1. Convert the following binary numbers to decimal numbers

- $1\ 0\ 1\ 1\ 1\ 1\ 0$ (unsigned)
  $2^6\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

  $(1\ 0\ 1\ 1\ 1\ 1\ 0)_2 = 0\cdot 2^0 + 1\cdot 2^1 + 1\cdot 2^2 + 1\cdot 2^3 + 1\cdot 2^4 + 0\cdot 2^5 + 1\cdot 2^6 = 0+2+4+8+16+0+64 =$

  $= (94)_{10}$

- $1\ 1\ 1\ 0\ 0\ 0\ 1$ (signed)

  ↖ sign bit (negative)

  $1\ 1\ 1\ 0\ 0\ 0\ 1$
  $0\ 0\ 0\ 1\ 1\ 1\ 0$ → reverse
  $0\ 0\ 0\ 1\ 1\ 1\ 1$
  $+\ 2^5\ 2^4\ 2^3\ 2^2\ 2^1\ 2^0$

  $\begin{array}{r} 1\ 1\ 1\ 0\ 0\ 0\ 1 \\ +\ 0\ 0\ 0\ 1\ 1\ 1\ 1 \\ \hline (1)\ 0\ 0\ 0\ 0\ 0\ 0\ 0 = 0 \end{array}$

  ↖ lost bit

  $(1\ 1\ 1\ 0\ 0\ 0\ 1)_2 = -(1\cdot 2^0 + 1\cdot 2^1 + 1\cdot 2^2 + 1\cdot 2^3 + 0\cdot 2^4 + 0\cdot 2^5) = -(1+2+4+8+0+0) =$

  $= (-15)_{10}$

2. Convert the following binary numbers to hexadecimal numbers

- $1\ 1\ 0\ 1\ 1\ 0\ 1$

  $0\ 1\ 1\ 0 \qquad 1\ 1\ 0\ 1$ → binary in groups of 4
  ↓ ↓
  6 13 → decimal
  ↓ ↓
  6 D → corresponding hexadecimal

  $(1\ 1\ 0\ 1\ 1\ 0\ 1)_2 = (6D)_{16}$

- $1\ 1\ 1\ 1\ 1\ 1\ 0$

  $0\ 1\ 1\ 1 \qquad 1\ 1\ 1\ 0$
  ↓ ↓
  7 14
  ↓ ↓
  7 E

  $(1\ 1\ 1\ 1\ 1\ 1\ 0)_2 = (7E)_{16}$

3. Convert the following hexadecimal numbers to binary numbers

- 0x B9

B	9	→ hexadecimal
↓	↓	
11	9	→ corresponding decimal
↓	↓	
1011	1001	→ binary

$(B9)_{16} = (10111001)_2$

- 0x 217

2	1	7
↓	↓	↓
14	1	7
↓	↓	↓
1110	0001	0111

$(217)_{16} = (111000010111)_2$

- 0x ACDC

A	C	D	C
↓	↓	↓	↓
10	12	13	12
↓	↓	↓	↓
1010	1100	1101	1100

$(ACDC)_{16} = (1010110011011100)_2$

4. Convert the following decimal numbers to binary number

- 256

256	2
256	128 | 2
0	128 | 64 | 2
	0 64 | 32 | 2
	0 32 | 16 | 2
	0 16 | 8 | 2
	0 8 | 4 | 2
	0 4 | 2 | 2
	0 2 | 1 | 2
	0 0 | 2
	1

$(256)_{10} = (100000000_2)$

- 3767 | 2
  3766 | 1883 | 2
  1 — 1882 | 941 | 2
  1 — 940 | 470 | 2
  1 — 470 | 235 | 2
  0 — 134 | 117 | 2
  1 — 116 | 58 | 2
  1 — 58 | 29 | 2
  0 — 28 | 14 | 2
  1 — 14 | 7 | 2
  0 — 6 | 3 | 2
  1 — 2 | 1 | 2
  1 — 1 | 0
  1

$(3767)_{10} = (111010110111)_2$

5. Find the two's complement of

- -17

1) Find the binary representation of 17:

17 | 2
16 | 8 | 2
1 — 8 | 4 | 2
0 — 4 | 2 | 2
0 — 2 | 1 | 2
0 — 0 | 0
1

$(17)_{10} = 00010001$

2) Reverse each number:

11101110

3) Add 1:

11101111

4) Find the sum:

```
  00010001
+ 11101111
100000000 = 0
```

- -123

1) Find the binary representation of 123

```
-123 | 2
 122 | 61 | 2
   1  60 | 30 | 2
      1  30 | 15 | 2
         0  14 | 7 | 2
            1  6 | 3 | 2
               1  2 | 1 | 2
                  1  0 | 0
                     1
```

$(123)_{10} = (01111011)_2$

2) Reverse each digit:

10000100

3) Add 1:

10000101

4) Sum up:

```
  01111011
+ 10000101
-----------
 100000000 = 0
```

6. Draw up the truth table for each expression

- !p && q

p	q	!p	!p && q
0	0	1	0
0	1	1	1
1	0	0	0
1	1	0	0

- (x && y) || x

x	y	(x && y)	(x && y) || x
0	0	0	0
0	1	0	0
1	0	0	1
1	1	1	1

- a || (! b && c) || ! b

a	b	c	! b	(! b && c)	a || (! b && c) || ! b
0	0	0	1	0	1
1	0	0	1	0	1
0	1	0	0	0	0
0	0	1	1	1	1
1	1	0	0	0	1
1	0	1	1	1	1
0	1	1	0	0	0
1	1	1	0	0	1

7. Draw a flowchart which takes an input number and calculates the reverse (e.g takes 12345 and returns 54321)