**Дискретная математика**

Домашнее задание №6

«Сложение чисел с плавающей запятой»

Вариант № 26

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Варианты задания

|  |  |
| --- | --- |
| ***A*** | ***B*** |
| 106,5 | 58,38 |

Ход работы

**#1**

1. Формат *Ф1*

*А* = (106,5)10 = (6A.8) = (0.6A8)16 · 162

М*А*

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

*В* = (58,38)10 = (3A.6(147AE))16 = (0.3A6(147AE))16 · 162

M*B*

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

Округление к ближайшему

2. Формат *Ф2*

*А* = (106,5)10 = (6A,8) = (0.11010101)2 · 27

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

*В* = (58,38)10 = (3A.6(147AE))16 = (0.1 110 1001 1000 01010001…..)2 · 26

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

Округление к ближайшему

**#2-4**

1. Формат *Ф1*

*XA* = 1 0 0 0 0 1 0

*XB* = 1 0 0 0 0 1 0

*XC*= 0 0 0 0 0 0 0

*ХС =* 0*.*

*Значит*

а) *А*>0, *B*>0:

М*А* = . 0 1 1 0 1 0 1 0 1 0 0 0

+

М*В* = . 0 0 1 1 1 0 1 0 0 1 1 0

М*С* = . 1 0 1 0 0 1 0 0 1 1 1 0

Результат сложения нормализован.

МС = . 1 0 1 0 0 1 0 0 1 1 1 0

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

*С*\* = М*С* · 16Р*с* = (0,A4E)16 · 162 = (A4,E)16 = 164,875.

Определим абсолютную и относительную погрешности результата:

Δ*С* = 164,88 – 164,875 = 0,005

δ*С* = · 100% = 0,003%

Погрешность полученного результата объясняется неточным представлением операндов.

б) *А*>0, *B*<0:

М*А* = \_ . 0 1 1 0 1 0 1 0 1 0 0 0

М*В* = . 0 0 1 1 1 0 1 0 0 1 1 0

М*С* = . 0 0 1 1 0 0 0 0 0 0 1 0

Результат сложения нормализован.

МС = . 0 0 1 1 0 0 0 0 0 0 1 0

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

*С*\* = М*С* · 16Р*с* = (0,302)16 · 162 = (30,2)16 = 48,125.

Определим абсолютную и относительную погрешности результата:

Δ*С* = 48,12 – 48,125 = -0,005

δ*С* = · 100% = 0,01%

Погрешность полученного результата объясняется неточным представлением операндов.

в) *А*<0, *B*>0:

М*B* = \_ . 0 0 1 1 1 0 1 0 0 1 1 0

М*A* = . 0 1 1 0 1 0 1 0 1 0 0 0

М*С* = . 1 1 0 0 1 1 1 1 1 1 1 0

Результат сложения нормализован и представлен в дополнительном коде.

МС = . 1 1 0 0 1 1 1 1 1 1 1 0

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

*С*\* = М*С* · 16Р*с* = (-0,302)16 · 162 = (-30,2)16 = -48.125.

Определим абсолютную и относительную погрешности результата:

Δ*С* = -48,12 – (-48,125) = -0,005

δ*С* = · 100% = 0,01%

Погрешность полученного результата объясняется неточным представлением операндов.

2. Формат *Ф2*

*А* = (106,5)10 = (6A.8) = (0,1 101 0101)2 · 27

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

*В* = (58,38)10 = (3A,6(147AE))16 = (0,1 110 1001 1000 0101)2 · 26

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

*XA* = 1 0 0 0 0 1 1 1

*XB* = 1 0 0 0 0 1 1 0

*XC*= 0 0 0 0 0 0 0 1

*ХС = ХA,* = 7*.*

(*XA-XB*). = 1;

а) *А*>0, *B*>0:

М*А* = . **1 1 0 1** *0 1 0 1* **0 0 0 0**

+

М*В* = . **0 1 1 1** 0 1 0 0 **1 1 0 0**

М*С* = 1. 0 1 0 0 1 0 0 1 1 1 0 0

Результат сложения денормализован влево.

МС = . 1 0 1 0 0 1 0 0 1 1 1 0

Т.к. выполнен сдвиг мантиссы вправо, то характеристику результата нужно увеличить на 1 (*ХС* = *ХС* +1 = 7).

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

*С*\* = М*С* · 2Р*с* = (0,1 010 01 0 0 1110)2 · 27 = (10100100,1110)2 = 164,875.

Определим абсолютную и относительную погрешности результата:

Δ*С* = 164,88 – 164,875 = 0,005

δ*С* = · 100% = 0,003%

Погрешность полученного результата объясняется следующими факторами:

• неточным представлением операндов;

б) *А*>0, *B*<0:

М*А* = . 1 1 0 1 0 1 0 1 0 0 0 0

+

М*В* = . 0 1 1 1 0 1 0 0 1 1 0 0

М*С* = . **0 1 1 0** 0 0 0 0 **0 1 0 0**

Результат сложения денормализован вправо.

МС = . 1 1 0 0 0 0 0 0 1 0 0 0

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

*С*\* = М*С* · 2Р*с* = (0,11000 0001000)2 · 26 = (110000,001)2 = 48,125.

Определим абсолютную и относительную погрешности результата:

Δ*С* = 48,12 – 48,125 = -0,005

δ*С* = · 100% = 0,001%

Погрешность полученного результата объясняется следующими факторами:

• неточным представлением операндов;

в) *А*<0, *B*>0:

М*В* = . 0 1 0 1 0 1 0 0 0 1 0 0

М*А* = . 1 0 0 0 1 1 0 0 0 1 0 0

-

М*С* = . 1 0 0 1 1 1 1 1 1 1 0 0

Результат сложения нормализован и представлен в дополнительном коде

МС = . 1 0 0 1 1 1 1 1 1 1 0 0

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

*С*\* = М*С* · 2Р*с* = (0,011 0000 00001)2 · 27 = (110000,00100)2 = -48,125.

Определим абсолютную и относительную погрешности результата:

Δ*С* = -48,12 – (-48,125) = 0,005

δ*С* = · 100% = 0,1%

Погрешность полученного результата объясняется следующими факторами:

• неточным представлением операндов;

**#5**

Результаты в обоих форматах (Ф1 и Ф2) получились с одинаковыми погрешностями так как у нас не было сдвигов при нормализации в Ф1, из за сдвигов порядков и денормализации в Ф2