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**1 Number conversions****1.1 Convert following numbers to binary numbers**

- a)  $55_{10} = 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 = 11\ 0111_2$
- b)  $677_{10} = 1 \cdot 2^9 + 0 \cdot 2^8 + 1 \cdot 2^7 + 0 \cdot 2^6 + 1 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 = 10\ 1010\ 0101_2$
- c)  $65_{10} = 1 \cdot 2^6 + 0 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 1 \cdot 2^0 = 100\ 0001_2$
- d)  $700_{10} = 1 \cdot 2^9 + 0 \cdot 2^8 + 1 \cdot 2^7 + 0 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 0 \cdot 2^1 + 0 \cdot 2^0 = 10\ 1011\ 1100_2$

**1.2 Convert following base-10 numbers to 2-complement 8 bits numbers.**

- a)  $+59 = -0 \cdot 2^7 + 0 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 0 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 = 0011\ 1011_2$
- b)  $-1 = -1 \cdot 2^7 + 1 \cdot 2^6 + 1 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 = 1111\ 1111_2$
- c)  $-128 = -1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 0 \cdot 2^4 + 0 \cdot 2^3 + 0 \cdot 2^2 + 0 \cdot 2^1 + 0 \cdot 2^0 = 1000\ 0000_2$
- d)  $-97 = -1 \cdot 2^7 + 0 \cdot 2^6 + 0 \cdot 2^5 + 1 \cdot 2^4 + 1 \cdot 2^3 + 1 \cdot 2^2 + 1 \cdot 2^1 + 1 \cdot 2^0 = 1001\ 1111_2$

**1.3 Convert the following unsigned numbers to the specified radix and size if it is possible. If conversion is not possible state the reason why.**

- a)  $0xE5 \rightarrow 8\text{ bit binary}$   
 $E5_{16} = 1110_2 + 0101_2 = 1110\ 0101_2$
- b)  $0x3F1 \rightarrow 8\text{ bit binary}$   
 $3F1_{16} = 0011_2 + 1111_2 + 0001_2 = 0011\ 1111\ 0001_2 \rightarrow \text{Can't convert to 8 bit binary}$
- c)  $0x3E8 \rightarrow 10\text{ bit binary}$   
 $3E8_{16} = 0011_2 + 1110_2 + 1000_2 = 0011\ 1110\ 1000_2 \rightarrow 11\ 1110\ 1000_2$
- d)  $0x73B \rightarrow 16\text{ bit binary}$   
 $73B_{16} = 0111_2 + 0011_2 + 1011_2 = 0111\ 0011\ 1011_2 \rightarrow 0000\ 0111\ 0011\ 1011_2$
- e)  $0011\ 0010_2 \rightarrow 10\text{ bit binary}$   
 $0011\ 0010_2 \rightarrow 00\ 0011\ 0010_2$
- f)  $0000\ 0100\ 1000\ 1011_2 \rightarrow 12\text{ bit binary}$   
 $0000\ 0100\ 1000\ 1011_2 \rightarrow 0100\ 1000\ 1011_2$
- g)  $1101\ 1001_2 \rightarrow 16\text{ bit binary}$   
 $1101\ 1001_2 \rightarrow 0000\ 0000\ 1101\ 1001_2$
- h)  $0010\ 0011\ 1011_2 \rightarrow 8\text{ bit binary}$   
 $0010\ 0011\ 1011_2 \rightarrow \text{Can't convert to 8 bit binary}$

- 1.4 Convert the following signed two's complement numbers to the given size if possible. If conversion is not possible state the reason why.
- a)  $1001\ 1101_2 \rightarrow 12\text{ bit binary}$   
 $1001\ 1101_2 = -99_{10} = 1111\ 1001\ 1101_2$
  - b)  $0001\ 0001_2 \rightarrow 16\text{ bit binary}$   
 $0001\ 0001_2 = 17_{10} = 0000\ 0000\ 0001\ 0001_2$
  - c)  $1111\ 1111\ 1010\ 1111_2 \rightarrow 8\text{ bit binary}$   
 $1111\ 1111\ 1010\ 1111_2 = -81_{10} = 1010\ 1111_2$
  - d)  $1110\ 1011\ 1001\ 0001_2 \rightarrow 12\text{ bit binary}$   
 $1110\ 1011\ 1001\ 0001_2 = -5231_{10} \rightarrow \text{Smaller than smallest 12 bit binary } (-2048) \rightarrow \text{Can't convert to 12 bit binary}$
  - e)  $0xFAC \rightarrow 16\text{ bit binary}$   
 $FAC_{16} = 1111_2 + 1010_2 + 1100_2 = 1111\ 1010\ 1100_2 \rightarrow 0000\ 1111\ 1010\ 1100_2$   
 $\rightarrow 1111\ 0000\ 0101\ 0100_2$
  - f)  $0x0F \rightarrow 16\text{ bit binary}$   
 $0F_{16} = 0000_2 + 1111_2 = 0000\ 1111_2 \rightarrow 0000\ 0000\ 0000\ 1111_2 \rightarrow 1111\ 1111\ 1111\ 0001_2$