

Compression – Huffman Coding Questions

Huffman Coding is quite hard to get your head around when you start learning about it. To get the understanding needed, it really helps to work through some example questions.

Huffman Coding Question 1

The word "bookkeeper" is the only non-hyphenated word in the English language with three consecutive double letters.

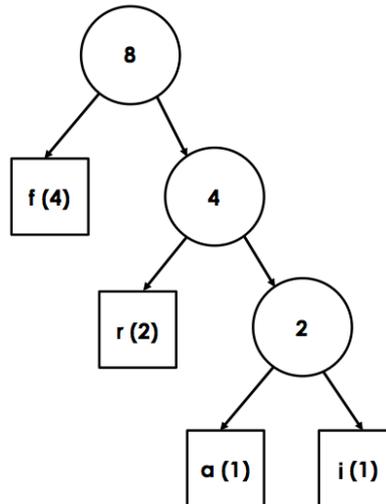
a) Complete the table below to show the frequency of each letter.

b	o	k	e	p	r
1					

b) **Explain** which letter you would expect to find closest to the top of the Huffman Tree created for "bookkeeper".

Huffman Coding Question 2

The Huffman Tree used to encode the word "riffraff" is shown below.



The numbers inside the nodes in a Huffman Tree represent the total frequency of each letter stored below that node. The value in the root node (the top node) should be the number of letters in the word being encoded

a) Complete the table to show the Huffman Coding used for each letter in the word "riffraff".

Character	Huffman Coding
f	0
r	10
a	
i	

b) Write down the Huffman Coding for "riffraff" using the values from your table.

c) Calculate the number of bits used to store "riffraff" when it is encoded using Huffman Coding.

d) Calculate the number of bits required to store "riffraff" if it is encoded using 7-bit ASCII encoding.

e) Calculate the space saving when using Huffman Coding rather than 7-bit ASCII coding to encode "riffraff".

Huffman Tree Question 3

A 10 letter English language word has been encoded using the Huffman Coding values shown below:

Character	Huffman Coding
o	0
d	10
l	110
v	111

The word is written, using Huffman Coding as:

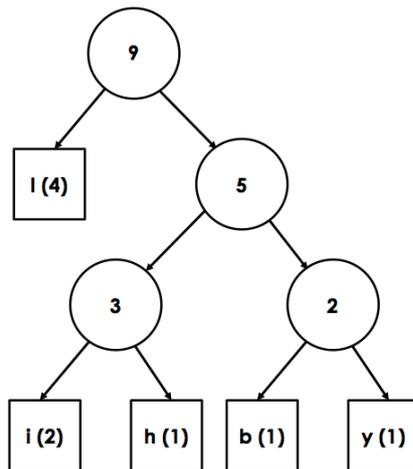
111 0 0 10 0 0 10 0 110 110

- How many bits are used to encode the word using Huffman Coding?
- How many bits are needed to encode the same word using 7-bit ASCII encoding?
- What is the space saving gained by using Huffman Coding?
- Write down the 10 letter word in plain English

In this question spaces are used to distinguish the encoding of each letter in the Huffman Coding version of the word.

Huffman Tree question 4

A Huffman Tree is shown below for the word "hillbilly".



- Fill in the table to show the Huffman Coding for each character in the word "hillbilly".

Character	Huffman Coding

- Explain**, using calculations to support your answer, how compressing "hillbilly" using Huffman Coding can save space compared to standard methods of encoding characters. (6 marks)

Part b is a longer question. You will need to:

- know how characters are usually encoded
- calculate the space saving when Huffman Coding is used
- communicate in your answer how much space is saved and why exactly. You should include the calculations within your answer.