Министерство образования и науки РФ

Федеральное государственное автономное

образовательное учреждение высшего образования

«Санкт-Петербургский национальный исследовательский университет

информационных технологий, механики и оптики»

**факультет программной инженерии и компьютерной техники**

**ДОМАШНЯЯ РАБОТА № 6**

по дисциплине

‘Дискретная Математика’

Вариант №12

*Выполнил:*

Студент группы P3109

Суханкин Дмитрий Юрьевич

*Преподаватель:*

Поляков Владимир

Иванович



Санкт-Петербург, 2022

Оглавление

[Пункт 1 2](#_Toc93027826)

[Ф1 2](#_Toc93027827)

[Ф2 2](#_Toc93027828)

[Пункт 2 3](#_Toc93027829)

[Ф1 3](#_Toc93027830)

[A > 0, B > 0 3](#_Toc93027831)

[A < 0, B > 0 3](#_Toc93027832)

[A > 0, B < 0 4](#_Toc93027833)

[Ф2 4](#_Toc93027834)

[A > 0, B > 0 5](#_Toc93027835)

[A < 0, B > 0 5](#_Toc93027836)

[A > 0, B < 0 6](#_Toc93027837)

# Пункт 1

A = 0,632

B = 8,287

## Ф1

A = 0,63210 ≈ 0,A1CA16 × 160

ХА = РА + 64 = 6410 = 100 00002

1 округление к ближайшему

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 0 | 1 |  |  |  |  |  | 7 | 8 |  |  |  |  |  |  |  |  |  |  | 19 |

B = 8,28710 ≈ 8,497816 = 0,8497816 × 161

ХА = РА + 64 = 6510 = 100 00012

1 округление к ближайшему

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 |  |  |  |  |  | 7 | 8 |  |  |  |  |  |  |  |  |  |  | 19 |

## Ф2

A = 0,63210 ≈ 0,1010 0001 1100 10102 × 20

ХА = РА + 128 = 12810 = 1000 00002

1 округление к ближайшему

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 |
| 0 |  |  |  |  |  |  |  | 8 | 9 |  |  |  |  |  |  |  |  |  | 19 |

B = 8,28710 ≈ 1000,0100 1001 0111 10002 = 0,1000 0100 1001 0111 10002 × 24

ХА = РА + 128 = 13210 = 1000 01002

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 0 | 1 |  |  |  |  |  |  | 8 | 9 |  |  |  |  |  |  |  |  |  | 19 |

# Пункт 2

## Ф1

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

(XA-XB). = -1

ХС = ХВ = 1.

### A > 0, B > 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4→ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | + | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| MB = | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| MC = | 0 | . | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |

Результат сложения нормализован.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 |
|  | 0 | 1 |  |  |  |  |  | 7 | 8 |  |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 16Pc = 0,8FA16 \* 161 = 8,FA16 ≈ 8,97610

∆С = СT – C\* = 8,976 - 8,919 = 0,057

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0,057 | \* 100% ≈ 0,0006%, |
| СT | 8,919 |

Погрешность полученного результата объясняется неточным представлением операндов.

### A < 0, B > 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MB = | - | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 4→ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| MC = | 0 | . | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |

Результат вычитания нормализован.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
|  | 0 | 1 |  |  |  |  |  | 7 | 8 |  |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 16Pc = 0,79816 \* 161 = 7,9816 = 7,5937510

∆С = СT – C\* = 7,655 – 7,59375 = 0,06125

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0.06125 | \* 100% ≈ 0,8%, |
| СT | 7,655 |

Погрешность полученного результата объясняется неточным представлением операндов.

### A > 0, B < 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4→ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | - | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 | 1 |
| MB = | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| MC = | 1 | . | 1 | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 1 | 0 | 0 | 0 |

Результат сложения нормализован и представлен в дополнительном коде.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
|  | 0 | 1 |  |  |  |  |  | 7 | 8 |  |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 16Pc = -0,79816 \* 161 = -7,9816 = -7,5937510

∆С = СT – C\* = 7,655 – 7,59375 = 0,06125

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0.06125 | \* 100% ≈ 0,8%, |
| СT | 7,655 |

Погрешность полученного результата объясняется неточным представлением операндов.

## Ф2

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

(XA-XB). = -4

ХС = ХВ = 4

### A > 0, B > 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4-> |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | + | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| MB = | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| MC = | 0 | . | 1 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |

Результат сложения нормализован

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 0 | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 |
|  | 0 | 1 |  |  |  |  |  |  | 8 | 9 |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 2Pc = 0,1000 1110 10102 \* 24 = 1000,1110 10102 ≈ 8,914062510

∆С = СT – C\* = 8,919 - 8,9140625 = 0,0049375

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0.0049375 | \* 100% ≈ 0,55%, |
| СT | 8,919 |

Погрешность полученного результата объясняется неточным представлением операндов и потерей значащих разрядов мантиссы одного из операндов при уравнивании порядков.

### A < 0, B > 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MB = | - | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| 4→ |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| MC = | 0 | . | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 |

Результат вычитания денормализован вправо.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MC = | 0 | . | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 |
|  | 0 | 1 |  |  |  |  |  |  | 8 | 9 |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 2Pc = 0,1111 01012 \* 23 = 0111,1010 10002 = 7,6562510

∆С = СT – C\* = 7,65625 - 7,655 = 0,00125

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0,00125 | \* 100% ≈ 0,02%, |
| СT | 7,655 |

Погрешность полученного результата объясняется неточным представлением операндов и потерей значащих разрядов мантиссы одного из операндов при уравнивании порядков.

### A > 0, B < 0

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 4→ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| MA = | - | . | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 1 |
| MB = | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 0 | 0 | 1 |
| MC = | 1 | . | 1 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 | 0 | 0 | 0 |

Результат сложения представлен в дополнительном коде.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MC = | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 |

Результат вычитания денормализован вправо.

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MC = | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| С = | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 0 | 0 | 1 | 1 | 1 | 0 |
|  | 0 | 1 |  |  |  |  |  |  | 8 | 9 |  |  |  |  |  |  |  |  |  | 19 |

Определим абсолютную и относительную погрешности результата:

С\* = MC \* 2Pc = -0,1111 0100 11102 \* 23 = -0111,1010 01112 = -7,6523437510

∆С = СT – C\* = 7,655 – 7,65234375 = 0,00265625

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| δС = | ∆С | \* 100% = | 0,00265625 | \* 100% ≈ 0,03%, |
| СT | 7,655 |

Погрешность полученного результата объясняется неточным представлением операндов и потерей значащих разрядов мантиссы одного из операндов при уравнивании порядков.

# Сравнение погрешностей

В формате Ф2 результаты получились точнее из-за того, что операнды представлены точнее.