

1.14 Write the number 581 in the 16-bit IDDD-643 standard that was introduced in Problem 1.13.

Solution

According to the IDDD-643 standard:

- Since the number is positive, the first bit is 0
- The largest power of 2 that divides into 581 is 9 since $2^9 = 512$. Thus,

$$\frac{581}{2^9} \times 2^9 = \frac{581}{512} \times 2^9 = 1.134765625 \times 2^9$$

- The exponent is 9. Adding a bias of 15, the value of the exponent that must be stored is $9+15 = 24$. The number 24 in binary form is:

$$24 = 1 \times 2^4 + 1 \times 2^3 = 16 + 8$$

Thus the number 24 in binary form is 11000. Since 5 bits can be used to store the exponent, 24 is stored as 11000.

- Next, the mantissa 0.134765625 in binary form is:

$$2^{-3} + 2^{-7} + 2^{-9} \text{ or, } 0.001000101$$

Since there are 10 bits of storage available, there is no loss in precision and the mantissa is stored as 0010001010. Thus, the number 581 in the IDDD-643 standard is stored as:

0	1	1	0	0	0	0	0	1	0	0	0	1	0	1	0
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