1

Symbol	*Encoding*
A	0
B	01
C	10
D	1

With the variable-length binary code above, what is the string "001" an encoding of?

1. AB
2. CD
3. AAD
4. Not enough information to answer

(4) is the correct answer. This is example of why it is necessary to have prefix-free encoding, we can't tell what is the proper way to decode since multiple keys could have the same prefix.

2

Symbol	*Encoding*
A	0
B	10
C	110
D	111

Symbol	*Frequency*
A	60%
B	25%
C	10%
D	5%

What is the average number of bits per symbol used by the variable-length code above?

1. 1.5
2. 1.55
3. 2
4. 2.5

(2) is the correct answer $.1 \cdot 6 + .25 \cdot 2 + .1 \cdot 3 + .05 \cdot 3 = 1.55$.

3 How many mergers will Huffman's greedy algorithm perform before halting?

1. $n - 1$
2. n
3. $\frac{(n+1) \cdot n}{2}$
4. Not enough information to answer

4 Consider the following symbol frequencies for a five-symbol alphabet:

Symbol	*Frequency*
A	60%
B	25%
C	10%
D	5%

What is the average encoding length of an optimal prefix-code?

1. 2.23
2. 2.4
3. 3
4. 3.45

5 Consider the following symbol frequencies for a five-symbol alphabet:

Symbol	*Frequency*
A	16%
B	8%
C	35%
D	7%
E	34%

What is the average encoding length of an optimal prefix-code?

1. 2.11
2. 2.31
3. 2.49

4. 2.5

6 What is the maximum numbef of bits that Huffman's greedy algorithm might use to encode a single symbol?

1. $log_2 n$
2. lnn
3. $n - 1$
4. n

7 Which of the following statements about Huffman's greedy algorithm are true?

1. A letter with frequency at least 0.4 will never be encoded with two or more bits
2. A letter with frequency at least 0.5 will never be encoded with two or more bits
3. If all symbols frequencies are less than 0.33, all symbols will encoded with at least two bits
4. If al symbols frequencies are less than 0.5, all symbols will be encoded with at least two bits.

8 Given an implementation of Huffman's greedy algorithm that uses a single invocation of a sorting subroutine, followed by a linear amount of additional work.