Announcements

Program due Wednesday

CS180 - Huffman Codes

Thursdays
Hello - 32 x 5

32-bits in newer version.

Fixed length codes

Hello - 40 bits

Standard ASCII: 8 bits per character.

as few bits as possible.

We want to transmit information using

Idea
So, how can we do better?

Take characters we need

What if we don't use every character?

Frequency based, use common characters
Encode: BAN

Prefix of another letter
No letter's code is the

Fixed length.

A fixed code is not a
when we have characters
Send information to
An ambiguous way to

Fix the free codes
two u,s, five v,s, eight w,s, four x,s, five y,s, and only one z.

eight h,s, thirteen i,s, two l,s, sixteen n,s, nine o,s, six r,s, twenty-seven s,s, twenty-two t,s,

eight g,s, three a,s, three c,s, two d,s, twenty-six e,s, five t,s, three g,s.

This sentence contains three a's, three c's, two d's, twenty-six e's, five t's, three g's.

So how do we do this, with exact

flawless counts?
Using frequency counts, build one of those trees.

| A | C | D | E | F | G | H | I | L | N | O | R | S | T | U | V | W | X | Y | Z |
| 3 | 3 | 2 | 6 | 5 | 3 | 8 | 1 | 3 | 2 | 1 | 6 | 9 | 6 | 2 | 7 | 2 | 2 | 5 | 8 | 4 |

Which ones should get few bits?

Which ones should use the most bits?

E, D, or U or Z.
Huffman's algorithm

Take the two least frequent characters.

Mess from 3 to 1 letter, which becomes

A new leaf, I succeed
| Example | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
| Merge C \( C + 2 \) | A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |

{1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100}
In end, build a tee!
170 x 8 = 1360

How many bits would ASCII use to send 'total'

Total = 646 bits
How many bits are in 36 bits?

Message: Hello

ASCII: 40-64

Exercise: 0100111101000100010000010000001
Decode a message
Build the fire
Read a book
Next program: Decode
Greedy algorithm
-there are many more
- Good to know!