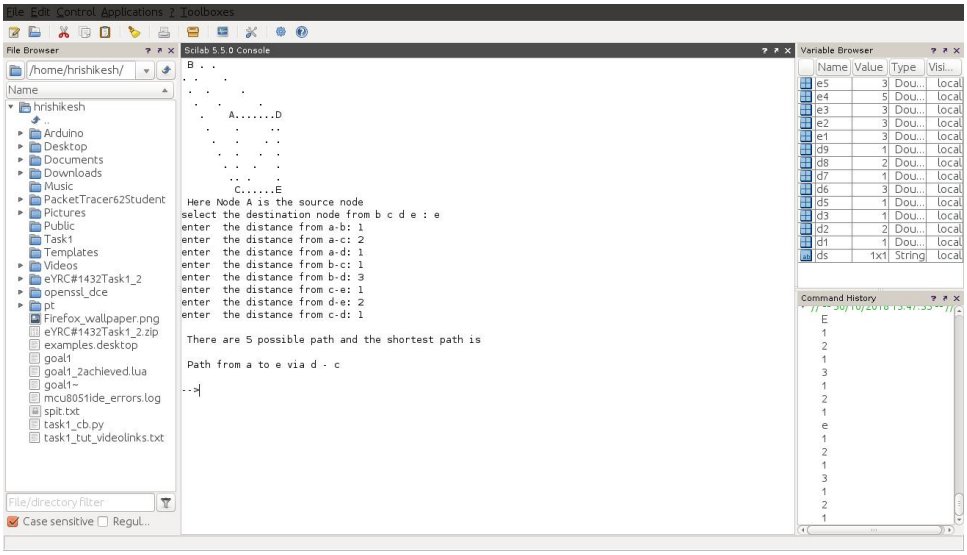


Figure 3.1: Study and calculate shortest path distance using Dijkstras Algorithm

```
    is
152 //
153 // Path from a to e via d - c
```

Experiment: 4

CALCULATE FIRST AND LAST ADDRESS OF GIVEN NETWORK

Scilab code Solution 4.4 To determine First address and Last address and Number of addresses in the block from any given classless address

```
1  //Note: Details of scilab software version and OS
       version used:
2  //Tested on OS: Ubuntu 14.04 LTS, 64 bit
3  //Scilab version: 5.5.0 (Tested on 64 bit version)
4  //Program Title: Classless Addressing: To determine
       First address,Last address and Number of
       addresses in the block from any given classless
       address.
5
6  clear ;
7  clc ;
8  ip1 =input('Enter the 1st part of ip : ')
9  ip2 =input('Enter the 2nd part of ip : ')
10 ip3 =input('Enter the 3rd part of ip : ')
11 ip4 =input('Enter the 4th part of ip : ')
12 n =8;
```

```
13 a3 = dec2bin (ip1 , n ) ;
14 a2 = dec2bin (ip2 , n ) ;
15 a1 = dec2bin (ip3 , n ) ;
16 a0 = dec2bin (ip4 , n ) ;
17
18 mask =input('Enter the prefix length/ CIDR :');
19
20 num_of_zeros =32 - mask ;
21 a = a3 + a2 + a1 + a0 ;
22 p1 = strsplit (a , mask ) ;
23 p = p1 (1) ;
24 for i = 1: num_of_zeros
25     p=p+ ' 0 ' ;
26 end
27 b = strsplit (p ,[8 16 24 ]);
28 b3 = bin2dec ( b (1) ) ;
29 b2 = bin2dec ( b (2) ) ;
30 b1 = bin2dec ( b (3) ) ;
31 b0 = bin2dec ( b (4) ) ;
32
33 printf ( "\n a)Dotted Decimal notation of first
      address :    %d . %d . %d . %d / %d" ,b3 , b2 ,
      b1 , b0 ,mask) ;
34
35 num_of_ones =32 - mask ;
36 a = a3 + a2 + a1 + a0 ;
37 p1 = strsplit (a , mask ) ;
38 p = p1 (1) ;
39 for i = 1: num_of_ones
40     p=p+ ' 1 ' ;
41 end
42 b = strsplit (p ,[8 16 24 ]);
43 b3 = bin2dec ( b (1) ) ;
44 b2 = bin2dec ( b (2) ) ;
45 b1 = bin2dec ( b (3) ) ;
46 b0 = bin2dec ( b (4) ) ;
47
48 printf ( "\n b)Dotted Decimal notation of last
```

```
    address   :    %d . %d . %d . %d / %d" ,b3 , b2 ,
    b1 , b0 ,mask) ;
49
50 num_of_addresses = 2^(32-mask);
51 printf ( "\n c) The number addresses is %d . " ,
    num_of_addresses ) ;
52
53
54 ////INPUT
55 //Enter the 1st part of ip : 167
56 //Enter the 2nd part of ip : 199
57 //Enter the 3rd part of ip : 170
58 //Enter the 4th part of ip : 82
59 //Enter the prefix length/ CIDR :27
60 //
61 //OUTPUT
62 //
63 //a)Dotted Decimal notation of first address :
    167 . 199 . 170 . 64 / 27
64 //b)Dotted Decimal notation of last address :    167
    . 199 . 170 . 95 / 27
65 //c) The number addresses is 32 .
```

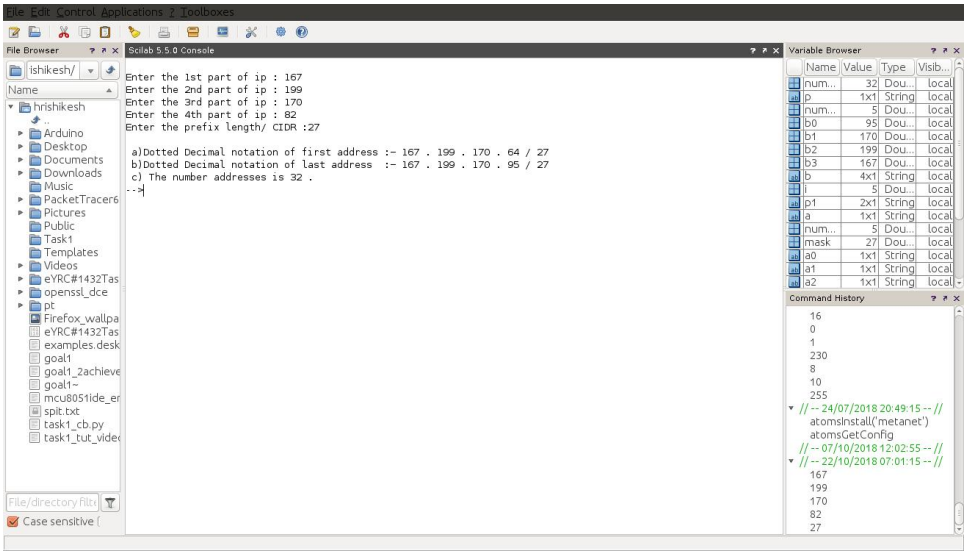


Figure 4.1: To determine First address and Last address and Number of addresses in the block from any given classless address

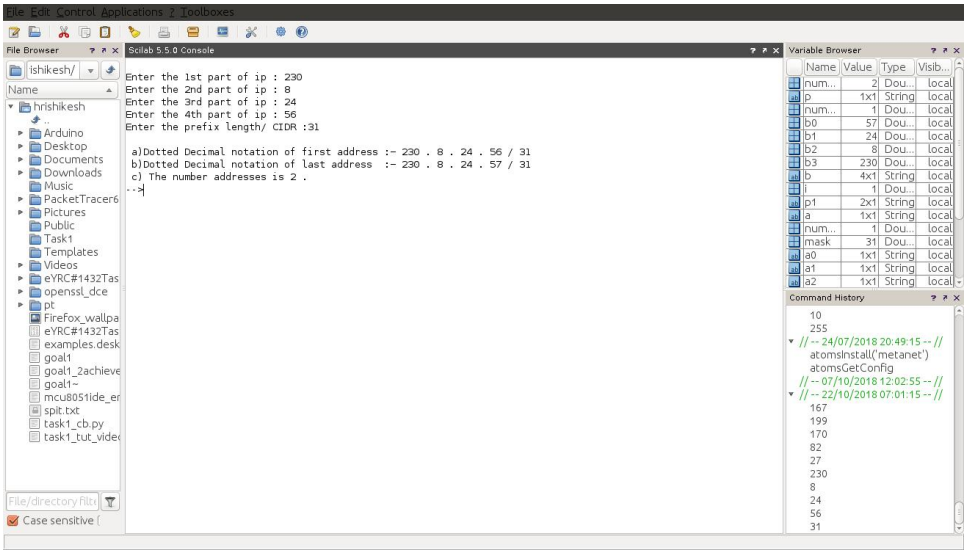


Figure 4.2: To determine First address and Last address and Number of addresses in the block from any given classless address

Experiment: 5

DESIGN OF SUBNET IN CLASSFUL IP ADDRESS

Scilab code Solution 5.5 To determine the Class and first and last address of the class Number of networks and Number of hosts for a given classful address

```
1 //Note: Details of scilab software version and OS
     version used:
2 //Tested on OS: Ubuntu 14.04 LTS, 64 bit
3 //Scilab version: 5.5.0 (Tested on 64 bit version)
4 //Program Title: Classful addressing: To determine
     the Class,1st & last address of the class, Number
      of networks and Number of hosts in the networks
     from any given classful address.
5 clear ;
6 clc ;
7 ip1 =input('Enter the 1st part of ip : ')
8 ip2 =input('Enter the 2nd part of ip : ')
9 ip3 =input('Enter the 3rd part of ip : ')
10 ip4 =input('Enter the 4th part of ip : ')
11 printf ( "Dotted Decimal notation of the IP address
     is :    %d . %d . %d . %d\n" ,ip1,ip2,ip3,ip4) ;
12
```

```
13 q=ip1;
14 n=0;
15 i=0;
16 if (q >=0 & q < 127) then
17     n=8;
18     i=1;
19     disp("The first byte is between 0 and 127.
          Therefore this is a Class A address.");
20     printf ("Network id: %d " ,ip1) ;
21     printf ("\nHost id: %d.%d.%d" ,ip2,ip3,ip4) ;
22     printf ("\nStart address : 0.0.0.0");
23     printf ("\nEnd address : 127.255.255.255");
24 elseif q==127 then
25     n=8;
26     i=1;
27     printf ("Network id: %d " ,ip1) ;
28     printf ("\nHost id: %d.%d.%d" ,ip2,ip3,ip4) ;
29     disp("The first byte is 127. Therefore it is a
          Class A address. This is used for Loopback
          addresses.");
30     printf ("\nStart address : 0.0.0.0");
31     printf ("\nEnd address : 127.255.255.255");
32 elseif (q >=128 & q <=191) then
33     n=16;
34     i=2;
35     disp("The first byte is between 128 and 191.
          Therefore this is a Class B address.");
36     printf ("Network id: %d.%d" ,ip1,ip2) ;
37     printf ("\nHost id: %d.%d" ,ip3,ip4) ;
38     printf ("\nStart address : 128.0.0.0");
39     printf ("\nEnd address : 191.255.255.255");
40 elseif ( q >=192 & q <=223) then
41     n=24;
42     i=3;
43     disp("The first byte is between 192 and 223.
          Therefore this is a Class C address.");
44     printf ("Network id: %d.%d.%d " ,ip1,ip2,ip3) ;
45     printf ("\nHost id: %d",ip4) ;
```

```
46      printf ("\nStart address : 192.0.0.0");
47      printf ("\nEnd address : 223.255.255.255");
48  elseif ( q >=224 & q <=239) then
49      disp("The first byte is between 224 and 239.
            Therefore this is a Class D address.");
50      printf ("\nStart address : 224.0.0.0");
51      printf ("\nEnd address : 239.255.255.255");
52  elseif (q >=240 & q <=255) then
53      disp("The first byte is between 240 and 255.
            Therefore this is a Class E address.");
54      printf ("\nStart address : 240.0.0.0");
55      printf ("\nEnd address : 255.255.255.255");
56  end
57
58
59  if n~=0 then
60      printf ("\nNumber of Networks %d" ,(2^(n-i))) ;
61      printf ("\nNumber of Hosts %d" ,(2^(32-n))-2) ;
62  end
63
64
65  //INPUT
66  //
67  //Enter the 1st part of ip : 172
68  //Enter the 2nd part of ip : 16
69  //Enter the 3rd part of ip : 0
70  //Enter the 4th part of ip : 1
71  //
72  //OUTPUT
73  //
74  //Dotted Decimal notation of the IP address is :
       172 . 16 . 0 . 1
75  //The first byte is between 128 and 191. Therefore
       this is a Class B address.
76  //Network id: 172.16
77  //Host id: 0.1
78  //Start address : 128.0.0.0
79  //End address : 191.255.255.255
```

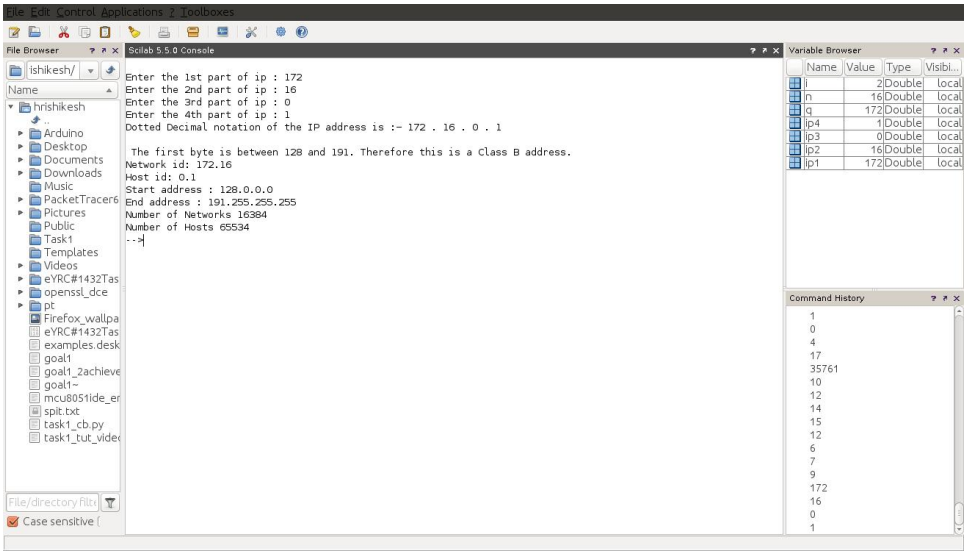


Figure 5.1: To determine the Class and first and last address of the class Number of networks and Number of hosts for a given classful address

```
80 //Number of Networks 16384
81 //Number of Hosts 65534
82 //
```

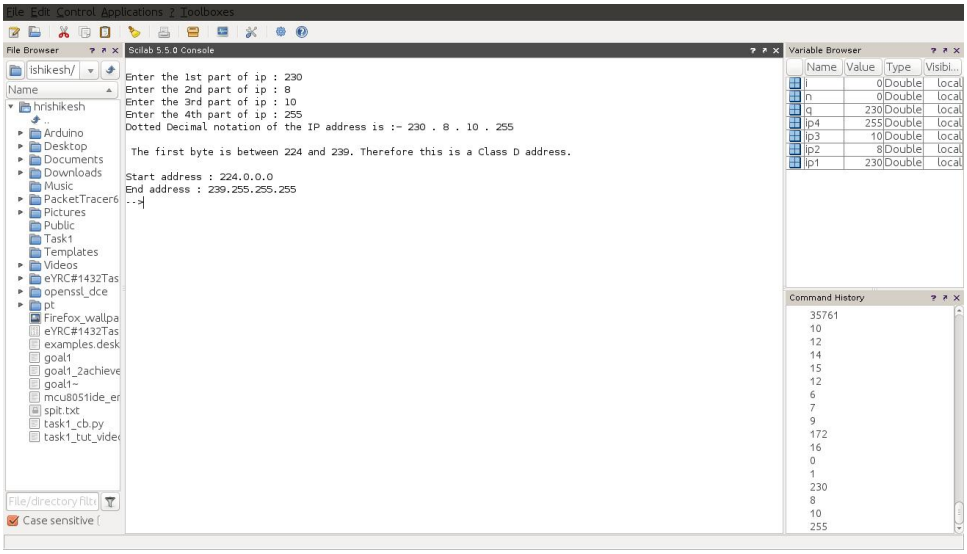


Figure 5.2: To determine the Class and first and last address of the class Number of networks and Number of hosts for a given classful address