**Разыграев Кирилл Р3115. Вариант 73**

A = 12,34  
B = 15,07

**Формат Ф1**

A = (12,34)10 = (C,570A3D)16 = (0,C570A3D)16 · 161

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

B = (15,07)10 = (F,11EB85)16 = (0,F11EB85)16 · 161

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

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| XA | = | – | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| XB | = | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| (XA-XB)пр. | = |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

(XA-XB) = 0; XC = XA = XB = 1

**A>0, B>0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA | = | + |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MB | = |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MC | = |  | 1 | . | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |

Результат сложения денормализован влево.  
  
MC = . 0 0 0 1 1 0 1 1 0 1 1 0  
  
Т.к. выполнен сдвиг мантиссы вправо, характеристику результата нужно увеличить на 1 (ХC = ХC + 1 = 2).

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

С\* = МС · 16Рс = (0,1B6)16 · 162 = 27,375.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = 27,41 – 27,375 = 0,035

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,035 |  | · 100% = 0,12769% |
| 27,41 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов
* потерей значащих разрядов мантиссы результата при его нормализации

**A>0, B<0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA | = | – |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MB | = |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MC | = |  |  | . | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |

Результат вычитания нормализован и представлен в дополнительном коде.  
  
MC = . 1 1 0 1 0 1 0 0 0 1 0 1

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

С\* = МС · 16Рс = (-0,2BB)16 · 161 = -2,73047.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = -2,73 – (-2,73047) = 0,00047

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00047 |  | · 100% = 0,01717% |
| -2,73 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов

**A<0, B>0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MB | = | – |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MA | = |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MC | = |  |  | . | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |

Результат вычитания нормализован.  
  
MC = . 0 0 1 0 1 0 1 1 1 0 1 1

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

С\* = МС · 16Рс = (0,2BB)16 · 161 = 2,73047.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = 2,73 – 2,73047 = -0,00047

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | -0,00047 |  | · 100% = 0,01717% |
| 2,73 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов;

**Формат Ф2**

A = (12,34)10 = (C,570A3D)16 = (0,1100010101110000101)2 · 24

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

B = (15,07)10 = (F,11EB85)16 = (0,111100010001111011)2 · 24

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

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| XA | = | – | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| XB | = | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| (XA-XB)пр. | = |  | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

(XA-XB) = 0; XC = XA = XB = 4

**A>0, B>0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA | = | + |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MB | = |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MC | = |  | 1 | . | 1 | 0 | 1 | 1 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 1 |

Результат сложения денормализован влево.  
  
MC = . 1 1 0 1 1 0 1 1 0 1 0 0  
  
Т.к. выполнен сдвиг мантиссы вправо, характеристику результата нужно увеличить на 1 (ХC = ХC + 1 = 5).

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

С\* = МС · 2Рс = (0,1101101101)2 · 25 = 27,40625.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = 27,41 – 27,40625 = 0,00375

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00375 |  | · 100% = 0,01368% |
| 27,41 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов
* потерей значащих разрядов мантиссы результата при его нормализации

**A>0, B<0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MA | = | – |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MB | = |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MC | = |  |  | . | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 1 | 0 | 1 |

Результат вычитания денормализован вправо и представлен в дополнительном коде.  
  
MC = . 0 1 0 1 0 0 0 1 0 1 0 0  
  
Т.к. выполнен сдвиг мантиссы влево, характеристику результата нужно уменьшить на 2 (ХC = ХC - 2 = 2).

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

С\* = МС · 2Рс = (-0,1010111011)2 · 22 = -2,73047.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = -2,73 – (-2,73047) = 0,00047

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00047 |  | · 100% = 0,01717% |
| -2,73 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов;
* потерей значащих разрядов мантиссы результата при его нормализации;

**A<0, B>0:**

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MB | = | – |  | . | 1 | 1 | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 |
| MA | = |  | . | 1 | 1 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 |
| MC | = |  |  | . | 0 | 0 | 1 | 0 | 1 | 0 | 1 | 1 | 1 | 0 | 1 | 1 |

Результат вычитания денормализован вправо.  
  
MC = . 1 0 1 0 1 1 1 0 1 1 0 0  
  
Т.к. выполнен сдвиг мантиссы влево, характеристику результата нужно уменьшить на 2 (ХC = ХC - 2 = 2).

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

С\* = МС · 2Рс = (0,1010111011)2 · 22 = 2,73047.  
  
Определим абсолютную и относительную погрешности результата:  
ΔС = 2,73 – 2,73047 = -0,00047

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | -0,00047 |  | · 100% = 0,01717% |
| 2,73 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов;
* потерей значащих разрядов мантиссы результата при его нормализации;

В формате Ф2 результаты получились точнее из-за того, что операнды представлены точнее и при нормализации результата сдвиг производился на один двоичный разряд, а не на четыре.