Converting Floating-Point Numbers from Decimal to Binary

There is a simple, step-by-step method for computing the binary expansion on the right-hand side of the point. We will illustrate the method by converting the decimal value .625 to a binary representation.

Step 1: Begin with the decimal fraction and multiply by 2. The whole number part of the result is the first binary digit to the right of the point.

Because .625 x 2 = 1.25, the first binary digit to the right of the point is a 1.
So far, we have .625 = .1??? . . . (base 2) .

Step 2: Next we disregard the whole number part of the previous result (the 1 in this case) and multiply by 2 once again. The whole number part of this new result is the *second* binary digit to the right of the point. We will continue this process until we get a zero as our decimal part or until we recognize an infinite repeating pattern.

Because .25 x 2 = 0.50, the second binary digit to the right of the point is a 0.
So far, we have .625 = .10?? . . . (base 2) .

Step 3: Disregarding the whole number part of the previous result (this result was .50 so there actually is no whole number part to disregard in this case), we multiply by 2 once again. The whole number part of the result is now the next binary digit to the right of the point.

Because .50 x 2 = 1.00, the third binary digit to the right of the point is a 1.
So now we have .625 = .101?? . . . (base 2) .

Step 4: In fact, we do not need a Step 4. We are finished in Step 3, because we had 0 as the fractional part of our result there.

Hence the representation of .625 = .101 (base 2) .