1.4 (a)

$$
\begin{array}{r|l}
16 & 1457 \\
16 & 91 \quad \cdots 1 \\
16 & 5 \quad \cdots 11 \\
 & 0 \quad \cdots 5
\end{array}
\qquad
\begin{array}{r}
0.11 \\
\times \quad 16 \\
\hline
(1).76 \\
\times \quad 16 \\
\hline
(12).16
\end{array}
$$

$\therefore 1457.11_{10} = 5B1.1C_{16}$

(b)

$5B1.1C_{16}$

$= \underline{0101}\,\underline{1011}\,\underline{0001}\,.\,\underline{0001}\,\underline{1100}_2$

$= 2661.070_8$

(c)

$0_{16} = 0000_2 = 00_4$ | $8_{16} = 1000_2 = 20_4$

$1_{16} = 0001_2 = 01_4$ | $9_{16} = 1001_2 = 21_4$

$2_{16} = 0010_2 = 02_4$ | $A_{16} = 1010_2 = 22_4$

$3_{16} = 0011_2 = 03_4$ | $B_{16} = 1011_2 = 23_4$

$4_{16} = 0100_2 = 10_4$ | $C_{16} = 1100_2 = 30_4$

$5_{16} = 0101_2 = 11_4$ | $D_{16} = 1101_2 = 31_4$

$6_{16} = 0110_2 = 12_4$ | $E_{16} = 1110_2 = 32_4$

$7_{16} = 0111_2 = 13_4$ | $F_{16} = 1111_2 = 33_4$

$\therefore 5B1.1C_{16} = 112301.0130_4$

(d)

$DEC.A_{16} = D \times 16^2 + E \times 16^1 + C \times 16^0 + A \times 16^{-1}$

$= 3328 + 224 + 12 + 0.625$

$= 3564.625_{10}$

1.5 (a)

$$\begin{array}{r} 1111 \\ +\ 1010 \\ \hline 11001 \end{array}$$

$$\begin{array}{r} 1111 \\ -\ 1010 \\ \hline 101 \end{array}$$

$$\begin{array}{r} 1111 \\ \times\ 1010 \\ \hline 1111 \\ 1111 \\ \hline 10010110 \end{array}$$

(b)

$$\begin{array}{r} 110110 \\ +\ 11101 \\ \hline 1010011 \end{array}$$

$$\begin{array}{r} 110110 \\ -\ 11101 \\ \hline 11001 \end{array}$$

$$\begin{array}{r} 110110 \\ \times\ 11101 \\ \hline 110110 \\ 110110 \\ 110110 \\ 110110 \\ \hline 11000011110 \end{array}$$

(c)

$$\begin{array}{r} 100100 \\ +\ 10110 \\ \hline 111010 \end{array}$$

$$\begin{array}{r} 100100 \\ -\ 10110 \\ \hline 1110 \end{array}$$

$$\begin{array}{r} 100100 \\ \times\ 10110 \\ \hline 100100 \\ 100100 \\ 100100 \\ \hline 1100011000 \end{array}$$

1.7 (a) $(21)_{10} + (11)_{10}$

$\overset{2's}{=} (010101)_2 + (001011)_2$

$\overset{1's}{=} (010101)_2 + (001011)_2$

2's

$$\begin{array}{r} 010101 \\ +\ 001011 \\ \hline 100000 \end{array}$$

↳ overflow

1's

$$\begin{array}{r} 010101 \\ +\ 001011 \\ \hline 100000 \end{array}$$

↳ overflow

(b) $(-14)_{10} + (-32)_{10}$

$\overset{2's}{=} (110010)_2 + (100000)_2$

$$\begin{array}{r} 110010 \\ +\ 100000 \\ \hline (1)\,010010 \end{array}$$

↳ overflow

(c) $(-25)_{10} + (18)_{10}$

$\overset{2's}{=} (100111)_2 + (010010)_2$

$\overset{1's}{=} (100110)_2 + (010010)_2$

$$\begin{array}{r} 100111 \\ +\ 010010 \\ \hline 111001 \end{array}$$

$$\begin{array}{r} 100110 \\ +\ 010010 \\ \hline 111000 \end{array}$$

1.17 (a)

$$\begin{array}{r} 1111 \\ +\ 1001 \\ \hline 11000 \end{array}$$

$$\begin{array}{r} 1111 \\ -\ 1001 \\ \hline 110 \end{array}$$

$$\begin{array}{r} 1111 \\ \times\ 1001 \\ \hline 1111 \\ 1111 \\ \hline 10000111 \end{array}$$

(b)

$$\begin{array}{r} 1101001 \\ +\ 110110 \\ \hline 10011111 \end{array}$$

$$\begin{array}{r} 1101001 \\ -\ 110110 \\ \hline 110011 \end{array}$$

$$\begin{array}{r} 1101001 \\ \times\ 110110 \\ \hline 1101001 \\ 1101001 \\ 1101001 \\ 1101001 \\ \hline 1011000100110 \end{array}$$

(c)

$$\begin{array}{r} 110010 \\ +\ 11101 \\ \hline 1001111 \end{array}$$

$$\begin{array}{r} 110010 \\ -\ 11101 \\ \hline 10101 \end{array}$$

$$\begin{array}{r} 110010 \\ \times\ 11101 \\ \hline 110010 \\ 110010 \\ 110010 \\ 110010 \\ \hline 10110101010 \end{array}$$

1.7 (d)

$(-12)_{10} + (13)_{10}$

$\overset{2's}{=} (110100)_2 + (001101)_2$

$\overset{1's}{=} (110011)_2 + (001101)_2$

2's

$$\begin{array}{r} 110100 \\ +\ 001101 \\ \hline (1)\,000001 \end{array}$$

1's

$$\begin{array}{r} 110011 \\ +\ 001101 \\ \hline (1)\,000000 \\ \longrightarrow 1 \\ \hline 000001 \end{array}$$

(e)

$(-11)_{10} + (-21)_{10}$

$\overset{2's}{=} (110101)_2 + (101011)_2$

$\overset{1's}{=} (110100)_2 + (101010)_2$

$$\begin{array}{r} 110101 \\ +\ 101011 \\ \hline (1)\,100000 \end{array}$$

$$\begin{array}{r} 110100 \\ +\ 101010 \\ \hline (1)\,011110 \\ \longrightarrow 1 \\ \hline 011111 \end{array}$$

↳ overflow

1.19 (a)

```
           101110
101 ) 1110 1001
      101
      ----
      1001
       101
      ----
       1000
        101
       ----
         110
         101
        ----
          11
```

check:

```
      101110
   x     101
   ---------
      101110
    101110
   ---------
    11100110
  +       11
   ---------
    11101001
```

(b)

```
             11011
1110 ) 110000001
       1110
       -----
       10100
        1110
       -----
        11000
         1110
        -----
         10101
          1110
         -----
           111
```

check:

```
        11011
     x   1110
     --------
       11011
      11011
     11011
     --------
     101111010
   +       111
     ---------
     110000001
```

(c)

```
            1100
1001 ) 1110010
       1001
       ----
        1010
        1001
        ----
          110
```

check:

```
        1100
     x  1001
     -------
        1100
     1100
     -------
     1101100
   +     110
     -------
     1110010
```

1.28

	4	3	2	1
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	1	0	0
4	1	0	0	0
5	1	0	0	1
6	1	0	1	0
7	1	1	0	0
8	1	1	0	1
9	1	1	1	0

9154

= 1110 0001 1001 1000

1.39 (a)

$$A \overset{1's}{=} (101010)_2 = (-21)_{10}$$

$$B \overset{1's}{=} (011101)_2 = (29)_{10} \quad ; \quad -B \overset{1's}{=} (100010)_2 = (-29)_{10}$$

(i) $A+B$

$$\begin{array}{r} 101010 \\ +\,011101 \\ \hline (1)\,000111 \\ \hookrightarrow \quad 1 \\ \hline 001000 \end{array}$$

(ii) $A-B$

$$\begin{array}{r} 101010 \\ +\,100010 \\ \hline (1)\,001100 \\ \hookrightarrow \quad 1 \\ \hline 001101 \end{array}$$

↳ overflow, since $(-)+(-) \Rightarrow (+)$

(b)

$$A \overset{2's}{=} (101010)_2 = (-22)_{10}$$

$$B \overset{2's}{=} (011101)_2 = (29)_{10} \quad ; \quad -B \overset{2's}{=} (100011)_2 = (-29)_{10}$$

(i) $A+B$

$$\begin{array}{r} 101010 \\ +\,011101 \\ \hline (1)\,000111 \end{array}$$

(ii) $A-B$

$$\begin{array}{r} 101010 \\ +\,100011 \\ \hline (1)\,001101 \end{array}$$

↳ overflow, since $(-)+(-) \Rightarrow (+)$

1.44.

1. Two positive numbers ⇒ ① 0x...x + 0x...x = 0x...x

(carry in = 0) = (carry out = 0).

② 0x...x + 0x...x = 1x...x

(carry in = 1) ≠ (carry out = 0) ⇒ overflow

2. Two negative numbers ⇒ ① 1x...x + 1x...x = 1x...x

(carry in = 1) = (carry out = 1)

② 1x...x + 1x...x = 0x...x

(carry in = 0) ≠ (carry out = 1) ⇒ overflow

3. A positive and a negative numbers

⇒ ① 0x...x + 1x...x = 0x...x

(carry in = 1) = (carry out = 1)

② 0x...x + 1x...x = 1x...x

(carry in = 0) = (carry out = 0)

∴ 當 carry in ≠ carry out 時，會產生 overflow.