Explanation of the calculation

To calculate the two's complement of a negative number, we first invert all of the bits in the number and then add 1.

Example:

The two's complement of -2 in a 5-bit binary system is calculated as follows:

```
-2 in two's complement = (11110)two
```

Step 1: Invert all of the bits in the number:

```
00010two -> 11101two
```

Step 2: Add 1:

```
11101two + 00001two = 11110two
```

Verification

We can verify that the calculation is correct by adding the two's complement of -2 to the original number:

```
(11110)two + (00010)two = (00000)two
```

This tells us that the two's complement of -2 is indeed (11110)two.

Why does the two's complement representation work?

The two's complement representation works because it allows us to represent negative numbers using the same addition and subtraction operators as we use for positive numbers.

For example, to add two positive numbers in two's complement, we simply add the two numbers together. If the sum is greater than or equal to 2^n, where n is the number of bits in

the representation, then the carry bit will be set. The carry bit can then be used to generate the correct two's complement representation of the sum.

Similarly, to subtract two numbers in two's complement, we simply subtract the smaller number from the larger number. If the difference is negative, then the two's complement representation of the difference will have the carry bit set.

Conclusion

The two's complement representation is a very efficient way to represent negative numbers in binary systems. It is used in all modern computers and digital devices.