Fixed Length Code

- Going going gone
  - g = 000
  - o = 001
  - i = 010
  - n = 011
  - e = 100
  - _ = 101

Variable Length Code

- Going going gone
  - g = 11
  - o = 01
  - i = 100
  - n = 101
  - e = 000
  - _ = 001

110110010111010010111010010111001101101000

Like To Hike?

- Snowing?
- Craving Donuts?
  - Sleep In
  - Take Bus
  - Hike
  - Snow-shoe

Like To Hike?

- Snowing?
  - Yes
- Craving Donuts?
  - No

Huffman Codes

- Going going gone

<table>
<thead>
<tr>
<th>Symbol</th>
<th>g</th>
<th>o</th>
<th>i</th>
<th>n</th>
<th>e</th>
<th>space</th>
</tr>
</thead>
<tbody>
<tr>
<td>occurrences</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>2</td>
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</tbody>
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<td>5</td>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
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</table>
no engine no go

<table>
<thead>
<tr>
<th>Symbol</th>
<th>e</th>
<th>g</th>
<th>i</th>
<th>n</th>
<th>o</th>
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</tbody>
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going going gone

- e = 000
- space = 001
- o = 01
- i = 100
- n = 101
- g = 11

no engine no go

- e = 000
- space = 11
- o = 001
- i = 101
- n = 01
- g = 100
going going gone

ioning ion

onion on egg

no engine no go

one eon on Io

inning nine ongoing

egg egging eggnog ego en engine eon gee
gene genie genii gi gig gin ginning go
going gone gong goo goon in ingoing inn
inning Io ion nee neo Neogene neon nine
 ninon no nog noggin nogging non none noon
 nooning ogee on one ongoing onion

Symbol  e  g  i  n  o  space  ALL
occurrences  28  42  26  58  35  46  235
frequency  0.12  0.18  0.11  0.25  0.15  0.19  1.00

Symbol  e  g  i  n  o  space
frequency  0.12  0.18  0.11  0.25  0.15  0.19

Symbol  e  i  g  n  o  space
frequency  0.23  0.18  0.25  0.15  0.19
## Expected Bits per Symbol

<table>
<thead>
<tr>
<th>Symbol</th>
<th>e</th>
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<th>i</th>
<th>o</th>
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<td>0.18</td>
<td>0.11</td>
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<td>000</td>
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<td>101</td>
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</tbody>
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\[
3 \times 0.56 + 2 \times 0.44 = 1.68 + .88 = 2.56
\]