**Задания для самостоятельной работы №2**

Десятичные числа **-57** и **112** перевести в двоичную систему методом «взвешивания». Получить произведение двух чисел, выполненное в дополнительном коде.

Переведём модули чисел в двоичную систему методом взвешивания:

|  |  |
| --- | --- |
| 57 | 32 |
| 32 | **1** |
| 25 | 16 |
| 16 | **1** |
| 9 | 8 |
| 8 | **1** |
| 1 | 4 |
| 0 | **0** |
| 1 | 2 |
| 0 | **0** |
| 1 | 1 |
| 1 | **1** |
| 0 |  |

-57 = -**1110012**

|  |  |
| --- | --- |
| 112 | 64 |
| 64 | **1** |
| 48 | 32 |
| 32 | **1** |
| 16 | 16 |
| 16 | **1** |
| 0 | 8 |
| 0 | **0** |
| 0 | 4 |
| 0 | **0** |
| 0 | 2 |
| 0 | **1** |
| 0 | 1 |
| 0 | 0 |
| 0 |  |

112 = **11100002**

Переведём числа в дополнительный код (n = 8):

Пусть X = -57, Y = 112:

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

Xпр =

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

Xоб =

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

Xд =

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

Yпр =

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

Yоб =

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

Yд =

Произведём умножение Xд на Yд:

Исходное положение: Z = Yд

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | `1 | 1 | 1 | 0 | 0 | 0 | 0 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y0 = y1 = y2 =y3 = 0 => Можно за одно действие сделать 4 сдвига вправо (1) |
| 1) + | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | `1 | 1 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y4 = 0 => К старшим разрядам добавляем Xд (действие 2) |
| 2) + | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |
|  | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | `1 | 1 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Делаем 1 сдвиг вправо |
|  | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 0 | `1 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y5 = 1 => К старшим разрядам добавляем Xд (действие 3) |
| 3) + | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | `1 | 1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Делаем 1 сдвиг вправо |
|  | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | `1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | y6 = 1 => К старшим разрядам добавляем Xд (действие 4) |
| 4) + | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 |  |  |  |  |  |  |  |  |
| 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | `1 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Делаем 1 сдвиг вправо |
|  | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0` |  |

Поскольку Y>0, никаких дополнительных действий производить не нужно:

**Zдп** = **1**|1001110001000 (Zд = Z)

**Zоб** = **1**|1001110000111 (Zоб = Zд - 1)

**Zпр** = **1**|0110001111000 (Zп = инвертированный Zоб)

**Искомый результат**

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

Произведём проверку: -11000111100002 = -(16 + 32 + 64 +128 + 2048 + 4096) = -638410

Действительно, 112 (-57) = -6384, значит ответ верный