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CPE 315

Homework 1

1. 0.010 = 0.02

Sign = 0

Exponent = 127 – 127 = 0

Fraction = 0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 0 | 0 |

1. 6.510 = 110.12

Sign = 0

Normalize: 110.1 = 1.101 x 22

Exponent = 127 + 2 = 12910 = 100000012

Fraction = 10100…0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 1000 0001 | 101 0000 0000 0000 0000 0000 |

1. 4.010 = 100.02

Sign = 0

Normalize: 100.0 = 1.000 x 22

Exponent = 127 + 2 = 12910 = 100000012

Fraction = 0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 1000 0001 | 0 |

1. -4.0 = -100.02

Sign = 1

Normalize: -100.0 = -1.000 x 22

Exponent = 127 + 2 = 129

Fraction = 0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 1 | 1000 0001 | 0 |

* 1. Maximum value of a single precision: 3.402823 x 1038

Hex value: 0x7F7FFFFF

Sign = 0

Biggest fraction is 1 – 2-24

Exponent 2128

Floating point representation: (1 − 2−24) × 2128

* 1. Maximum value of double precision: 1.79769 x 10308

Hex value: 0x7FFFFFFFFFFFF

Sign = 0

Biggest fraction is 1 – 2-53

Exponent 21023

Floating point representation: (1 – 2-53) x 21023

* 1. 0.3752 = 0.0112

Sign = 0

Normalize: 0.0112 = 1.1 x 2-2

Exponent = 127 – 2 = 12510 = 0111 1101

Fraction = 100…0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 0111 1101 | 100 0000 0000 0000 0000 0000 |

28.010 =11100.02

Sign = 0

Normalize: 11100.0 = 1.11000 x 24

Exponent = 127 + 4 = 13110 = 1000 0011

Fraction = 11000…0

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 1000 0011 | 110 0000 0000 0000 0000 0000 |

* 1. We must put the numbers on the common scale of 4.

Shift the number with lower scale which is 1.1 x 2-2 to 0.0000011 x 24.   
And then we can add them together. Result: 1.1100011 x 24

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 0 | 1000 0011 | 110 0011 0000 0000 0000 0000 |

* 1. Single-precision: 24 actual bits including the hidden 1
  2. Double-precision: 53 actual bits including the hidden 1

0xBE00 = 1011 1110 0000 0000

|  |  |  |
| --- | --- | --- |
| Sign | Exponent | Fraction |
| 1 | 0 1111 | 10 0000 0000 |

Sign = 1

Real Exponent = 15 – 15 = 0

Denormalize: –1.1 x 20 = –1.12 = –1.510