**Дискретная математика**

Домашнее задание №6

«Сложение чисел с плавающей запятой»

Вариант № 85

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**СЛОЖЕНИЕ ЧИСЕЛ С ПЛАВАЮЩЕЙ ЗАПЯТОЙ**

Варианты задания

|  |  |  |
| --- | --- | --- |
| **85** | 0,245 | 0,786 |

***А* = 0,245; *В* = 0,786.**

1. Формат *Ф1* (число разрядов мантиссы *m* =12).

A = (0,245)10 = (0,3EB)16 \* 160

М*А*

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

**1** округление к ближайшему

0 1 7 8 19  
*В* = (0,786)10 = (0,C93)16 · 160

M*B*

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

**1** округление к ближайшему

0 1  7 8 19

*XA* = \_1 0 0 0 0 0 0

*XB* = 1 0 0 0 0 0 0

(*XA-XB*)доп.= 0 0 0 0 0 0 0

(*XA-XB*). = 0; *ХС = ХВ =* 0*.*

**а) Оба операнда положительные (*А*>0, *B*>0):**

М*А* = . 0 0 1 1 1 1 1 0 1 1 0 0

+

М*В* = . 1 1 0 0 1 0 0 1 0 1 0 0

М*С* = 1. 0 0 0 0 1 0 0 0 0 0 0 0

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

*С*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (1,08)16 · 160 = (1,08)16 = 1,03125.

Δ*С* = *С*Т - *С*\* = 1,031–1,03125 = -0,00025,

где Δ*С* –абсолютная погрешность;

*С*Т –точное значение;

*С*\* - приближенное значение.

δ*С* = · 100% = = 0,024%,

где δ*С* – относительная погрешность.

**б) *А*<0, *B*>0.**

Сложение мантисс будем проводить их прямым вычитанием. В качестве уменьшаемого используем мантиссу положительного операнда (*В*);

2,3) М*В* = . 1 1 0 0 1 0 0 1 0 1 0 0  
 М*А* = . 0 0 1 1 1 1 1 0 1 1 0 0

4

М*С* =1. 1 0 0 0 1 0 1 0 1 0 0 0

Результат сложения нормализован.

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

*С*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (0,8A8)16 · 160 = (0,8A8)16 = 0.541015625.

Δ*С* = *С*Т - *С*\* = 0,541 – 0.541015625 = -0,000015625,

δ*С* = · 100% = = 0,00288%.

**в) *А*>0, *B*<0.**

2,3) М*В* = . 1 1 0 0 1 0 0 1 0 1 0 0  
 М*А* = . 0 0 1 1 1 1 1 0 1 1 0 0

М*С* =1. 1 0 0 0 1 0 1 0 1 0 0 0

Результат сложения нормализован.

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

*С*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (-0, 8A8)16 · 160 = (-0,8A8)16 = -0.541015625.

Δ*С* = *С*Т - *С*\* = -0,541 + 0.541015625= 0,000015625,

δ*С* = · 100% = = 0,00288%.

2. Формат *Ф2*.

*А* = (0,245)10 = (0,3EB)16 = (0.111110101000)2 · 2-2

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

19 18 11 10 0  
*В* = (0,786)10 = (0,C93)16 = (0,110010010011)2 · 20

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

19 18 11 10 0

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

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

(*XA-XB*)доп.= 1 1 1 1 1 1 1 0

(*XA-XB*). = -2; *ХС = ХВ* = 0*.*

а) Оба операнда положительные (*А*>0, *B*>0):

2

М*А* = . 0 0 1 1 1 1 1 1 0 1 0 1

+

М*В* = . 1 1 0 0 1 0 0 1 0 0 1 1

М*С* = 1 . 0 0 0 0 1 0 0 0 1 0 0 0

2

МС = 0 . 0 1 0 0 0 0 1 0 0 0 1 0

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

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

*С*

19 18 11 10 0  
*С*\* = М*С* · 2Р*с* = (0,100001000100)2 · 21 = (1.00001000100)2 = 1.033203125.

Δ*С* = *С*Т - *С*\* = 1,031 – 1.033203125 = -0,002203125,

δ*С* = · 100% = \* 100% = 0,21%.

б) *А*<0, *B*>0.

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

5

М*С* = 0 . 1 0 0 0 1 0 0 1 1 1 1 0

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

*С*

19 18 11 10 0  
 *С*\* = М*С* · 2Р*с* = (0.1000100111102 · 20 = (0.1000100111102) = 0.53857421875.

Δ*С* = *С*Т - *С*\* = 0,541 – 0.53857421875 = 0,00242578125.

δ*С* = · 100% = \* 100% = 0,44%.

в) *А*>0, *B*<0.

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

5

М*С* = 0 . 1 0 0 0 1 0 0 1 1 1 1 0

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

*С*

19 18 11 10 0  
 *С*\* = М*С* · 2Р*с* = (0.1000100111102 · 20 = (0.1000100111102) = -0.53857421875.

Δ*С* = *С*Т - *С*\* = -0.541 + 0.53857421875= -0, 00242578125.

δ*С* = · 100% = \* 100% = 0,44%.