**Задания для самостоятельной работы №2**

Десятичные числа **101** и **-62** перевести в двоичную систему методом «взвешивания». Получить произведение двух чисел, выполненное в дополнительном коде.

Переведём модули чисел в двоичную систему методом взвешивания:

|  |  |
| --- | --- |
| 62 | 32 |
| 32 | **1** |
| 30 | 16 |
| 16 | **1** |
| 14 | 8 |
| 8 | **1** |
| 6 | 4 |
| 4 | **1** |
| 2 | 2 |
| 2 | **1** |
| 0 |  |

-62 = -**1111102**

|  |  |
| --- | --- |
| 101 | 64 |
| 64 | **1** |
| 37 | 32 |
| 32 | **1** |
| 5 | 4 |
| 4 | **1** |
| 1 | 1 |
| 1 | **1** |
| 0 |  |

101 = **11001012**

Переведём числа в дополнительный код (n = 8):

Пусть X = 101, Y = -62:

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |

Xпр =

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |

Xоб =

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |

Xд =

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 1 | 1 | 1 | 1 | 1 | 0 |

Yпр =

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 |

Yоб =

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 |

Yд =

Произведём умножение Xд на Yд:

Исходное положение: Z = Yд

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | `1 | 0 | 0 | 0 | 0 | 1 | 0 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y0 = 0 => |
| + | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | `1 | 0 | 0 | 0 | 0 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y1 = 1 => К старшим разрядам добавляем Xд (действие 1) |
| 1) + | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | `1 | 0 | 0 | 0 | 0 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Делаем 1 сдвиг вправо |
|  | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | `1 | 0 | 0 | 0 | 0 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y2 = y3 = y4 =y5 = 0 => Можно за одно действие сделать 4 сдвига вправо |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 | 0 | `1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | => К старшим разрядам добавляем Xд (действие 2) |
| 2) + | 0 | 0 | 1 | 1 | 0 | 0 | 1 | 0 | 1 |  |  |  |  |  |  |  |  |
|  | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | `1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Делаем 1 сдвиг вправо |
|  | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0` |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Y < 0 => К старшим разрядам добавляем (-X)д (действие 4) |
| 4) + | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 1 | 1 |  |  |  |  |  |  |  |  |
|  | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0` |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Результат в дополнительном коде: |
|  | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0` |  |

**Zдп** = **1**|10011110001010

**Zоб** = **1**|10011110001001 (Zоб = Zд - 1)

**Zпр** = **1**|01100001110110 (Zп = инвертированный Zоб)

**Искомый результат**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 1 | 0 |
| Бит  знака |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Произведём проверку: **-**11000011101102 = -(2+4+16+32+64+2048+4096) = -626210

Действительно, 101 (-62) = -6262, значит ответ верный