2023-2024 学年第 1 学期 数字逻辑作业

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章节名称： 第 1 章　数字系统与编码

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2. 将下列二进制数转换成十进制数、八进制数和十六进制数。

(1) 1101 ;

Answer: *Set* $(N)_2 = 1101$, *then*

$$(N)_{10} = 1 * 2^3 + 1 * 2^2 + 0 * 2^1 + 1 * 2^0$$
$$= 8 + 4 + 1$$
$$= 13$$
$$\because (N)_2 = \underline{001}\,\underline{101}$$
$$= \underline{1101}$$
$$\therefore (N)_8 = 15, \quad (N)_{16} = D$$

(3) 0.101 ;

Answer: *Set* $(N)_2 = 0.101$, *then*

$$(N)_{10} = 0 * 2^0 + 1 * 2^{-1} + 0 * 1^{-2} + 1 * 2^{-3}$$
$$= \frac{1}{2} + \frac{1}{8}$$
$$= \frac{5}{8}$$
$$\because (N)_2 = \underline{000}.\,\underline{101}$$
$$= \underline{0000}.\,\underline{1010}$$
$$\therefore (N)_8 = 0.5, \quad (N)_{16} = 0.A$$

(5) 10101.11 ;

Answer: *Set* $(N)_2 = 10101.11$, *then*

$$(N)_{10} = 1 * 2^4 + 0 * 2^3 + 1 * 2^2 + 0 * 2^1 + 1 * 2^0 + 1 * 2^{-1} + 1 * 2^{-2}$$
$$= 16 + 4 + 1 + \frac{1}{2} + \frac{1}{4}$$
$$= 21.75$$
$$\because (N)_2 = \underline{010}\,\underline{101}.\,\underline{110}$$
$$= \underline{0001}\,\underline{0101}.\,\underline{1100}$$
$$\therefore (N)_8 = 25.6, \quad (N)_{16} = 15.C$$

3. 将下列十进制数转换成二进制数、八进制数和十六进制数。

(1) 27 ;

Answer: *Set* $(N)_{10} = 27$,

$$27 \div 2 = 13...1$$
$$13 \div 2 = 6...1$$
$$6 \div 2 = 3...0$$
$$3 \div 2 = 1...1$$
$$1 \div 2 = 0...1$$

then

$$(N)_2 = 11011$$

According to **2.**,

$$(N)_8 = 33$$
$$(N)_{16} = 1B$$

(3) 0.375 ;

Answer: *Set* $(N)_{10} = 0.375$,

$$
\begin{array}{r}
0.375 \\
* \quad 2 \\
\hline
[1].750 \\
* \quad 2 \\
\hline
[1].500 \\
* \quad 2 \\
\hline
[1].000
\end{array}
$$

then

$$(N)_2 = 0.111$$

According to **2.**,

$$(N)_8 = 0.7$$
$$(N)_{16} = 0.D$$

(5) 174.25 ;

Answer: *Set* $(N)_{10} = 174.25$, according to **2.** , **3.(1)(3)** ,

$$(N)_2 = 10101110.01$$
$$(N)_8 = 256.2$$
$$(N)_{16} = AE.4$$

4. 进行下列数制的转换：

(3) $(65634)_8 = (\ ? \ )_{10}$;

Answer:

$$(65634)_8 = 6 * 8^4 + 5 * 8^3 + 6 * 8^2 + 3 * 8^1 + 4 * 8^0$$
$$= (27548)_{10}$$

(4) $(121.02)_3 = (\ ? \ )_4$;

Answer:

$$\because (121.02)_3 = 1 * 3^2 + 2 * 3^1 + 1 * 3^0 + 2 * 3^{-2}$$
$$= 9 + 6 + 1 + \frac{2}{9}$$
$$= (16.3333...)_{10}$$
$$\because (16.3333...)_{10} \approx (100.1032)_4$$
$$\therefore (121.02)_3 = (100.1032)_4$$

5. 写出下列各数的原码、反码和补码。

1. $+0.00101$ **Answer:** *0.00101; 0.11010; 0.11011* .
2. -0.10000 **Answer:** *1.10000; 1.01111; 1.10000* .
3. -0.11011 **Answer:** *1.11011; 1.00100; 1.11100* .
4. $+10101$ **Answer:** *010101; 001010; 001011* .
5. -10000 **Answer:** *110000; 101111; 110000* .
6. -11111 **Answer:** *111111; 100000; 100001* .

6. 已知下列机器数，写出他们的真值。

$[X_1]_原 = 11011$, $[X_2]_反 = 11011$, $[X_2]_补 = 11011$, $[X_4]_补 = 10000$。

Answer:

$$X_1 = -1011, \quad X_2 = -0100, \quad X_3 = -0101, \quad X_4 = +1111$$

Question: 整数真值的最高位的数值可以为 0 吗？

7. 完成下列代码之间转换。

(1) $(0001100110010001.0111)_{BCD} = (\ ? \ )_{10}$;

Answer: According to BCD：

$$(\underline{0001} \ \underline{1001} \ \underline{1001} \ \underline{0001}.\underline{0111})_{BCD} = (1991.7)_{10}$$

(2) $(137.9)_{10}=($? $)_{余3}$;

Answer: According to 余 3 码：

$$(137.9)_{10} = (\underline{0100}\ \underline{0110}\ \underline{1010}.\underline{1100})_{余3}$$

(3) $(1011001110010111)_{余3}=($? $)_{BCD}$;

Answer: According to 余 3 码 and BCD：

$$(\underline{1011}\ \underline{0011}\ \underline{1001}\ \underline{0111})_{余3} = (\underline{1000}\ \underline{0000}\ \underline{0110}\ \underline{0100})_{BCD}$$

8.将下列 BCD 码转换成十进制数和二进制数。

(1) 011010000011 ;

Answer:

$$(\underline{0110}\ \underline{1000}\ \underline{0011})_{BCD} = (683)_{10}$$
$$= (1010101101)_2$$

(2) 01000101.1001 ;

Answer:

$$(\underline{0100}\ \underline{0101}.\underline{1001})_{BCD} = (45.9)_{10}$$
$$= (101101.111)_2$$

9.试写出下列二进制数的典型格雷码。

(1) 111000 ;

Answer: *Set* $(N)_2 = 111000$, *then*

$$(N)_{Grey} = 100111$$

(2) 10101010 ;

Answer: *Set* $(N)_2 = 10101010$, *then*

$$(N)_{Grey} = 11111111$$

10.试编写出一位余 3 码的奇校验汉明码。（取 2 的余 3 码为代表）

Answer:

　　1.根据要传输的信息码位数 k 来确定需要的最小汉明校验码位数，设为 r:

$$\because (2)_{余3} = 0101$$
$$\therefore k = 4$$
$$\because 2^r \geq r + k + 1$$
$$\therefore 2^r \geq r + 4 + 1$$

$$\therefore r_{\min} = 3.$$

设 3 位校验码分别为 b_1, b_2, b_3

2.将 3 位校验码分别置于 1、2、4 码位上，则构成汉明码

$$b_1 b_2 0 b_3 101.$$

3.将汉明码分组，并进行奇校验运算以确定校验位的取值：

$$b_1 = 0 \oplus 1 \oplus 1 \oplus 1 = 1$$
$$b_2 = 0 \oplus 0 \oplus 1 \oplus 1 = 0$$
$$b_3 = 1 \oplus 0 \oplus 1 \oplus 1 = 1$$

s.t.

$$\begin{aligned} G\left((2)_{\text{余}3}\right) &= G(0101) \\ &= b_1 b_2 0 b_3 101 \\ &= 1001101. \end{aligned}$$