Scilab Textbook Companion for Digital Logic Circuit Analysis & Design by Victor P. Nelson, H. Troy Nagle, J.david Irwin, Bill D. Carroll[1]

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Book Description

Title: Digital Logic Circuit Analysis & Design

Author: Victor P. Nelson, H. Troy Nagle, J.david Irwin, Bill D. Carroll

Publisher: Prentice Hall, Upper Saddle River, N.j. 07632

Edition: 1

Year: 1995

ISBN: 0134638948

Scilab numbering policy used in this document and the relation to the above book.

Exa Example (Solved example)

Eqn Equation (Particular equation of the above book)

AP Appendix to Example(Scilab Code that is an Appednix to a particular Example of the above book)

For example, Exa 3.51 means solved example 3.51 of this book. Sec 2.3 means a scilab code whose theory is explained in Section 2.3 of the book.

Contents

List of Scilab Codes

Chapter 1

Number System and Codes

Scilab code Exa 1.1 Addition of two binary numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.1
6 //Addition of two binary numbers
7
8 clc
9 clear
10
11 a='111101'
12 b='10111'
13 ad=bin2dec(a)        //Conversion of input1 to
      decimal format
14 bd=bin2dec(b)        //Conversion of input2 to
      decimal format
15 c=ad+bd              //Addition of 2 inputs in their
      decimal format
16 x=dec2bin(c)         //Decimal to binary conversion
17 disp("Sum of two binary numbers is",x)
```

Scilab code Exa 1.2 Addition of four binary numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.2
6 //Addition of four binary numbers
7
8 clc
9 clear
10
11 p='101101'
12 q='110101'
13 r='001101'
14 s='010001'
15 pd=bin2dec(p)        //Conversion of input1 to
      decimal format
16 qd=bin2dec(q)        //Conversion of input2 to
      decimal format
17 rd=bin2dec(r)        //Conversion of input3 to
      decimal format
18 sd=bin2dec(s)        //Conversion of input4 to
      decimal format
19 a=pd+qd              //Addition of first 2 input in
      their decimal format
20 b=rd+sd              //Addition of next 2 input in
      their decimal format
21 c=a+b                //Addition of two answers
      obtained from the additions of 4 inputs
22 x=dec2bin(c)         //Decimal to binary conversion
23 disp("Sum of four binary numbers is",x)
```

Scilab code Exa 1.3 Addition of four binary numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.3
6 //Addition of four binary numbers
7
8 clc
9 clear
10
11 p='101101'
12 q='110101'
13 r='001101'
14 s='010001'
15 pd=bin2dec(p)         //Conversion of input1 to
      decimal format
16 qd=bin2dec(q)         //Conversion of input2 to
      decimal format
17 rd=bin2dec(r)         //Conversion of input3 to
      decimal format
18 sd=bin2dec(s)         //Conversion of input4 to
      decimal format
19 a=pd+qd+rd+sd         //Addition of 4 inputs in their
      decimal format
20 x=dec2bin(a)          //Decimal to binary conversion
21 disp("Sum of four binary numbers is",x)
```

Scilab code Exa 1.4 Subtraction of two binary numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.4
6 //Subtraction of two binary numbers
7
8 clc
9 clear
10
11 a='1001101'
12 b='10111'
13 ad=bin2dec(a)          //Conversion of input1 to
      decimal format
14 bd=bin2dec(b)          //Conversion of input2 to
      decimal format
15 c=ad-bd                //Subtraction of 2 inputs in
      their decimal format
16 x=dec2bin(c)           //Decimal to binary conversion
17 disp("Difference between two binary numbers is",x)
```

Scilab code Exa 1.5 `Multiplication of two binary numbers`

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.5
6 //Multiplication of two binary numbers
7
8 clc
9 clear
10
```

```
11 a='10111'
12 b='1010'
13 ad=bin2dec(a)        //Conversion of input1 to
      decimal format
14 bd=bin2dec(b)        //Conversion of input2 to
      decimal format
15 c=ad*bd              //Multiplication of 2 inputs in
      their decimal format
16 x=dec2bin(c)         //Decimal to binary conversion
17 disp("Product of two binary numbers is",x)
```

Scilab code Exa 1.6 Division of two binary numbers

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.6
6  //Division of two binary numbers
7
8  clc
9  clear
10
11 a='1110111'
12 b='1001'
13 ad=bin2dec(a)        //Conversion of input1 to
      decimal format
14 bd=bin2dec(b)        //Conversion of input2 to
      decimal format
15 r=modulo(ad,bd)      //Finding the remainder using
      modulo function
16 c=ad/bd              //Division of 2 inputs in their
      decimal format
17 q=floor(c)           //Finding the quotient using
```

```
    floor function
18 quo=dec2bin(q)       //Decimal to binary conversion
19 rem=dec2bin(r)       //Decimal to binary conversion
20 disp("The quotient is",quo)
21 disp("The remainder is",rem)
```

Scilab code Exa 1.7 Addition of two octal numbers

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.7
6  //Addition of two octal numbers
7
8  clc
9  clear
10
11 a='4163'
12 b='7520'
13 ad=oct2dec(a)        //Conversion of input1 to
       decimal format
14 bd=oct2dec(b)        //Conversion of input2 to
       decimal format
15 c=ad+bd              //Addition of 2 inputs in their
       decimal format
16 x=dec2oct(c)         //Decimal to octal conversion
17 disp("Sum of two octal numbers is",x)
```

Scilab code Exa 1.8 Subtraction of two octal numbers

```
1  //Book      Digital Logic Circuit Analysis and Design
```

```
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.8
6 //Subtraction of two octal numbers
7
8 clc
9 clear
10
11 a='6204'
12 b='5173'
13 ad=oct2dec(a)        //Conversion of input1 to
      decimal format
14 bd=oct2dec(b)        //Conversion of input2 to
      decimal format
15 c=ad-bd              //Subtraction of 2 inputs in
      their decimal format
16 x=dec2oct(c)         //Decimal to octal conversion
17 disp("Difference between two octal numbers is",x)
```

Scilab code Exa 1.9 Multiplication of two octal numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.9
6 //Multiplication of two octal numbers
7
8 clc
9 clear
10
11 a='4167'
```

```
12 b='2503'
13 ad=oct2dec(a)        //Conversion of input1 to
      decimal format
14 bd=oct2dec(b)        //Conversion of input2 to
      decimal format
15 c=ad*bd              //Multiplication of 2 inputs in
      their decimal format
16 x=dec2oct(c)         //Decimal to octal conversion
17 disp("Product of two octal numbers is",x)
```

Scilab code Exa 1.10 Division of two octal numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.10
6 //Division of two octal numbers
7
8 clc
9 clear
10
11 a='4163'
12 b='25'
13 ad=oct2dec(a)        //Conversion of input1 to
      decimal format
14 bd=oct2dec(b)        //Conversion of input2 to
      decimal format
15 r=modulo(ad,bd)      //Finding the remainder using
      modulo function
16 c=ad/bd              //Division of 2 inputs in their
      decimal format
17 q=floor(c)           //Finding the quotient using
      floor function
```

```
18 quo=dec2oct(q)       //Decimal to octal conversion
19 rem=dec2oct(r)       //Decimal to octal conversion
20 disp("The quotient is",quo)
21 disp("The remainder is",rem)
```

Scilab code Exa 1.11 Addition of two hexadecimal numbers

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.11
6  //Addition of two hexadecimal numbers
7
8  clc
9  clear
10
11 a='2A58'
12 b='71D0'
13 ad=hex2dec(a)        //Conversion of input1 to
       decimal format
14 bd=hex2dec(b)        //Conversion of input2 to
       decimal format
15 c=ad+bd              //Addition of 2 inputs in their
       decimal format
16 x=dec2hex(c)         //Decimal to hexadecimal
       conversion
17 disp("Sum of two hexadecimal numbers is",x)
```

Scilab code Exa 1.12 Subtraction of two hexadecimal numbers

```
1  //Book      Digital Logic Circuit Analysis and Design
```

```
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.12
6 //Subtraction of two hexadecimal numbers
7
8 clc
9 clear
10
11 a='9F1B'
12 b='4A36'
13 ad=hex2dec(a)          //Conversion of input1 to
      decimal format
14 bd=hex2dec(b)          //Conversion of input2 to
      decimal format
15 c=ad-bd                //Subtraction of 2 inputs in
      their decimal format
16 x=dec2hex(c)           //Decimal to hexadecimal
      conversion
17 disp("Difference between two hexadecimal numbers is"
      ,x)
```

Scilab code Exa 1.13 Multiplication of two hexadecimal numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.13
6 //Multiplication of two hexadecimal numbers
7
8 clc
9 clear
```

```
10
11 a='5C2A'
12 b='71D0'
13 ad=hex2dec(a)          //Conversion of input1 to
      decimal format
14 bd=hex2dec(b)          //Conversion of input2 to
      decimal format
15 c=ad*bd                //Multiplication of 2 inputs in
      their decimal format
16 x=dec2hex(c)           //Decimal to hexadecimal
      conversion
17 disp("Product of two hexadecimal numbers is",x)
```

Scilab code Exa 1.14 Division of two hexadecimal numbers

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.1
6 //Division of two hexadecimal numbers
7
8 clc
9 clear
10
11 a='27FCA'
12 b='3E'
13 ad=hex2dec(a)          //Conversion of input1 to
      decimal format
14 bd=hex2dec(b)          //Conversion of input2 to
      decimal format
15 r=modulo(ad,bd)        //Finding the remainder using
      modulo function
16 c=ad/bd                //Division of 2 inputs in their
```

```
    decimal format
17 q=floor(c)           //Finding the quotient using
    floor function
18 quo=dec2hex(q)       //Decimal to hexadecimal
    conversion
19 rem=dec2hex(r)       //Decimal to hexadecimal
    conversion
20 disp("The quotient is",quo)
21 disp("The remainder is",rem)
```

Scilab code Exa 1.15 Binary to Decimal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
    Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.15
6 //Binary to Decimal conversion
7
8 clc
9 clear
10
11 a='10100'
12 ad=bin2dec(a)          //Conversion of input to decimal
    format
13 disp("Decimal equivalent of the binary number is",ad
   )
```

Scilab code Exa 1.16 Octal to Decimal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
```

```
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.16
6 //Octal to Decimal conversion
7
8 clc
9 clear
10
11 a='274'
12 ad=oct2dec(a)          //Conversion of input to decimal
      format
13 disp("Decimal equivalent of the octal number is",ad)
```

Scilab code Exa 1.17 Binary to octal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.17
6 //Binary to octal conversion
7
8 clc
9 clear
10
11 //Binary to decimal conversion
12
13 bin=1101.011
14 d=modulo(bin,1)       //Separation of decimal part
     from integer part
15 d=d*10^10
16 a=floor(bin)          //Separation of integer part
```

```
    from decimal part
17  q=0                 //Intializing the power to 0
18  f=0                 //Initializing the integer part
    to 0
19  while(a>0)          //Conversion of binary input to
    decimal
20      r=modulo(a,10)
21      f=f+(2^q)*r
22      a=a/10
23      a=floor(a)
24      q=q+1
25  end
26  p=1                 //Initializing the column value
    of matrix w to 1
27  while(d>0)          //Entering the binary bits of
    decimal part into a matrix
28      e=modulo(d,2)
29      w(1,p)=e
30      d=d/10
31      d=floor(d)
32      p=p+1
33  end
34  z=0                 //Initializing decimal part to 0
35  for n=1:p-1         //Multiplying each bits with its
     corresponding positional value and adding
36      z=z+w(1,n)*(0.5)^(11-n)
37  end
38  z=z*10000
39  z=round(z)          //Rounding off the decimal part
40  z=z/10000
41  x=f+z
42
43  //Decimal to octal conversion
44
45  a=x
46  d=modulo(a,1)       //Separation of decimal part
    from integer part
47  a=floor(a)          //Separation of integer part
```

```
   from decimal part
48 b=0                  //Initializing the interger part
    to 0
49 q=0                  //Initializing the power to 0
50 while(a>0)           //Conversion of integer part to
   binary format
51     z=modulo(a,8)
52     b=b+(10^q)*z
53     a=a/8
54     a=floor(a)
55     q=q+1
56 end
57 s=0                  //Initializing the decimal part
   to zero
58 for i=1:10           //Conversion of decimal part to
   binary format
59     d=d*8
60     q=floor(d)
61     s=s+(q/(10^i))
62     if d>=1 then
63         d=modulo(d,1)
64     end
65 end
66 k=b+s                //Addition of integer and
   decimal part
67 disp("Octal equivalent of binary input",k)
```

Scilab code Exa 1.18 Hexadecimal to decimal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
    Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.18
```

```
6  //Hexadecimal to decimal conversion
7
8  clc
9  clear
10
11 hex='AF3.15'
12 h=strsplit(hex,".")     //Separation of decimal part
       and integer part
13 a=hex2dec(h(1))
14 d=strtod(h(2))
15 p=1                    //Initializing the column
       value of matrix w to 1
16 while(d>0)             //Entering the binary bits of
       decimal part into a matrix
17     e=modulo(d,10)
18     w(1,p)=e
19     d=d/10
20     d=floor(d)
21     p=p+1
22 end
23 z=0                    //Initializing decimal part to
       0
24 for n=1:p-1            //Multiplying each bits with
       its corresponding positional value and adding
25     z=z+w(1,n)*(1/16)^(p-n)
26 end
27 x=a+z
28 disp("Decimal equivalent of hexadecimal input",x)
```

Scilab code Exa 1.19 Decimal to octal conversion

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
```

```
4
5 //Chapter 1; Example 1.19
6 //Decimal to octal conversion
7
8 clc
9 clear
10
11 a=234
12 ao=dec2oct(a)        //Conversion of input to octal
     format
13 disp("Octal equivalent of the decimal number is",ao)
```

Scilab code Exa 1.20 Decimal to hexadecimal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
     Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.20
6 //Decimal to hexadecimal conversion
7
8 clc
9 clear
10
11 a=234
12 ah=dec2hex(a)        //Conversion of input to
     hexadecimal format
13 disp("Hexadecimal equivalent of the decimal number
     is",ah)
```

Scilab code Exa 1.21 Decimal to octal conversion

```
1 //Book     Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.21
6 //Decimal to octal conversion
7
8 clc
9 clear
10
11 a=0.1285
12 s=0                    //Initialising the decimal part
     to 0
13 for i=1:10             //Conversion of decimal part
     octal format
14     a=a*8
15     q=floor(a)
16     s=s+(q/(10^i))
17     if a>=1 then
18         a=modulo(a,1)
19     end
20 end
21 disp("Octal equivalent of decimal input",s)
```

Scilab code Exa 1.22 Decimal to binary conversion

```
1 //Book     Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.22
6 //Decimal to binary conversion
7
```

```
clc
clear

q=0
b=0

a=0.828125
s=0                    //Initialising the decimal part
   to 0
for i=1:10             //Conversion of decimal part to
   binary format
    a=a*2
    q=floor(a)
    s=s+(q/(10^i))
    if a>=1 then
        a=modulo(a,1)

    end
end
disp("Binary equivalent of decimal input",s)
```

Scilab code Exa 1.23 Base 9 to base 11 conversion

```
//Book      Digital Logic Circuit Analysis and Design
//Authors - Victor P.Nelson, H. Troy Nagle, J. David
    Irwin, Bill D. Carroll
//Scilab Version - 6.1.0 ; OS - Windows

//Chapter 1; Example 1.23
//Base 9 to base 11 conversion

clc
clear

//Base 9 to decimal conversion
```

```
12
13 a=18.6
14 d=modulo(a,1)        //Separation of decimal part
      from integer part
15 a=floor(a)          //Separation of integer part
      from decimal part
16 b=0                 //Initializing the interger part
       to 0
17 q=0                 //Initializing the power to 0
18 while(a>0)          //Conversion of integer part to
      decimal format
19     z=modulo(a,10)
20     b=b+(9^q)*z
21     a=a/10
22     a=floor(a)
23     q=q+1
24 end
25 s=0                 //Initializing the decimal part
      to zero
26 for i=1:10          //Conversion of decimal part to
      decimal format
27     d=d*10
28     q=floor(d)
29     s=s+(q/(9^i))
30     if d>=1 then
31         d=modulo(d,1)
32     end
33 end
34 k=b+s               //Addition of integer and
      decimal part
35
36 //Decimal to base 11 conversion
37
38 a=k
39 d=modulo(a,1)        //Separation of decimal part
      from integer part
40 a=floor(a)          //Separation of integer part
      from decimal part
```

```
41 b=0                    //Initializing the interger part
       to 0
42 q=0                    //Initializing the power to 0
43 while(a>0)             //Conversion of integer part to
      base 11
44     z=modulo(a,11)
45     b=b+(10^q)*z
46     a=a/11
47     a=floor(a)
48     q=q+1
49 end
50 s=0                    //Initializing the decimal part
      to zero
51 for i=1:10             //Conversion of decimal part to
      base 11
52     d=d*11
53     q=floor(d)
54     s=s+(q/(10^i))
55     if d>=1 then
56         d=modulo(d,1)
57     end
58 end
59 k=b+s                  //Addition of integer and
      decimal part
60 disp("Base 11 equivalent of base 9 input",k)
```

Scilab code Exa 1.24 Binary to octal conversion

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.24
6 //Binary to octal conversion
```

```
7
8  clc
9  clear
10
11 a=1011011.1010111
12 d=modulo(a,1)        //Separation of decimal part
      from integer part
13 d=d*10^9
14 a=floor(a)          //Separation of integer part
      from decimal part
15
16 //Grouping of integer part
17
18 q=1                 //Intializing the column value
      of matrix b to 1
19 while(a>0)          //Grouping the integer part of
      binary bit into 3 and entering it into a matrix b
20     r=modulo(a,1000)
21     b(1,q)=r
22     a=a/1000
23     a=floor(a)
24     q=q+1
25 end
26
27 //Conversion of grouped integer part to octal format
28
29 i=0                 //Initializing the integer part
      to 0
30 for m=1:q-1         //Multiplying each grouped bits
      with its corresponding positional value and
      adding
31     n=m-1
32     f=b(1,m)
33     t=1             //Intializing the column value
         of matrix w to 1
34     while(f>0)      //Entering the grouped binary
         bits into a matrix w
35       r=modulo(f,10)
```

```
36          w(1,t)=r
37          f=f/10
38          f=floor(f)
39          t=t+1
40      end
41      s=0                 //Initializing the grouped
           binary bits to 0
42      for m=1:t-1         //Multiplying each bits with its
           corresponding positional value and adding
43          c=m-1
44          s=s+w(1,m)*(2^c)
45      end
46      i=i+s*10^n
47  end
48
49  //Grouping of decimal part
50
51  q=1                     //Intializing the column value
       of matrix b to 1
52  while(d>0)              //Grouping the decimal part of
       binary bit into 3 and entering it into a matrix b
53      r=modulo(d,1000)
54      r=round(r)
55      b(1,q)=r
56      d=d/1000
57      d=floor(d)
58      q=q+1
59  end
60
61  //Conversion of grouped decimal part to octal format
62
63  j=0                     //Initializing the decimal part
       to 0
64  for m=1:q-1             //Multiplying each grouped bits
       with its corresponding positional value and
       adding
65      n=m-1
66      f=b(1,m)
```

```
67      t=1                 //Intializing the column value
           of matrix w to 1
68      while(f>0)          //Entering the grouped binary
           bits into a matrix w
69          r=modulo(f,10)
70          w(1,t)=r
71          f=f/10
72          f=floor(f)
73          t=t+1
74      end
75      s=0                 //Initializing the grouped
           binary bits to 0
76      for m=1:t-1         //Multiplying each bits with its
            corresponding positional value and adding
77          c=m-1
78          s=s+w(1,m)*2^c
79      end
80      j=j+s*10^n
81  end
82  j=j/10^(q-1)            //Converting to decimal part
83
84  //Addition of integer and decimal part
85
86  k=i+j
87  disp("Octal equivalent of binary input",k)
```

Scilab code Exa 1.25 Hexadecimal to octal conversion

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.25
6  //Hexadecimal to octal conversion
```

```
clc
clear

hex='AF.16C'
h=strsplit(hex,".")     //Separation of decimal part
   and integer part

//Converting the integer part to binary value

x=strsplit(h(1))        //Splitting the integer part
x=hex2dec(x)            //Conversion of hexadecimal
   value to decimal value
x=dec2bin(x)            //Conversion of decimal value
    to binary value
x=x(1)+x(2)             //Concatenation of string
a=strtod(x)             //Conversion of string to
   number

//Grouping of integer part

q=1                     //Intializing the column
   value of matrix b to 1
while(a>0)              //Grouping the integer part
   of binary bit into 3 and entering it into a
   matrix b
    r=modulo(a,1000)
    b(1,q)=r
    a=a/1000
    a=floor(a)
    q=q+1
end

//Conversion of grouped integer part to octal format

i=0                     //Initializing the integer
   part to 0
for m=1:q-1             //Multiplying each grouped
   bits with its corresponding positional value and
```

```
    adding
36      n=m-1
37      f=b(1,m)
38      t=1                     //Intializing the column
           value of matrix w to 1
39      while(f>0)              //Entering the grouped binary
            bits into a matrix w
40          r=modulo(f,10)
41          w(1,t)=r
42          f=f/10
43          f=floor(f)
44          t=t+1
45      end
46      s=0                     //Initializing the grouped
           binary bits to 0
47      for m=1:t-1             //Multiplying each bits with
           its corresponding positional value and adding
48          c=m-1
49          s=s+w(1,m)*(2^c)
50      end
51      i=i+s*10^n
52  end
53
54  //Converting the decimal part to binary value
55
56  y=strsplit(h(2))            //Splitting the decimal part
57  y=hex2dec(y)                //Conversion of hexadecimal
       value to decimal value
58  y=dec2bin(y)                //Conversion of decimal value
        to binary value
59  y=y(1)+y(2)+y(3)            //Concatenation of string
60  n=length(y)                 //Calculating the length of
       the string
61  n=n/3
62  d=strtod(y)                 //Conversion of string to
       number
63
64  //Grouping of decimal part
```

```
65
66 q=1                        //Intializing the column
      value of matrix b to 1
67 for j=1:n                  //Grouping the decimal part
      of binary bit into 3 and entering it into a
      matrix b
68     r=modulo(d,1000)
69     r=round(r)
70     b(1,q)=r
71     d=d/1000
72     d=floor(d)
73     q=q+1
74 end
75
76 //Conversion of grouped decimal part to octal format
77
78 j=0                         //Initializing the decimal
      part to 0
79 for m=1:q-1                 //Multiplying each grouped
      bits with its corresponding positional value and
      adding
80     n=m-1
81     f=b(1,m)
82     t=1                     //Intializing the column
         value of matrix w to 1
83     while(f>0)              //Entering the grouped binary
          bits into a matrix w
84         r=modulo(f,10)
85         w(1,t)=r
86         f=f/10
87         f=floor(f)
88         t=t+1
89     end
90     s=0                     //Initializing the grouped
         binary bits to 0
91     for m=1:t-1             //Multiplying each bits with
         its corresponding positional value and adding
92         c=m-1
```

```
93          s=s+w(1,m)*2^c
94      end
95      j=j+s*10^n
96  end
97  j=j/10^(q-1)            //Converting to decimal part
98
99  //Addition of integer and decimal part
100
101 k=i+j
102 disp("Octal equivalent of hexadecimal input",k)
```

Scilab code Exa 1.26 Determination of sign magnitude code

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.26
6  //Determination of sign magnitude code
7
8  clc
9  clear
10
11 N='-(13)'
12
13 //In binary
14
15 r=2                    //Since base 2
16 s=r-1
17 a=13
18 b=dec2bin(a)          //Conversion of decimal to binary
       format
19 disp("Sign-magnitude code of N in binary,",s)
20 disp(b)
```

```
21
22 //In decimal
23
24 r=10                    //Since base 10
25 s=r-1
26 disp("Sign-magnitude code of N in decimal",s)
27 disp(a)
```

Scilab code Exa 1.27 Twos complement of 01100101

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.27
6 //Twos complement of 01100101
7
8 clc
9 clear
10
11 N='01100101'
12 n=8                   //Number of bits
13 x=2^n
14 y=bin2dec(N)         //Conversion of binary value to
      decimal format
15 z=x-y                //Subtraction in decimal format
16 a=dec2bin(z)         //Conversion of decimal value to
      binary format
17 disp("Twos complement of 01100101",a)
```

Scilab code Exa 1.28 Twos complement of binary number and its verification

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.28
6  //Twos complement of binary number and its
       verification
7
8  clc
9  clear
10
11 //Twos complement of 11010100
12
13 N='11010100'
14 n=8                    //Number of bits
15 x=2^n
16 y=bin2dec(N)           //Conversion of binary value to
       decimal format
17 z=x-y                  //Subtraction in decimal format
18 a=dec2bin(z)           //Conversion of decimal value to
       binary format
19 disp("Twos complement of 11010100",a)
20
21 //Verification
22
23 b=y+z
24 q=0                    //Initializing the power to 0
25 d=0                    //Initializing the binary value
       to 0
26 for i=1:n              //Conversion of decimal value to
       binary format without carry
27     c=modulo(b,2)
28     d=d+(10^q)*c
29     b=b/2
30     b=floor(b)
31     q=q+1
32 end
```

```
33 if (d==0) then
34     disp("Twos complement of 11010100 is verified")
35 end
```

Scilab code Exa 1.29 Twos complement of 00101100

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.29
6 //Twos complement of 00101100
7
8 clc
9 clear
10
11 N='00101100'
12 n=8                  //Number of bits
13 x=2^n
14 y=bin2dec(N)         //Conversion of binary value to
      decimal format
15 z=x-y                //Subtraction in decimal format
16 a=dec2bin(z)         //Conversion of decimal value to
      binary format
17 disp("Twos complement of 00101100",a)
```

Scilab code Exa 1.30 Twos complement of 10110

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
```

```
4
5 //Chapter 1; Example 1.30
6 //Twos complement of 10110
7
8 clc
9 clear
10
11 N='10110'
12 n=8
13 x=2^n
14 y=bin2dec(N)        //Conversion of binary value to
     decimal format
15 z=x-y               //Subtraction in decimal format
16 a=dec2bin(z)        //Conversion of decimal value to
     binary format
17 disp("Twos complement of 10110",a)
```

Scilab code Exa 1.31 10s complement of decimal number

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
     Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.31
6 //10s complement of decimal number
7
8 clc
9 clear
10
11 N=40960
12 n=5                  //Number of digits
13 x=10^n
14 z=x-N               //Subtraction in decimal format
15 disp("10s complement of 40960",z)
```

Scilab code Exa 1.32 Twos complement of 01100101

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.32
6 //Twos complement of 01100101
7
8 clc
9 clear
10
11 N=01100101
12 n=8
13 q=1                  //Intializing the column value of
      matrix b to 1
14 for i=1:n            //Entering the bits into matrix
15     r=modulo(N,10)
16     b(1,q)=r
17     N=N/10
18     N=floor(N)
19     q=q+1
20 end
21
22 //Checking the first nonzero bit
23
24 f=0                  //Initializing the binary number
     to 0
25 for m=1:q-1
26     if b(1,m)==1 then
27         c=m-1
28         f=f+b(1,m)*10^c
29         k=m
```

```
30          break
31       end
32  end
33
34  //Complementing the remaining bits
35
36  for m=k+1:q-1
37      if b(1,m)==1 then
38          b(1,m)=0
39      else
40          b(1,m)=1
41      end
42      c=m-1
43      f=f+b(1,m)*10^c
44  end
45  disp("Twos complement of 01100101",f)
```

Scilab code Exa 1.33 Twos complement of 11010100

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.33
6  //Twos complement of 11010100
7
8  clc
9  clear
10
11 N=11010100
12 n=8
13 q=1                  //Intializing the column value of
       matrix b to 1
14 for i=1:n            //Entering the binary bits into a
```

```
      matrix
15    r=modulo(N,10)
16    b(1,q)=r
17    N=N/10
18    N=floor(N)
19    q=q+1
20  end
21
22  //Checking the first nonzero bit
23
24  f=0                  //Initializing the binary number
       to 0
25  for m=1:q-1
26      if b(1,m)==1 then
27          c=m-1
28          f=f+b(1,m)*10^c
29          k=m
30          break
31       end
32  end
33
34  //Complementing the remaining bits
35
36  for m=k+1:q-1
37      if b(1,m)==1 then
38          b(1,m)=0
39      else
40          b(1,m)=1
41      end
42      c=m-1
43      f=f+b(1,m)*10^c
44  end
45  disp("Twos complement of 11010100",f)
```

Scilab code Exa 1.34 Twos complement of 10110

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.34
6  //Twos complement of 10110
7
8  clc
9  clear
10
11 N=10110
12 n=8
13 q=1                  //Intializing the column value of
       matrix b to 1
14 for i=1:n            //Entering the binary bits into a
       matrix
15     r=modulo(N,10)
16     b(1,q)=r
17     N=N/10
18     N=floor(N)
19     q=q+1
20 end
21
22 //Checking the first nonzero bit
23
24 f=0                  //Initializing the binary number
     to 0
25 for m=1:q-1
26     if b(1,m)==1 then
27         c=m-1
28         f=f+b(1,m)*10^c
29         k=m
30         break
31      end
32 end
33
34 //complementing the remaining bits
```

```
35
36 for m=k+1:q-1
37     if b(1,m)==1 then
38         b(1,m)=0
39     else
40         b(1,m)=1
41     end
42     c=m-1
43     f=f+b(1,m)*10^c
44 end
45 disp("Twos complement of 10110",f)
```

Scilab code Exa 1.35 10s complement of 40960

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.35
6 //10s complement of 40960
7
8 clc
9 clear
10
11 N=40960
12 q=1                  //Intializing the column value of
      matrix b to 1
13 while N>0            //Entering the digits into a
     matrix
14     r=modulo(N,10)
15     b(1,q)=r
16     N=N/10
17     N=floor(N)
18     q=q+1
```

```
19 end
20
21 //Checking the first nonzero bit
22
23 f=0                  //Initializing the decimal number
       to 0
24 for m=1:q-1
25     if b(1,m)~=0
26         c=m-1
27         f=f+(10-b(1,m))*10^c
28         k=m          //Initializing the position of
               first nonzero bit
29         break
30      end
31 end
32
33 //Complementing the remaining bits
34
35 for m=k+1:q-1
36     c=m-1
37     f=f+(9-b(1,m))*10^c
38 end
39 disp("10s complement of 40960",f)
```

Scilab code Exa 1.36 Twos complement of 01100101

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.36
6 //Twos complement of 01100101
7
8 clc
```

```
clear

N='01100101'
n=8                    //Number of bits
a=bin2dec(N)           //Conversion of input to decimal
   format
f=bitcmp(a,n)          //Bitwise complement of decimal
   number
x=f+1                  //Adding 1 to the decimal number
s=dec2bin(x)           //Conversion of decimal number to
    binary format
disp("Twos complement of 01100101",s)
```

Scilab code Exa 1.37 Twos complement of 11010100

```
//Book      Digital Logic Circuit Analysis and Design
//Authors - Victor P.Nelson, H. Troy Nagle, J. David
    Irwin, Bill D. Carroll
//Scilab Version - 6.1.0 ; OS - Windows

//Chapter 1; Example 1.37
//Twos complement of 11010100

clc
clear

N='11010100'
n=8                    //Number of bits
a=bin2dec(N)           //Conversion of input to decimal
   format
f=bitcmp(a,n)          //Bitwise complement of decimal
   number
x=f+1                  //Adding 1 to the decimal number
s=dec2bin(x)           //Conversion of decimal number to
    binary format
```

```
17 disp("Twos complement of 11010100",s)
```

Scilab code Exa 1.38 10s complement of 40960

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.38
6  //10s complement of 40960
7
8  clc
9  clear
10
11 N=40960
12 q=1                  //Intializing the column value of
       matrix b to 1
13 while N>0            //Entering the digits into a
      matrix
14     r=modulo(N,10)
15     b(1,q)=r
16     N=N/10
17     N=floor(N)
18     q=q+1
19 end
20
21 //Complementing the each bits
22
23 f=0                  //Initializing the decimal number
       to 0
24 for m=1:q-1
25     c=m-1
26     f=f+(9-b(1,m))*10^c
27 end
```

```
28
29 //Adding 1 to the complemented number
30
31 x=f+1
32 disp("10s complement of 40960",x)
```

Scilab code Exa 1.39 Twos complement of plus or minus 1100101

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.39
6  //Twos complement of plus or minus 1100101
7
8  clc
9  clear
10
11 N='01100101'
12 n=8
13 x=2^n
14 y=bin2dec(N)          //Conversion of input to decimal
       format
15 a=x-y
16 q=1                   //Initializing the column value
       of matrix b to 1
17 for i=1:n             //Conversion of decimal value to
       binary format
18     z=modulo(a,2)
19     b(1,q)=z
20     a=a/2
21     a=floor(a)
22     q=q+1
23 end
```

```
24 s=b(1,q-1)          //Separating the sign bit
25 i=0                 //Initializing two's complement
     value to 0
26 for m=1:q-2         //Multiplying each bits with its
     corresponding positional value and adding
27     c=m-1
28     i=i+b(1,m)*10^c
29 end
30 disp("Twos complement of 1100101 is",s,i)
```

Scilab code Exa 1.40 Twos complement of plus or minus 110101

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.40
6 //Twos complement of plus or minus 110101
7
8 clc
9 clear
10
11 N='00110101'
12 n=8
13 x=2^n
14 y=bin2dec(N)         //Conversion of input to decimal
     format
15 a=x-y
16 q=1                 //Initializing the column value
     of matrix b to 1
17 for i=1:n           //Conversion of decimal value to
     binary format
18     z=modulo(a,2)
19     b(1,q)=z
```

```
20      a=a/2
21      a=floor(a)
22      q=q+1
23  end
24  s=b(1,q-1)          //Separating the sign bit
25  i=0                 //Initializing two's complement
       value to 0
26  for m=1:q-2         //Multiplying each bits with its
       corresponding positional value and adding
27      c=m-1
28      i=i+b(1,m)*10^c
29  end
30  disp("Twos complement of 110101",s,i)
```

Scilab code Exa 1.41 Twos complement of minus 13

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.41
6  //Twos complement of minus 13
7
8  clc
9  clear
10
11 N=13
12 n=8
13 x=2^n
14 a=x-N
15 q=1                 //Initializing the column value
       of matrix b to 1
16 for i=1:n           //Conversion of decimal value to
       binary format
```

```
17      z=modulo(a,2)
18      b(1,q)=z
19      a=a/2
20      a=floor(a)
21      q=q+1
22  end
23  s=b(1,q-1)          //Separating the sign bit
24  i=0                 //Initializing two's complement
       value to 0
25  for m=1:q-2         //Multiplying each bits with its
       corresponding positional value and adding
26      c=m-1
27      i=i+b(1,m)*10^c
28  end
29  disp("Twos complement of 13",s,i)
```

Scilab code Exa 1.42 Decimal representation of 1 1111010

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.42
6  //Decimal representation of 1 1111010
7
8  clc
9  clear
10
11 N='11111010'
12 n=8
13 x=2^n
14 y=bin2dec(N)        //Conversion of input to decimal
       format
15 a=x-y
```

```
16 q=1                  //Initializing the column value
      of matrix b to 1
17 for i=1:n            //Conversion of decimal value to
      binary format
18     z=modulo(a,2)
19     b(1,q)=z
20     a=a/2
21     a=floor(a)
22     q=q+1
23 end
24 s=b(1,q-1)          //Separating the sign bit
25 i=0                  //Initializing two's complement
      value to 0
26 for m=1:q-2         //Conversion of binary bits to
      decimal value
27     c=m-1
28     i=i+b(1,m)*(2^c)
29 end
30 if s==0 then
31     disp("Twos complement of (1,1111010) is",i)
32     disp("Therefore, decimal representation of
         (1,1111010) is",-i)
33 else
34     disp("Twos complement of (1,1111010) is",-i)
35     disp("Therefore, decimal representation of
         (1,1111010)",i)
36 end
```

Scilab code Exa 1.43 Addition of two decimal numbers using 5 bit 2s complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
     Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
```

```
5  //Chapter 1; Example 1.44
6  //Addition of two decimal numbers using 5 bit 2s
       complement
7
8  clc
9  clear
10
11 //Conversion of decimal inputs to 5-bit binary
       numbers
12
13 a=9
14 q=0                    //Initializing the power to 0
15 x=0                    //Initializing the binary value
       to 0
16 for i=1:5              //Conversion of decimal number to
       5-bit binary number
17     r=modulo(a,2)
18     x=x+(10^q)*r
19     a=a/2
20     a=floor(a)
21     q=q+1
22 end
23 b=5
24 q=0                    //Initializing the power to 0
25 y=0                    //Initializing the binary value
       to 0
26 for i=1:5              //Conversion of decimal number to
       5-bit binary number
27     r=modulo(b,2)
28     y=y+(10^q)*r
29     b=b/2
30     b=floor(b)
31     q=q+1
32 end
33
34 //Addition of two 5-bit binary number
35
36 q=0                    //Initializing the power to 0
```

```
37 a=0                  //Initializing the decimal value
      to 0
38 while(x>0)           //Conversion of binary value to
      decimal number
39      r=modulo(x,10)
40      a=a+(2^q)*r
41      x=x/10
42      x=floor(x)
43      q=q+1
44 end
45 q=0                  //Initializing the power to 0
46 b=0                  //Initializing the decimal value
      to 0
47 while(y>0)           //Conversion of binary value to
      decimal number
48      r=modulo(y,10)
49      b=b+(2^q)*r
50      y=y/10
51      y=floor(y)
52      q=q+1
53 end
54 c=a+b
55 q=1                  //Initializing the column value
      of matrix b to 1
56 for i=1:5            //Conversion of decimal value to
      binary format
57      z=modulo(c,2)
58      w(1,q)=z
59      c=c/2
60      c=floor(c)
61      q=q+1
62 end
63
64 //Conversion of binary value to decimal number
65
66 i=0                  //Initializing decimal value to 0
67 n=0                  //Initializing the number of bits
       to 0
```

```
for m=1:q-2          //Multiplying each bits with its
   corresponding positional value and adding
    c=m-1
    i=i+w(1,m)*(2^c)
    n=n+1
end
s=w(1,q-1)
disp("Sum of two decimal numbers is")
if s==0 then
    disp(i)
else
    c=2^n-i          //Two's complement of sum
    disp(-c)
end
```

Scilab code Exa 1.44 Addition of two decimal numbers using 5 bit 2s complement

```
//Book      Digital Logic Circuit Analysis and Design
//Authors - Victor P.Nelson, H. Troy Nagle, J. David
    Irwin, Bill D. Carroll
//Scilab Version - 6.1.0 ; OS - Windows

//Chapter 1; Example 1.44
//Addition of two decimal numbers using 5 bit 2s
   complement

clc
clear

//Conversion of decimal inputs to 5-bit binary
   numbers

a=12
q=0                  //Initializing the power to 0
x=0                  //Initializing the binary value
```

```
    to 0
for i=1:5           //Conversion of decimal number to
    5-bit binary number
    r=modulo(a,2)
    x=x+(10^q)*r
    a=a/2
    a=floor(a)
    q=q+1
end
b=7
q=0                 //Initializing the power to 0
y=0                 //Initializing the binary value
    to 0
for i=1:5           //Conversion of decimal number to
    5-bit binary number
    r=modulo(b,2)
    y=y+(10^q)*r
    b=b/2
    b=floor(b)
    q=q+1
end

//Addition of two 5-bit binary number

q=0                 //Initializing the power to 0
a=0                 //Initializing the decimal value
    to 0
while(x>0)          //Conversion of binary value to
    decimal number
     r=modulo(x,10)
    a=a+(2^q)*r
    x=x/10
    x=floor(x)
    q=q+1
end
q=0                 //Initializing the power to 0
b=0                 //Initializing the decimal value
    to 0
```

```
47 while(y>0)          //Conversion of binary value to
      decimal number
48     r=modulo(y,10)
49     b=b+(2^q)*r
50     y=y/10
51     y=floor(y)
52     q=q+1
53 end
54 c=a+b
55 q=1                 //Initializing the column value
      of matrix b to 1
56 for i=1:5           //Conversion of decimal value to
      binary format
57     z=modulo(c,2)
58     w(1,q)=z
59     c=c/2
60     c=floor(c)
61     q=q+1
62 end
63
64 //Conversion of binary value to decimal number
65
66 i=0                 //Initializing decimal value to 0
67 n=0                 //Initializing the number of bits
      to 0
68 for m=1:q-2         //Multiplying each bits with its
      corresponding positional value and adding
69     c=m-1
70     i=i+w(1,m)*(2^c)
71     n=n+1
72 end
73 s=w(1,q-1)
74 disp("Sum of two decimal numbers is")
75 if s==0 then
76     disp(i)
77 else
78     c=2^n-i         //Two's complement of sum
79     disp(-c)
```

```
80 end
```

Scilab code Exa 1.45 Addition of 12 and minus 5 using 5 bit 2s complement

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.45
6  //Addition of 12 and minus 5 using 5 bit 2s
       complement
7
8  clc
9  clear
10
11 //Conversion of decimal inputs to 5-bit binary
       numbers
12
13 a=12
14 q=0                    //Initializing the power to 0
15 x=0                    //Initializing the binary value
       to 0
16 for i=1:5              //Conversion of decimal number to
       5-bit binary number
17     r=modulo(a,2)
18     x=x+(10^q)*r
19     a=a/2
20     a=floor(a)
21     q=q+1
22 end
23 b=5
24 n=5                    //Since 5 bit 2's complement
25 b=2^n-b                //Computing 2's complement
26 q=0                    //Initializing the power to 0
```

```
27 y=0                  //Initializing the binary value
      to 0
28 for i=1:5            //Conversion of decimal number to
       5-bit binary number
29      r=modulo(b,2)
30      y=y+(10^q)*r
31      b=b/2
32      b=floor(b)
33      q=q+1
34 end
35
36 //Addition of two 5-bit binary number
37
38 q=0                  //Initializing the power to 0
39 a=0                  //Initializing the decimal value
      to 0
40 while(x>0)           //Conversion of binary value to
      decimal number
41      r=modulo(x,10)
42      a=a+(2^q)*r
43      x=x/10
44      x=floor(x)
45      q=q+1
46 end
47 q=0                  //Initializing the power to 0
48 b=0                  //Initializing the decimal value
      to 0
49 while(y>0)           //Conversion of binary value to
      decimal number
50      r=modulo(y,10)
51      b=b+(2^q)*r
52      y=y/10
53      y=floor(y)
54      q=q+1
55 end
56 c=a+b
57 q=1                  //Initializing the column value
      of matrix b to 1
```

```
58 for i=1:5            //Conversion of decimal value to
      binary format
59     z=modulo(c,2)
60     w(1,q)=z
61     c=c/2
62     c=floor(c)
63     q=q+1
64 end
65
66 //Conversion of binary value to decimal number
67
68 i=0                  //Initializing decimal value to 0
69 n=0                  //Initializing the number of bits
       to 0
70 for m=1:q-2          //Multiplying each bits with its
      corresponding positional value and adding
71     c=m-1
72     i=i+w(1,m)*(2^c)
73     n=n+1
74 end
75 s=w(1,q-1)
76 disp("Sum of 12 and -5 is")
77 if s==0 then
78     disp(i)
79 else
80     c=2^n-i          //Two's complement of sum
81     disp(-c)
82 end
```

Scilab code Exa 1.46 Addition of minus 12 and 5 using 5 bit 2s complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
```

```
4
5  //Chapter 1; Example 1.46
6  //Addition of minus 12 and 5 using 5 bit 2s
       complement
7
8  clc
9  clear
10
11 //Conversion of decimal inputs to 5-bit binary
       numbers
12
13 a=12
14 n=5                    //Since 5 bit 2's complement
15 a=2^n-a               //Computing 2's complement
16 q=0                   //Initializing the power to 0
17 x=0                   //Initializing the binary value
       to 0
18 for i=1:5             //Conversion of decimal number to
       5-bit binary number
19     r=modulo(a,2)
20     x=x+(10^q)*r
21     a=a/2
22     a=floor(a)
23     q=q+1
24 end
25 b=5
26 q=0                   //Initializing the power to 0
27 y=0                   //Initializing the binary value
       to 0
28 for i=1:5             //Conversion of decimal number to
       5-bit binary number
29     r=modulo(b,2)
30     y=y+(10^q)*r
31     b=b/2
32     b=floor(b)
33     q=q+1
34 end
35
```

```
36 //Addition of two 5-bit binary number
37
38 q=0                    //Initializing the power to 0
39 a=0                    //Initializing the decimal value
      to 0
40 while(x>0)             //Conversion of binary value to
      decimal number
41     r=modulo(x,10)
42     a=a+(2^q)*r
43     x=x/10
44     x=floor(x)
45     q=q+1
46 end
47 q=0                    //Initializing the power to 0
48 b=0                    //Initializing the decimal value
      to 0
49 while(y>0)             //Conversion of binary value to
      decimal number
50     r=modulo(y,10)
51     b=b+(2^q)*r
52     y=y/10
53     y=floor(y)
54     q=q+1
55 end
56 c=a+b
57 q=1                    //Initializing the column value
      of matrix b to 1
58 for i=1:5              //Conversion of decimal value to
      binary format
59     z=modulo(c,2)
60     w(1,q)=z
61     c=c/2
62     c=floor(c)
63     q=q+1
64 end
65
66 //Conversion of binary value to decimal number
67
```

```
68 i=0                  //Initializing decimal value to 0
69 n=0                  //Initializing the number of bits
       to 0
70 for m=1:q-2          //Multiplying each bits with its
      corresponding positional value and adding
71     c=m-1
72     i=i+w(1,m)*(2^c)
73     n=n+1
74 end
75 s=w(1,q-1)
76 disp("Sum of -12 and 5 is")
77 if s==0 then
78     disp(i)
79 else
80     c=2^n-i          //Two's complement of sum
81     disp(-c)
82 end
```

Scilab code Exa 1.47 Addition of 0 0111 and minus 1 1010 using 5 bit 2s complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.47
6 //Addition of 0 0111 and minus 1 1010 using 5 bit 2s
      complement
7
8 clc
9 clear
10
11 x=00111
12 y='11010'
13 b=bin2dec(y)
```

```
14 n=5                    //Since 5 bit 2's complement
15 b=2^n-b                //Computing 2's complement
16 q=0                    //Initializing the power to 0
17 y=0                    //Initializing the binary value
      to 0
18 for i=1:5              //Conversion of decimal number to
       5-bit binary number
19     r=modulo(b,2)
20     y=y+(10^q)*r
21     b=b/2
22     b=floor(b)
23     q=q+1
24 end
25
26 //Addition of two 5-bit binary number
27
28 q=0                    //Initializing the power to 0
29 a=0                    //Initializing the decimal value
      to 0
30 while(x>0)             //Conversion of binary value to
      decimal number
31     r=modulo(x,10)
32     a=a+(2^q)*r
33     x=x/10
34     x=floor(x)
35     q=q+1
36 end
37 q=0                    //Initializing the power to 0
38 b=0                    //Initializing the decimal value
      to 0
39 while(y>0)             //Conversion of binary value to
      decimal number
40     r=modulo(y,10)
41     b=b+(2^q)*r
42     y=y/10
43     y=floor(y)
44     q=q+1
45 end
```

```
46 c=a+b
47 q=1                    //Initializing the column value
      of matrix b to 1
48 for i=1:5             //Conversion of decimal value to
      binary format
49     z=modulo(c,2)
50     w(1,q)=z
51     c=c/2
52     c=floor(c)
53     q=q+1
54 end
55
56 //Conversion of binary value to decimal number
57
58 i=0                    //Initializing decimal value to 0
59 n=0                    //Initializing the number of bits
       to 0
60 for m=1:q-2           //Multiplying each bits with its
      corresponding positional value and adding
61     c=m-1
62     i=i+w(1,m)*(2^c)
63     n=n+1
64 end
65 s=w(1,q-1)
66 disp("Sum of (0,0111) and -(1,1010) is")
67 if s==0 then
68     disp(i)
69 else
70     c=2^n-i           //Two's complement of sum
71     disp(-c)
72 end
```

Scilab code Exa 1.48 Addition of minus 9 and minus 5 using 5 bit 2s complement

```
1 //Book      Digital Logic Circuit Analysis and Design
```

```
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.48
6 //Addition of minus 9 and minus 5 using 5 bit 2s
     complement
7
8 clc
9 clear
10
11 //Conversion of decimal inputs to 5-bit binary
     numbers
12
13 a=9
14 n=5                    //Since 5 bit 2's complement
15 a=2^n-a               //Computing 2's complement
16 q=0                    //Initializing the power to 0
17 x=0                    //Initializing the binary value
     to 0
18 for i=1:5              //Conversion of decimal number to
      5-bit binary number
19     r=modulo(a,2)
20     x=x+(10^q)*r
21     a=a/2
22     a=floor(a)
23     q=q+1
24 end
25 b=5
26 b=2^n-b               //Computing 2's complement
27 q=0                    //Initializing the power to 0
28 y=0                    //Initializing the binary value
     to 0
29 for i=1:5              //Conversion of decimal number to
      5-bit binary number
30     r=modulo(b,2)
31     y=y+(10^q)*r
32     b=b/2
```

```
33      b=floor(b)
34      q=q+1
35  end
36
37  //Addition of two 5-bit binary number
38
39  q=0                 //Initializing the power to 0
40  a=0                 //Initializing the decimal value
       to 0
41  while(x>0)          //Conversion of binary value to
       decimal number
42      r=modulo(x,10)
43      a=a+(2^q)*r
44      x=x/10
45      x=floor(x)
46      q=q+1
47  end
48  q=0                 //Initializing the power to 0
49  b=0                 //Initializing the decimal value
       to 0
50  while(y>0)          //Conversion of binary value to
       decimal number
51      r=modulo(y,10)
52      b=b+(2^q)*r
53      y=y/10
54      y=floor(y)
55      q=q+1
56  end
57  c=a+b
58  q=1                 //Initializing the column value
       of matrix W to 1
59  for i=1:5           //Conversion of decimal value to
       binary format
60      z=modulo(c,2)
61      w(1,q)=z
62      c=c/2
63      c=floor(c)
64      q=q+1
```

```
65 end
66
67 //Conversion of binary value to decimal number
68
69 i=0                    //Initializing decimal value to 0
70 n=0                    //Initializing the number of bits
       to 0
71 for m=1:q-2           //Multiplying each bits with its
      corresponding positional value and adding
72     c=m-1
73     i=i+w(1,m)*(2^c)
74     n=n+1
75 end
76 s=w(1,q-1)             //Separating the sign bit
77 disp("Sum of -9 and -5 is")
78 if s==0 then
79     disp(i)
80 else
81     c=2^n-i            //Two's complement of sum
82     disp(-c)
83 end
```

Scilab code Exa 1.49 Addition of minus 12 and minus 5 using 5 bit 2s complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.49
6 //Addition of minus 12 and minus 5 using 5 bit 2s
      complement
7
8 clc
9 clear
```

```
10
11 //Conversion of decimal inputs to 5-bit binary
      numbers
12
13 a=12
14 n=5                    //Since 5 bit 2's complement
15 a=2^n-a               //Computing 2's complement
16 q=0                   //Initializing the power to 0
17 x=0                   //Initializing the binary value
      to 0
18 for i=1:5             //Conversion of decimal number to
      5-bit binary number
19     r=modulo(a,2)
20     x=x+(10^q)*r
21     a=a/2
22     a=floor(a)
23     q=q+1
24 end
25 b=5
26 b=2^n-b               //Computing 2's complement
27 q=0                   //Initializing the power to 0
28 y=0                   //Initializing the binary value
      to 0
29 for i=1:5             //Conversion of decimal number to
      5-bit binary number
30     r=modulo(b,2)
31     y=y+(10^q)*r
32     b=b/2
33     b=floor(b)
34     q=q+1
35 end
36
37 //Addition of two 5-bit binary number
38
39 q=0                   //Initializing the power to 0
40 a=0                   //Initializing the decimal value
      to 0
41 while(x>0)           //Conversion of binary value to
```

```
    decimal number
42      r=modulo(x,10)
43      a=a+(2^q)*r
44      x=x/10
45      x=floor(x)
46      q=q+1
47  end
48  q=0                 //Initializing the power to 0
49  b=0                 //Initializing the decimal value
    to 0
50  while(y>0)          //Conversion of binary value to
    decimal number
51      r=modulo(y,10)
52      b=b+(2^q)*r
53      y=y/10
54      y=floor(y)
55      q=q+1
56  end
57  c=a+b
58  q=1                 //Initializing the column value
    of matrix b to 1
59  for i=1:5           //Conversion of decimal value to
    binary format
60      z=modulo(c,2)
61      w(1,q)=z
62      c=c/2
63      c=floor(c)
64      q=q+1
65  end
66
67  //Conversion of binary value to decimal number
68
69  i=0                 //Initializing decimal value to 0
70  n=0                 //Initializing the number of bits
     to 0
71  for m=1:q-2         //Multiplying each bits with its
    corresponding positional value and adding
72      c=m-1
```

```
73      i=i+w(1,m)*(2^c)
74      n=n+1
75  end
76  s=w(1,q-1)
77  disp("Sum of -12 and -5 is")
78  if s==0 then
79      disp(i)
80  else
81      c=2^n-i          //Two's complement of sum
82      disp(-c)
83  end
```

Scilab code Exa 1.50 Computation of A plus B and A minus B and B minus A and minus

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.50
6  //Computation of A plus B and A minus B and B minus
       A and minus A minus B with A is equal to 25 and B
       is equal to minus 46
7
8  clc
9  clear
10
11 A=25
12 B=46
13 N=9                  //Since the computer uses the 8-
       bit memory
14 B=2^N-B              //Computing 2's complement
15
16 //Computation of A+B
17
```

```
18 c=A+B
19 q=1                    //Initializing the column value
      of matrix b to 1
20 for i=1:9              //Conversion of decimal value to
      binary format
21      z=modulo(c,2)
22      w(1,q)=z
23      c=c/2
24      c=floor(c)
25      q=q+1
26 end
27 i=0                    //Initializing decimal value to 0
28 n=0                    //Initializing the number of bits
       to 0
29 for m=1:q-2            //Multiplying each bits with its
      corresponding positional value and adding
30      c=m-1
31      i=i+w(1,m)*(2^c)
32      n=n+1
33 end
34 s=w(1,q-1)
35 disp("A+B is")
36 if s==0 then
37      disp(i)
38 else
39      c=2^n-i           //Two's complement of sum
40      disp(-c)
41 end
42
43 //Computation of A-B
44
45 b=2^N-B                //Computing 2's complement
46 c=A+b                  //b represent -B
47 q=1                    //Initializing the column value
      of matrix b to 1
48 for i=1:9              //Conversion of decimal value to
      binary format
49      z=modulo(c,2)
```

```
50      w(1,q)=z
51      c=c/2
52      c=floor(c)
53      q=q+1
54  end
55  i=0                 //Initializing decimal value to 0
56  n=0                 //Initializing the number of bits
        to 0
57  for m=1:q-2         //Multiplying each bits with its
       corresponding positional value and adding
58      c=m-1
59      i=i+w(1,m)*(2^c)
60      n=n+1
61  end
62  s=w(1,q-1)
63  disp("A-B is")
64  if s==0 then
65      disp(i)
66  else
67      c=2^n-i         //Two's complement of sum
68      disp(-c)
69  end
70
71  //Computation of B-A
72
73  a=2^N-A             //Computing 2's complement
74  c=B+a               //a represent -A
75  q=1                 //Initializing the column value
       of matrix b to 1
76  for i=1:9           //Conversion of decimal value to
       binary format
77      z=modulo(c,2)
78      w(1,q)=z
79      c=c/2
80      c=floor(c)
81      q=q+1
82  end
83  i=0                 //Initializing decimal value to 0
```

```
n=0                    //Initializing the number of bits
    to 0
for m=1:q-2            //Multiplying each bits with its
   corresponding positional value and adding
    c=m-1
    i=i+w(1,m)*(2^c)
    n=n+1
end
s=w(1,q-1)
disp("B-A is")
if s==0 then
    disp(i)
else
    c=2^n-i            //Two's complement of sum
    disp(-c)
end

//Computation of -A-B

a=2^N-A                //Computing 2's complement
b=2^N-B                //Computing 2's complement
c=a+b                  //a and b are the representation
   of -A and -B respectively
q=1                    //Initializing the column value
   of matrix b to 1
for i=1:9              //Conversion of decimal value to
   binary format
    z=modulo(c,2)
    w(1,q)=z
    c=c/2
    c=floor(c)
    q=q+1
end
i=0                    //Initializing decimal value to 0
n=0                    //Initializing the number of bits
    to 0
for m=1:q-2            //Multiplying each bits with its
   corresponding positional value and adding
```

```
115      c=m-1
116      i=i+w(1,m)*(2^c)
117      n=n+1
118  end
119  s=w(1,q-1)
120  disp("-A-B is")
121  if s==0 then
122      disp(i)
123  else
124      c=2^n-i          //Two's complement of sum
125      disp(-c)
126  end
```

Scilab code Exa 1.51 Addition of 75 and minus 21 using 3 digits 10s complement

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.51
6  //Addition of 75 and  minus 21 using 3 digits 10s
       complement
7
8  clc
9  clear
10
11 a=75
12 b=21
13 n=3                  //Since 3-digits 10's complement
14 c=10^n-b             //Computing 10's complement
15 d=a+c
16 q=1                  //Initializing the column value
       of matrix w to 1
17 for i=1:n            //Discarding the carry digit
```

```
18      r=modulo(d,10)
19      w(1,q)=r
20      d=d/10
21      d=floor(d)
22      q=q+1
23  end
24  i=0                     //Initializing sum to 0
25  n=0                     //Initializing the number of bits
        to 0
26  for m=1:q-2             //Multiplying each bits with its
       corresponding positional value and adding
27      c=m-1
28      i=i+w(1,m)*(10^c)
29      n=n+1
30  end
31  s=w(1,q-1)
32  disp("Sum of 75 and -(21) is")
33  if s==0 then
34      disp(i)
35  else
36      a=10^n-i            //Computing 10's complement
37      disp(-a)
38  end
```

Scilab code Exa 1.52 Addition of 21 and minus 75 using 3 digits 10s complement

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.52
6  //Addition of 21 and minus 75 using 3 digits 10s
       complement
7
```

```
clc
clear

a=21
b=75
n=3                    //Since 3-digits 10's complement
c=10^n-b               //Computing 10's complement
d=a+c
q=1                    //Initializing the column value
   of matrix w to 1
for i=1:n              //Discarding the carry digit
    r=modulo(d,10)
    w(1,q)=r
    d=d/10
    d=floor(d)
    q=q+1
end
i=0                    //Initializing sum to 0
n=0                    //Initializing the number of bits
    to 0
for m=1:q-2            //Multiplying each bits with its
   corresponding positional value and adding
    c=m-1
    i=i+w(1,m)*(10^c)
    n=n+1
end
s=w(1,q-1)
disp("Sum of 21 and -(75) is")
if s==0 then
    disp(i)
else
    a=10^n-i           //Computing 10's complement
    disp(-a)
end
```

Scilab code Exa 1.53 1s complement of 01100101 using diminished radix complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.53
6 //1s complement of 01100101 using diminished radix
     complement
7
8 clc
9 clear
10
11 a='01100101'
12 n=8                    //Number of bits
13 x=bin2dec(a)           //Conversion of binary input to
     decimal format
14 y=2^n
15 b=y-x-1                //Subtraction of x value and 1
     from y value
16 N=dec2bin(b)           //Conversion of decimal number to
      binary format
17 disp("1s complement of 01100101",N)
```

Scilab code Exa 1.54 1s complement of 11010100 using diminished radix complement

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.54
6 //1s complement of 11010100 using diminished radix
     complement
```

```
7
8  clc
9  clear
10
11 a='11010100'
12 n=8                    //Number of bits
13 x=bin2dec(a)           //Conversion of binary input to
      decimal format
14 y=2^n
15 b=y-x-1                //Subtraction of x value and 1
      from y value
16 N=dec2bin(b)           //Conversion of decimal number to
       binary format
17 disp("1s complement of 11010100",N)
```

Scilab code Exa 1.55 9s complement of 40960 using diminished radix complement

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.55
6  //9s complement of 40960 using diminished radix
      complement
7
8  clc
9  clear
10
11 x=40960
12 n=5                    //Number of digits in the input
13 y=10^n
14 N=y-x-1                //Subtraction of x value and 1
      from y value
15 disp("9s complement of 40960",N)
```

Scilab code Exa 1.56 Addition of plus 1001 and minus 0100 using diminished radix c

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.56
6 //Addition of plus 1001 and minus 0100 using
     diminished radix complement
7
8 clc
9 clear
10
11 a='1001'
12 b='0100'
13 n=5                    //5-bit code
14 x=bin2dec(a)           //Conversion of binary input to
     decimal format
15 y=bin2dec(b)           //Conversion of binary input to
     decimal format
16 y=2^n-y-1              //one's complement of negative
     input
17 c=x+y
18 q=1                    //Initializing the column value
     of matrix w to 1
19 for i=1:n+1            //Conversion of decimal value to
     binary format
20     z=modulo(c,2)
21     w(1,q)=z
22     c=c/2
23     c=floor(c)
24     q=q+1
25 end
```

```
26 s=w(1,q-1)          //Separating the carry from the
      binary number
27 i=0                 //Initializing the sum to 0
28 for m=1:q-2         //Converting the bits into
      decimal number
29     c=m-1
30     i=i+w(1,m)*2^c
31 end
32 x=i+s               //Adding the carry to the decimal
       number
33 y=dec2bin(x)
34 disp("Sum of +(1001) and -(0100)",y)
```

Scilab code Exa 1.57 Addition of plus 1001 and minus 1111 using diminished radix c

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.57
6 //Addition of plus 1001 and minus 1111 using
      diminished radix complement
7
8 clc
9 clear
10
11 a='1001'
12 b='1111'
13 n=5                 //5-bit code
14 x=bin2dec(a)        //Conversion of binary input to
      decimal format
15 y=bin2dec(b)        //Conversion of binary input to
      decimal format
16 y=2^n-y-1           //one's complement of negative
```

```
    input
17 c=x+y
18 q=1                  //Initializing the column value
    of matrix w to 1
19 for i=1:n+1          //Conversion of decimal value to
    binary format
20     z=modulo(c,2)
21     w(1,q)=z
22     c=c/2
23     c=floor(c)
24     q=q+1
25 end
26 s=w(1,q-1)           //Separating the carry from the
    binary number
27 i=0                  //Initializing the sum to 0
28 for m=1:q-2          //Converting the bits into
    decimal number
29     c=m-1
30     i=i+w(1,m)*2^c
31 end
32 x=i+s                //Adding the carry to the decimal
     number
33 y=dec2bin(x)
34 disp("Sum of +(1001) and -(1111)",y)
```

Scilab code Exa 1.58 Addition of minus 1001 and minus 0011 using diminished radix

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
     Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.58
6 //Addition of minus 1001 and minus 0011 using
    diminished radix complement
```

```
7
8  clc
9  clear
10
11 a='1001'
12 b='0011'
13 n=5                    //5-bit code
14 x=bin2dec(a)           //Conversion of binary input to
      decimal format
15 x=2^n-x-1              //one's complement of negative
      input
16 y=bin2dec(b)           //Conversion of binary input to
      decimal format
17 y=2^n-y-1              //one's complement of negative
      input
18 c=x+y
19 q=1                    //Initializing the column value
      of matrix w to 1
20 for i=1:n+1            //Conversion of decimal value to
      binary format
21     z=modulo(c,2)
22     w(1,q)=z
23     c=c/2
24     c=floor(c)
25     q=q+1
26 end
27 s=w(1,q-1)             //Separating the carry from the
      binary number
28 i=0                    //Initializing the sum to 0
29 for m=1:q-2            //Converting the bits into
      decimal number
30     c=m-1
31     i=i+w(1,m)*2^c
32 end
33 x=i+s                  //Adding the carry to the decimal
       number
34 y=dec2bin(x)
35 disp("Sum of -(1001) and -(0011)",y)
```

Scilab code Exa 1.59 Addition of plus 75 and minus 21 using diminished radix compl

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.59
6 //Addition of plus 75 and minus 21 using diminished
     radix complement
7
8 clc
9 clear
10
11 a=75
12 b=21
13 n=3                    //3-digit code
14 b=10^n-b-1            //Nine's complement of negative
     input
15 c=a+b
16 q=1                   //Initializing the column value
     of matrix w to 1
17 for i=1:n+1           //Entering the digits of decimal
     number into a matrix
18     z=modulo(c,10)
19     w(1,q)=z
20     c=c/10
21     c=floor(c)
22     q=q+1
23 end
24 s=w(1,q-1)            //Separating the carry from the
     decimal number
25 i=0                   //Initializing sum to 0
26 for m=1:q-2           //Multiplying each bits with its
```

```
    corresponding positional value and adding
27      c=m-1
28      i=i+w(1,m)*10^c
29  end
30  x=i+s                   //Adding the carry to the decimal
      number
31  disp("Sum of +(75) and -(21)",x)
```

Scilab code Exa 1.60 Addition of plus 21 and minus 75 using diminished radix compl

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.60
6  //Addition of plus 21 and minus 75 using diminished
       radix complement
7
8  clc
9  clear
10
11 a=21
12 b=75
13 n=3                     //3-digit code
14 b=10^n-b-1              //Nine's complement of negative
       input
15 c=a+b
16 q=1                     //Initializing the column value
       of matrix w to 1
17 for i=1:n+1             //Entering the digits of decimal
       number into a matrix
18      z=modulo(c,10)
19      w(1,q)=z
20      c=c/10
```

```
21      c=floor(c)
22      q=q+1
23  end
24  s=w(1,q-1)          //Separating the carry from the
       decimal number
25  i=0                 //Initializing sum to 0
26  for m=1:q-2         //Multiplying each bits with its
       corresponding positional value and adding
27      c=m-1
28      i=i+w(1,m)*10^c
29  end
30  x=i+s               //Adding the carry to the decimal
       number
31  disp("Sum of +(21) and -(75)",x)
```

Scilab code Exa 1.61 Two possible interpretation of the 8 bit fixed point number 0

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.61
6  //Two possible interpretation of the 8 bit fixed
       point number 01101010
7
8  clc
9  clear
10
11 a=01101010
12 n=8
13
14 //Fixed-point integer representation
15
16 c=a
```

```
17 q=1                  //Intializing the column value of
       matrix b to 1
18 for i=1:n            //Entering the binary bits into a
       matrix
19     r=modulo(c,10)
20     b(1,q)=r
21     c=c/10
22     c=floor(c)
23     q=q+1
24 end
25 s=b(1,q-1)          //Separating the sign bit from
     the binary number
26 x=0                  //Initializing binary number to 0
27 if s==0 then
28     for m=1:q-2     //Multiplying each bits with its
         corresponding positional value and adding
29         c=m-1
30         x=x+b(1,m)*10^c
31     end
32     disp("Positive integer representation of 8-bit
         fixed point number",x)
33 else
34     for m=1:q-2     //Multiplying each bits with its
         corresponding positional value and adding
35         c=m-1
36         x=x+b(1,m)*2^c
37     end
38     x=bitcmp(x,n-1)//Bitwise complement of decimal
         number
39     x=dec2bin(x)    //Decimal to binary conversion
40     x=strtod(x)     //String to decimal conversion
41     disp("Negative integer representation of 8-bit
         fixed point number",-x)
42 end
43
44 //Fixed-point fraction representation
45
46 y=x/10^(n-1)
```

```
47 if s==0 then
48     disp("Positive fraction representation of 8-bit
          fixed point number",y)
49 else
50     disp("Negative fraction representation of 8-bit
          fixed point number",-y)
51 end
```

Scilab code Exa 1.62 Two possible interpretation of the 8 bit fixed point number 1

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.62
6 //Two possible interpretation of the 8 bit fixed
     point number 11101010
7
8 clc
9 clear
10
11 a=11101010
12 n=8
13
14 //Fixed-point integer representation
15
16 q=1                  //Intializing the column value of
      matrix b to 1
17 for i=1:n            //Entering the binary bits into a
      matrix
18     r=modulo(a,10)
19     b(1,q)=r
20     a=a/10
21     a=floor(a)
```

```
22      q=q+1
23  end
24  s=b(1,q-1)          //Separating the sign bit from
       the binary number
25  x=0                 //Initializing binary number to 0
26  if s==0 then
27      disp("true")
28      for m=1:q-2     //Multiplying each bits with its
           corresponding positional value and adding
29          c=m-1
30          x=x+b(1,m)*10^c
31      end
32      disp("Positive integer representation",x)
33  else
34      for m=1:q-2     //Multiplying each bits with its
           corresponding positional value and adding
35          c=m-1
36          x=x+b(1,m)*2^c
37      end
38      x=bitcmp(x,n-1)//Bitwise complement of decimal
           number
39      x=dec2bin(x)    //Decimal to binary conversion
40      x=strtod(x)     //String to decimal conversion
41      disp("Negative integer representation",-x)
42  end
43
44  //Fixed-point fraction representation
45
46  y=x/10^(n-1)
47  if s==0 then
48      disp("Positive fraction representation",y)
49  else
50      disp("Negative fraction representation",-y)
51  end
```

Scilab code Exa 1.63 Floating point format of binary number 101101 point 101

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.63
6 //Floating point format of binary number 101101
     point 101
7
8 clc
9 clear
10
11 N=101101.101
12 e=5
13 a=floor(N)
14 n=0                  //Initializing the number digits
     in decimal part to 0
15 while a>0
16     a=a/10
17     a=floor(a)
18     n=n+1
19 end
20 M=N/(10^n)
21 b=2^(e-1)           //Bias value
22 b=dec2bin(b)
23 b=strtod(b)         //String to decimal conversion
24 E=n
25 E=dec2bin(E)
26 E=strtod(E)         //String to decimal conversion
27 E=E+b               //Adding the bias value to the
     two's complement of E
28 q=1                 //Initializing the column value
     of matrix W to 1
29 while E>0
30     r=modulo(E,10)
31     w(1,q)=r
```

```
32      E=E/10
33      E=floor(E)
34      q=q+1
35  end
36  s=w(1,q-1)          //Separating the sign bit of the
       exponent
37  E=0                 //Initializing exponent value to
       0
38  for m=1:q-1         //Multiplying each bits with its
       corresponding positional value and adding
39      c=m-1
40      E=E+w(1,m)*(10^c)
41  end
42  if s==1 then
43      Sm=0
44  end
45  M=M*(10^10)
46  format('v',12)      //Formatting the output
47  disp("Floating point format of 101101.101 is",[Sm,E,
       M])
```

Scilab code Exa 1.64 Decimal number to BCD conversion

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.64
6  //Decimal number to BCD conversion
7
8  clc
9  clear
10
11 N=9750
```

```
12 n=4                          //Number of digits in decimal
       number
13 for i=1:n
14     r=modulo(N,10)
15     x(i)=dec2bin(r,4)   //Decimal to binary
          conversion with 4 bits
16     N=N/10
17     N=floor(N)
18 end
19 x=x(4)+x(3)+x(2)+x(1)
20 disp("BCD equivalent of 9750",x)
```

Scilab code Exa 1.65 ASCII code conversion of Digital

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.65
6  //ASCII code conversion of Digital
7
8  clc
9  clear
10 a="Digital"
11 l=length(a)          //Length of string
12 b=strsplit(a)        //Splitting the string
13 a=ascii(a)           //String to ASCII conversion
14 x=dec2bin(a)         //Decimal to binary conversion
15 y=dec2hex(a)         //Decimal to hexadecimal
       conversion
16 disp(["Character","Binary Code","Hexadecimal Code"])
17 for i=1:l
18     disp([b(i),x(i),y(i)])
19 end
```

Scilab code Exa 1.66 Gray code conversion for 1 to 15

```
1 //Book      Digital Logic Circuit Analysis and Design
2 //Authors - Victor P.Nelson, H. Troy Nagle, J. David
      Irwin, Bill D. Carroll
3 //Scilab Version - 6.1.0 ; OS - Windows
4
5 //Chapter 1; Example 1.66
6 //Gray code conversion for 1 to 15
7
8 clc
9 clear
10
11 for i=0:15
12     b=i
13     n=4                          //Number of bits
14     a=dec2bin(b,n)               //Decimal to binary
          conversion with n bits
15     a=strtod(a)                  //String to decimal
          conversion
16     for j=1:n                    //Spliting the bits
17         x(j)=modulo(a,10)
18         a=a/10
19         a=floor(a)
20     end
21     y(n)=x(n)
22     k=n-1
23     while(k>0)
24         if bitand(x(k +1),x(k))==1 then //Bitwise
              logical AND operation
25             y(k)=bitcmp(1,1)             //Bitwise
                 complement
26         else
27             y(k)=bitor(x(k+1),x(k))      //Bitwise
```

```
                logical OR operation
28          end
29          k=k-1
30      end
31      z=0                         //Initializing the gray
           code to 0
32      for j=1:n                   //Multiplying each bits
           with its corresponding positional value and
           adding
33          z=z+y(j)*(10^(j-1))
34      end
35      disp(b)
36      printf("Gray code %04d\n",z)
37  end
```

Scilab code Exa 1.68 Determination of weights and distance between two binary numb

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.68
6  //Determination of weights and distance between two
       binary numbers
7
8  clc
9  clear
10
11 I=01101100
12 J=11000100
13 i=I
14 j=J
15 n=0                             //Initializing the weight
       of I to 0
```

```
16 while i>0                          //Counting the 1 bits in
      the binary number
17     r=modulo(i,10)
18     if r==1
19         n=n+1
20     end
21     i=i/10
22     i=floor(i)
23 end
24 disp("Weight of I is",n)
25 m=0                               //Initializing the weight
      of J to 0
26 while j>0                          //Counting the 1 bits in
      the binary number
27         e=modulo(j,10)
28     if e==1
29         m=m+1
30     end
31     j=j/10
32     j=floor(j)
33 end
34 disp("Weight of J is",m)
35 n=0                               //Initializing the
      position of bit to 0
36 for i=1:8                          //Comparing the two
      numbers bit by bit
37     r=modulo(I,10)
38     e=modulo(J,10)
39     if r~=e then                   //Computing the number
          differ in bit positions
40         d=n
41         n=1
42     end
43     I=I/10
44     J=J/10
45     I=floor(I)
46     J=floor(J)
47     n=n+1
```

```
48 end
49 disp("Distance between I and J is",d)
```

Scilab code Exa 1.70 ASCII code with even parity in 16 bit segments

```
1  //Book      Digital Logic Circuit Analysis and Design
2  //Authors - Victor P.Nelson, H. Troy Nagle, J. David
       Irwin, Bill D. Carroll
3  //Scilab Version - 6.1.0 ; OS - Windows
4
5  //Chapter 1; Example 1.70
6  //ASCII code with even parity in 16 bit segments
7
8  clc
9  clear
10
11 a='CATCH 22'
12 b=ascii(a)                    //String to ASCII
       conversion
13 for i=1:8
14     a=b(i)
15     d=dec2bin(a,7)            //Decimal to binary
           conversion
16     x=strtod(d)               //String to decimal
           conversion
17     n=0                       //Initializing number
           of 1-bits to 0
18     for j=1:7
19         r=modulo(x,10)
20         if r==1 then
21             n=n+1
22         end
23         x=x/10
24         x=floor(x)
25     end
```

```
26      if modulo(n,2)==0 then
27          c(i)='0'+d
28      else
29          c(i)='1'+d
30      end
31  end
32  p=c(1)+c(2)
33  q=c(3)+c(4)
34  r=c(5)+c(6)
35  s=c(7)+c(8)
36  disp("ASCII code of CATCH 22 in 16-bits")
37  disp("WordX:",p)
38  disp("WordX+1:",q)
39  disp("WordX+2:",r)
40  disp("WordX+3:",s)
```