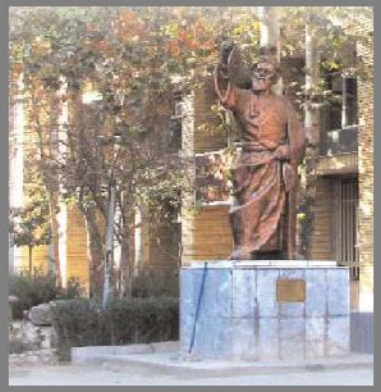
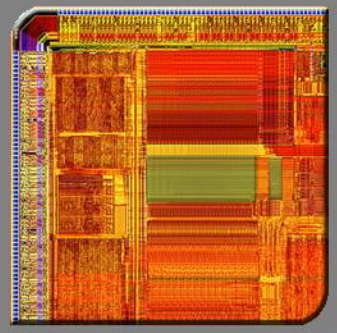
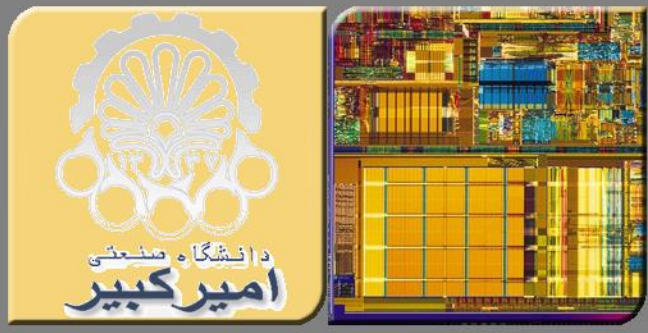
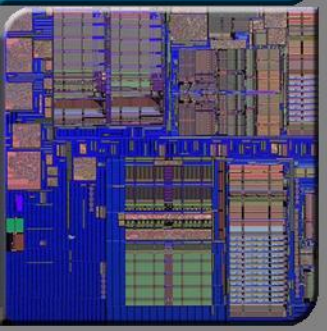






اصول سیستمهای کامپیوتری

استاندارد نمایش اعداد اعشاری



مدرس: دکتر محمد حسن شیرعلی شهرضا

دانشگاه صنعتی امیرکبیر (پلی تکنیک تهران)

استاندارد اعداد اعشاری

- **دقت تک**

- Single Precision

s	e (8-bits)	f (23-bits)

- Value of bits stored in representation is:
  - If e=255 and f != 0, then v is NaN regardless of s
  - If e=255 and f = 0, then $v = (-1)^s \infty$
  - If 0 < e < 255, then $v = (-1)^s 2^{e-127} (1.f)$ – normalized number
  - If e = 0 and f != 0, the $v = (-1)^s 2^{-126} (0.f)$
    - Denormalized numbers – allow for graceful underflow
  - If e = 0 and f = 0 the $v = (-1)^s 0$ (zero)

استاندارد اعداد اعشاری

- **دقت مضاعف**

- Double Precision

s	e (11-bits)	f (52-bits)

- Value of bits in word representation is:
  - If e=2047 and f != 0, then v is NaN regardless of s
  - If e=2047 and f = 0, then v = $(-1)^s \infty$
  - If 0 < e < 2047, then v = $(-1)^s 2^{e-1023}$ (1.f)
    - – normalized number
  - If e = 0 and f != 0, the v = $(-1)^s 2^{-1022}$ (0.f)
    - Denormalized numbers – allow for graceful underflow
  - If e = 0 and f = 0 the v = $(-1)^s$ 0 (zero)

مثال ۱

- Converting from base 10 to the representation
- Single precision example
- Covert 100_{10}
- Step 1 – convert to binary - 0110 0100

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

- In a binary representation form of 1.xxx have
  - 0110 0100 = 1.100100 x 2^6

مثال ۱ (ادامه)

- 1.1001×2^6 is binary for 100
- Thus the exponent is a 6
  - Biased exponent will be 6+127=133 = 1000 0101
  - Sign will be a 0 for positive
  - Stored fractional part f will be 1001
- Thus we have
  - s e f
  - 0 100 0 010 1 1 00 1000....
  - 4 2 C 8 0 0 0 0 in hexadecimal
  - $42C8 0000 is representation for 100

مثال ۲

- Representation for -175

175 = 128 + 32 + 8 + 4 + 2 +1 = 1010 1111 –

Or 1.0101111×2^7 –

S = 1 –

Exponent is 7 +127 = 134 = 1000 0110 –

Fractional part f = 0101111 –

Representation 1100 0011 0010 1111 0000 …. –

Or in Hex $C32F 0000 –

مثال ۱ برای تبدیل معکوس

- Convert $C32F 0000 into decimal
- Extract components from
  - 1100 0011 0010 1111
  - S = 1
  - Exponent = 1000 0110 = 128+4+2 = 134
  - unbias 134 – 127 =7
  - f = 0101111 so mantissa is 1.0101111
  - Adjust by exponent 1010 1111 (move binary pt 7 places)
  - Or 128+32+15 = 175
  - Sign is negative so -175

مثال ۲ برای تبدیل معکوس

- Convert $41C8 0000 to decimal
  - 0100 0001 1100 1000 0000 …. –
  - S is 0 so positive number –
  - Exponent 1000 0011 = 128+3=131-127=4 –
  - f = 1001 so mantissa is 1.1001 –
  - With 4 binary positions have 11001 as final number or a decimal 25 –