Домашнее задание 6

Вариант 87

А = 0,821

В = 0,982

1. **Формат *Ф1* (число разрядов мантиссы *m* =12).**  
   A = (0,821)10 = (0,D22D0E)16 = (0,D22D0E)16  · 160

М*А*

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

B = (0,982)10 = (0,FB645A)16 = (0,FB645A)16 · 160

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

М*А*

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

(XA-XB) = 0; XC = XA = XB = 0

а) A>0, B>0.

2,3)

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

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

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

С\* = МС · 16Рс = (0,1CD)16 · 161 = 1,80078.  
  
4) Абсолютная и относительная погрешности результата:  
ΔС = 1,803 – 1,80078 = 0,00222

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00222 |  | · 100% = 0,12306% |
| 1,803 |

Погрешность полученного результата объясняется следующими факторами:

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

b) A<0, B>0:

2,3)

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

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

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

С\* = МС · 16Рс = (0,293)16 · 160 = 0,16089.  
  
4) Абсолютная и относительная погрешности результата:  
ΔС = 0,161 – 0,16089 = 0,00011

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00011 |  | · 100% = 0,06915% |
| 0,161 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов;

c) A>0, B<0.

2,3)

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

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

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

С\* = МС · 16Рс = (-0,293)16 · 160 = -0,16089.  
  
4) Абсолютная и относительная погрешности результата:  
ΔС = -0,161 – (-0,16089) = -0,00011

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | -0,00011 |  | · 100% = 0,06915% |
| -0,161 |

Погрешность полученного результата объясняется следующими факторами:

* неточным представлением операндов;

1. **Формат *Ф2*.**

A = (0,821)10 = (0,D22D0E)16 = (0,1101001000101101)2 · 20

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

B = (0,982)10 = (0,FB645A)16 = (0,11111011011001)2 · 20

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

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

(XA-XB) = 0; XC = XA = XB = 0

а) A>0, B>0.

2,3)

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

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

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

С\* = МС · 2Рс = (0,1110011011)2 · 21 = 1,80273.  
4) Абсолютная и относительная погрешности результата:  
ΔС = 1,803 – 1,80273 = 0,00027

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00027 |  | · 100% = 0,01473% |
| 1,803 |

Погрешность полученного результата объясняется следующими факторами:

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

b) A<0, B>0.

2,3)

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

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

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

С\* = МС · 2Рс = (0,1010010011)2 · 2-2 = 0,16089.  
  
4) Абсолютная и относительная погрешности результата:  
ΔС = 0,161 – 0,16089 = 0,00011

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | 0,00011 |  | · 100% = 0,06915% |
| 0,161 |

Погрешность полученного результата объясняется следующими факторами:

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

б) A>0, B<0.

2,3)

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

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

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

С\* = МС · 2Рс = (-0,1010010011)2 · 2-2 = -0,16089.  
  
4) Абсолютная и относительная погрешности результата:  
ΔС = -0,161 – (-0,16089) = -0,00011

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = |  | -0,00011 |  | · 100% = 0,06915% |
| -0,161 |

Погрешность полученного результата объясняется следующими факторами:

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

5) 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.

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