**Mobile Programming and Multimedia - exercise on lossless compression**

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**Exercise**

Encode the string: abcabcabcabcffffffffffff000000000000ffffffffffffffffffffffff

using:

* the LZW algorithm and
* choose an algorithm between Shannon-Fano and Huffman.

Compare the two results in terms of compression ratio.

**LZW algorithm**

Here it is possible to observe the execution of LZW algorithm on the given sequence through the following table.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **w** | **k** | **output** | **code** | **symbol** |
| NULL | a |  |  |  |
|  | b |  |  |  |
|  | c |  |  |  |
|  | a |  |  |  |
|  | b |  |  |  |
|  | c |  |  |  |
|  | a |  |  |  |
|  | b |  |  |  |
|  | c |  |  |  |
|  | a |  |  |  |
|  | b |  |  |  |
|  | c |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
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|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | 0 |  |  |  |
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|  | f |  |  |  |
|  | f |  |  |  |
|  | f |  |  |  |
|  | EOF |  |  |  |

**Shannon-Fano algorithm**

Here it is possible to observe the tree, resulting from the execution of Shannon-Fano’s algorithm on the given sequence.

Immagine che contiene diagramma, linea

Descrizione generata automaticamente

The following table presents the algorithm results, with encodings of every character.

|  |  |  |
| --- | --- | --- |
| **Character** | **Occurrences** | **Code** |
| f | 36 | 0 |
| 0 | 12 | 10 |
| a | 4 | 110 |
| b | 4 | 1110 |
| c | 4 | 1111 |

# bits used to represent the encoded sequence = 104 bits

Since the above table is crucial to decode any output sequence of Shannon-Fano’s algorithm, this table must be contained in the compressed result of the algorithm and due to this it should be considered in the total amount of bits used to represent the Shannon-Fano’s output sequence.

# bits used to represent the table = … bits

# total bits used to represent Shannon-Fano’s output sequence (including the table) = … bits

**Compression ratio** = uncompressed information / compressed information