



Compression: Huffman and LZW

Huffman

Implement the following Python code and complete Table 1. Note that Bits (Equal) is defined as the number of bits that we would use for the string if we were using the same number of bits for each character. For example with eight characters we would need 3 bits (000 ... 111), and for 9 characters we would need 4 bits (0000 ... 1111).

<http://www.asecuritysite.com/comms/huff>

Table 1: Huffman table

Input string	Coding	Bits (Huffman)	Bits (ASCII)	Bits (Equal)
<u>“arkansas”</u>	11 00 010 11 011 10 11 10			
“anteaters like ants”				
“test”				
“peter piper picked a picked pepper”				
“Cows graze in groves on grass which grows in grooves in groves”				

Implement a Huffman coder which will analyse the following text, and determine the Huffman table:

James Clerk Maxwell was a Scottish scientist in the field of mathematical physics. His most notable achievement was to formulate the classical theory of electromagnetic radiation, bringing together for the first time electricity, magnetism, and light as manifestations of the same phenomenon. Maxwell's equations for electromagnetism have been called the "second great unification in physics" after the first one realised by Isaac Newton.

With the publication of A Dynamical Theory of the Electromagnetic Field in 1865, Maxwell demonstrated that electric and magnetic fields travel through space as waves moving at the speed of light. Maxwell proposed that light is an undulation in the same medium that is the cause of electric and magnetic phenomena. The unification of light and electrical phenomena led to the prediction of the existence of radio waves.

Maxwell helped develop the Maxwell–Boltzmann distribution, a statistical means of describing aspects of the kinetic theory of gases. He is also known for presenting the first durable colour photograph in 1861 and for his foundational work on analysing the rigidity of rod-and-joint frameworks (trusses) like those in many bridges.

His discoveries helped usher in the era of modern physics, laying the foundation for such fields as special relativity and quantum mechanics. Many physicists regard Maxwell as the 19th-century scientist having the greatest influence on 20th-century physics. His contributions to the science are considered by many to be of the same magnitude as those of Isaac Newton and Albert Einstein. In the millennium poll—a survey of the 100 most prominent physicists—Maxwell was voted the third greatest physicist of all time, behind only Newton and Einstein. On the centenary of Maxwell's birthday, Einstein described Maxwell's work as the "most profound and the most fruitful that physics has experienced since the time of Newton"

Determine the number of bits required to encode the above text with Huffman code, also the number of bits required to encode using 8-bit ASCII. What is the reduction in the number of bits used?

LZW

Implement the Python code defined at:

<http://www.asecuritysite.com/comms/lz>

Table 2: LZW table

Input string	Coding	Bits (LZW)	Bits (ASCII)	Bits (Equal)
Cows graze in groves on grass which grows in grooves in groves	'C', 'o', 'w', 's', ' , 'g', 'r', 'a', 'z', 'e', ' ', 'i', 'n', 260, 'r', 'o', 'v', 'e', 259, 'o', 268, 261, 'a', 's', 259, 'w', 'h', 'i', 'c', 'h', 269, 257, 259, 267, 286, 271, 273, 266, 276, 270,			

	272, 's'			
“I wish to wish the wish you wish to wish, but if you wish the wish the witch wishes, I won't wish the wish you wish to wish”				