Санкт-Петербургский Национальный Исследовательский  
Университет ИТМО

Факультет программной инженерии и компьютерной техники

**Домашняя работа №6**

По дискретной математике

Вариант 17

Выполнил:

Студент группы P3132

Кучерук Родион Олегович

Преподаватель:

Поляков Владимир Иванович



Санкт-Петербург

2023

* 1. **ЗАДАНИЕ 6**

**СЛОЖЕНИЕ ЧИСЕЛ С ПЛАВАЮЩЕЙ ЗАПЯТОЙ**

|  |  |  |
| --- | --- | --- |
| **17** | 256,8 | 244,6 |

***А* = 256,8; *В* = 244,6.**

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

A = (256,8)10 = (0,100CCCCCD)16 = (100,СССССD)16 \* 163

М*А*

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

0 1 7 8 19  
*В* = (244,6)10 = (F4,99999A)16 = (0,F499999A)16 · 162

M*B*

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

0 1  7 8 19

*XA* = \_ 1 0 0 0 0 1 1

*XB* = 1 0 0 0 0 1 0

(*XA-XB*)пр. = 0 0 0 0 0 0 1

(*XA-XB*). = 1; *ХС = ХВ =* 3*.*

**а) *А* > 0, *B* > 0:**

М*А* = . 0 0 0 1 0 0 0 0 0 0 0 1

+

М*В* = . 0 0 0 0 1 1 1 1 0 1 0 0

М*С* = . 0 0 0 1 1 1 1 1 0 1 0 1

Результат сложения нормализован.

4

МС = . 0 0 0 1 1 1 1 1 0 1 0 1

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

*С:*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (0,1F5)16 · 163 = 501.

Δ*С* = *С*Т *С*\* = 501,4 501 = 0,4,

где Δ*С* – абсолютная погрешность;

*С*Т – точное значение;

*С*\* – приближенное значение.

δ*С* = · 100% = = 0,07978%,

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*);

М*А* = . 0 0 0 1 0 0 0 0 0 0 0 1

М*В* = . 0 0 0 0 1 1 1 1 0 1 0 0

М*С* = . 0 0 0 0 0 0 0 0 1 1 0 1

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

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

*С:*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (0,D00)16 · 161 = 13

Δ*С* = *С*Т - *С*\* = 12,2 13= 0,8

δ*С* = · 100% = = 6,55738%.

**в) *А* < 0, *B* > 0.**

М*А* = . 0 0 0 0 1 1 1 1 0 1 0 0

М*В* = . 0 0 0 1 0 0 0 0 0 0 0 1

М*С* = . 1 1 1 1 1 1 1 1 0 0 1 1

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

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

*С:*

0 1  7 8 19

*С*\* = М*С* · 16Р*с* = (0,D00)16 · 161 = 13

Δ*С* = *С*Т *С*\* = 12,2 (13)= 0,8

δ*С* = · 100% = = 6,55738%.

2. Формат *Ф2*.

*А* = (256,8)10 = (100,CCCCCD)16 = (0,1000000001100110011001101)2 · 29

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

19 18 11 10 0  
*В* = (244,6)10 = (F4,99999A)16 = (0,11110100100110011001101)2 · 28

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

19 18 11 10 0

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

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

(*XA-XB*)доп.= 0 0 0 0 0 0 0 1

(*XA-XB*). = 1; *ХС = ХA* = 9*.*

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

М*А* = . 1 0 0 0 0 0 0 0 0 1 1 0

+

М*В* = . 0 1 1 1 1 0 1 0 0 1 0 0

М*С* = . 1 1 1 1 1 0 1 0 1 0 1 0

Результат сложения нормализован.  
  
MC = . 1 1 1 1 1 0 1 0 1 0 1 0

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

*С:*

19 18 11 10 0  
*С*\* = М*С* · 2Р*с* = (0,11111010101)2 · 29 = 501.25

Δ*С* = *С*Т *С*\* = 501,4 501,25 = 0,15,

δ*С* = · 100% = \* 100% = 0,02992%.

б) *А* > 0, *B* < 0.

М*А* = . 1 0 0 0 0 0 0 0 0 1 1 0

М*В* = . 0 1 1 1 1 0 1 0 0 1 0 0

М*С* = . 0 0 0 0 0 1 1 0 0 0 1 0

Результат вычитания денормализован вправо.  
  
MC = . 1 1 0 0 0 1 0 0 0 0 0 0  
  
Т.к. выполнен сдвиг мантиссы влево, характеристику результата нужно уменьшить на 5 (ХC = ХC - 5 = 4).

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

*С:*

19 18 11 10 0  
 *С*\* = М*С* · 2Р*с* = (0.110001)2 · 24 = 12,25

Δ*С* = *С*Т *С*\* = 12,2 12,25 = 0,05

δ*С* = · 100% = \* 100% = 0,40984%.

в) *А* < 0, *B* > 0.

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

5

М*С* = 0 . 1 1 1 1 1 0 0 1 1 1 1 0

MC = . 0 0 1 1 1 1 0 0 0 0 0 0  
  
Т.к. выполнен сдвиг мантиссы влево, характеристику результата нужно уменьшить на 5 (ХC = ХC - 5 = 4).

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

*С:*

19 18 11 10 0  
 *С*\* = М*С* · 2Р*с* = (0.110001)2 · 24 = 12.25

Δ*С* = *С*Т - *С*\* = 12,2+ (12,25)= 0,5

δ*С* = · 100% = \* 100% = 0,40984%.