**Алексей Жоров**

**гр. 14-502**

**Обязательное задание к практической работе №1**

**«Алгоритмы сжатия двоичной информации»**

Статический алгоритм Хаффмана

Исходная информационная последовательность: 13 10 9 8 7 8 8 10 9 8 7 9 9 8 7 10 9 5

|  |  |  |
| --- | --- | --- |
| Символ | Статистика появления | Двоичное представление |
| 13 | 1 | 0001 |
| 10 | 3 | 0010 |
| 9 | 5 | 0011 |
| 8 | 5 | 0100 |
| 7 | 3 | 0101 |
| 5 | 1 | 0110 |

Объем исходного текста: 18 (символов) х 4 (бита) = 72 бита

|  |  |  |
| --- | --- | --- |
| Символ | Частость | Код |
| 13 | 1 | 0000 |
| 5 | 1 | 0001 |
| 10 | 3 | 001 |
| 9 | 3 | 10 |
| 8 | 5 | 11 |
| 7 | 5 | 01 |

Объем сжатого текста: 1х4 + 1х4 + 3х3 + 5х2 + 5х2 +3х2 =43 бита

Ксж = 43/72 = 1,67

Алгоритм Лемпеля-Зива LZ77

Сжатие

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Словарь 16 бит | | | | | | | | | | | | | | | | Буфер 7 бит | | | | | | | Код | Двоичный код |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 0, 0, ’13’ | 0000 000 0001 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 0, 0, ’10’ | 0000 000 0010 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 0, 0, ‘9’ | 0000 000 0011 |
|  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 0, 0, ‘8’ | 0000 000 0100 |
|  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 0, 0, ‘7’ | 0000 000 0101 |
|  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 3, 1, ‘8’ | 0011 001 0100 |
|  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 1, 4, ‘9’ | 0100 100 0011 |
|  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  | 2, 3, '10’ | 0010 011 0010 |
| 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  |  |  |  |  | 2, 1, ‘5’ | 0010 001 0110 |
| 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  |  |  |  |  |  |  |  |  |

Распаковка

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Двоичный код | Код для распаковки | Словарь 16 бит | | | | | | | | | | | | | | | | Восстановленный текст |
| 0000 000 0001 | 0, 0, ’13’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 13 |
| 0000 000 0010 | 0, 0, ’10’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 10 |
| 0000 000 0011 | 0, 0, ‘9’ |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 9 |
| 0000 000 0100 | 0, 0, ‘8’ |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 8 |
| 0000 000 0101 | 0, 0, ‘7’ |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 7 |
| 0011 010 0100 | 3, 1, ‘8’ |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 8 8 |
| 0010 100 0011 | 1, 4, ‘9’ |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 10 9 8 7 9 |
| 0010 011 0010 | 2, 3, '10’ | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 8 7 10 |
| 0010 001 0110 | 2, 1, ‘5’ | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 | 9 5 |

Объем исходного текста: 18 (символов) х 4 (бита) = 72 бита

Объем сжатого текста: 9 (кодов) х 11 (бит)= 99 бит

Ксж= 99/ 72 = 1,38

Алгоритм Лемпеля - Зива - Сторера - Шимански LZSS

Сжатие

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Словарь 16 бит | | | | | | | | | | | | | | | | Буфер 7 бит | | | | | | | Код | Двоичный код |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 0, ’13’ | 0 0001 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 0, ’10’ | 0 0010 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 0, ‘9’ | 0 0011 |
|  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 0, ‘8’ | 0 0100 |
|  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 0, ‘7’ | 0 0101 |
|  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 0, ‘8’ | 0 0100 |
|  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 0, ‘8’ | 0 0100 |
|  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 1, 1, 4 | 1 0001 100 |
|  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 | 0, ‘9’ | 0 0011 |
|  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  | 1, 2, 3 | 1 0010 011 |
|  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  |  |  |  | 1, 1, 2 | 1 0001 010 |
| 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  |  |  |  |  |  | 0, ‘5’ | 0 0110 |
| 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 |  |  |  |  |  |  |  |  |  |

Распаковка

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Двоичный код | Код для распаковки | Словарь 16 бит | | | | | | | | | | | | | | | | Восстановленный текст |
| 0 0001 | 0, ’13’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 13 |
| 0 0010 | 0, ’10’ |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 10 |
| 0 0011 | 0, ‘9’ |  |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 9 |
| 0 0100 | 0, ‘8’ |  |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 8 |
| 0 0101 | 0, ‘7’ |  |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 7 |
| 0 0100 | 0, ‘8’ |  |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 |
| 0 0100 | 0, ‘8’ |  |  |  |  |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 8 |
| 1 0001 100 | 1, 1, 4 |  |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 10 9 8 7 |
| 0 0011 | 0, ‘9’ |  |  |  |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 |
| 1 0010 011 | 1, 2, 3 |  | 13 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 9 8 7 |
| 1 0001 010 | 1, 1, 2 | 10 | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 10 9 |
| 0 0110 | 0, ‘5’ | 9 | 8 | 7 | 8 | 8 | 10 | 9 | 8 | 7 | 9 | 9 | 8 | 7 | 10 | 9 | 5 | 5 |

Объем исходного текста: 18 (символов) х 4 бита = 72 бита

Объем сжатого текста: 9 (кодов) х 5 бит + 3 (кодов) х 8 бит = 69 бит

Ксж= 69/ 72 = 0,96