Problems for Quiz 9

Name:_____ Student ID:_____ Score:_____

1. (40%) Find a (binary) Huffman code for the source with probabilities {0.5, 0.25, 0.125, 0.125} and compute their average codeword length.

   Solution. A solution is $\{0, 10, 110, 111\}$.

   Note: Other possible solutions are $\{0, 11, 100, 101\}$, $\{1, 00, 010, 011\}$ and $\{1, 01, 000, 001\}$.

2. (60%) Decompress 010001111000 by the Lempel-Ziv coding algorithm if the decompressor knows the index is fixed as 3 bits in length. You shall also complete the below index-string table.

index	1	2	3	4	5
string	0	1			

   Solution. The decompressor will treat the sequence as a sequential concatenation of (index, last bit):

$$(010, 0)(011, 1)(100, 0) \equiv (2, 0)(3, 1)(4, 0)$$

   Then, each step takes in one (index, last bit). Table can be built on the fly.

   - $(2, 0) \to 10$ and renew table as

index	1	2	3
string	0	1	10

   - $(3, 1) \to 101$ and renew table as

index	1	2	3	4
string	0	1	10	101

   - $(4, 0) \to 1010$ and renew table as

index	1	2	3	4	5
string	0	1	10	101	1010

   Thus the decompressed sequence is 101011010.