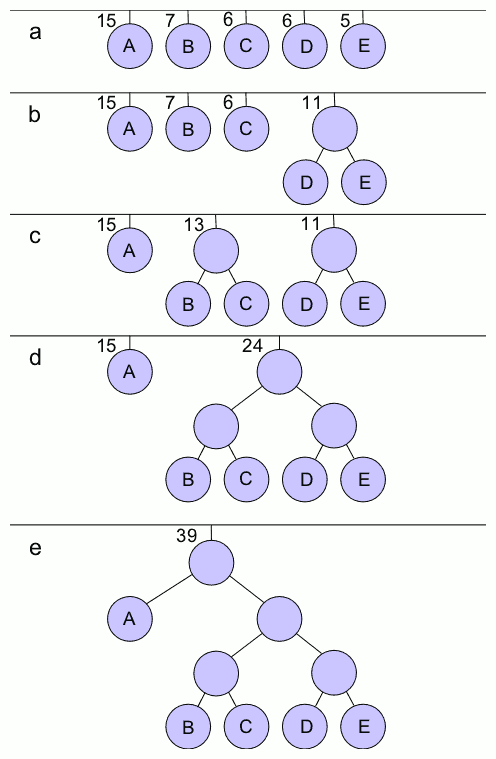
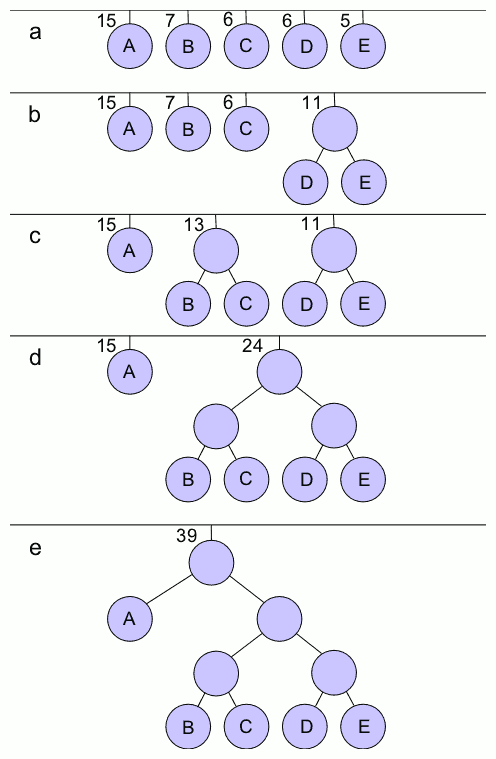
**Question 1: Huffman Encoding Proof**  
   
Prove:  
For two symbols A and B with probabilities P(A) >= P(B), then in the resultant representation sequence according to Huffman encoding procedure, the length of symbol A is no longer than that of symbol B.  
  
Assume:





The binary representation of each given symbol is determined by the path that must be traversed to get to the leaf node.

A B C D E

0 100 101 110 111

The length of a symbol is determined by the depth at which the leaf nodes lies in the optimal tree. In example but examination we can see that

Let’s assume S is the set of all symbols and S’ is the set of all symbols with probability less than symbol A

We can generalize the argument to we can take any symbol on the right hand side of the tree and it’s length in binary will always be larger than P(A)

Base case: where H has only two symbols we can see that P(a) >= P(b) let’s assume that a and b have equal probability the length of A and B will be both 1, with their paths equal to 1 respectively 0 , 1. In the nth case where all probabilities are equal, P(A,B,C,D..N) = 1/n where N is odd we can look at the case where 3. We can see that P(A)>=P(B)>=P(C) the lengths respectively are 1<=2<=2.

