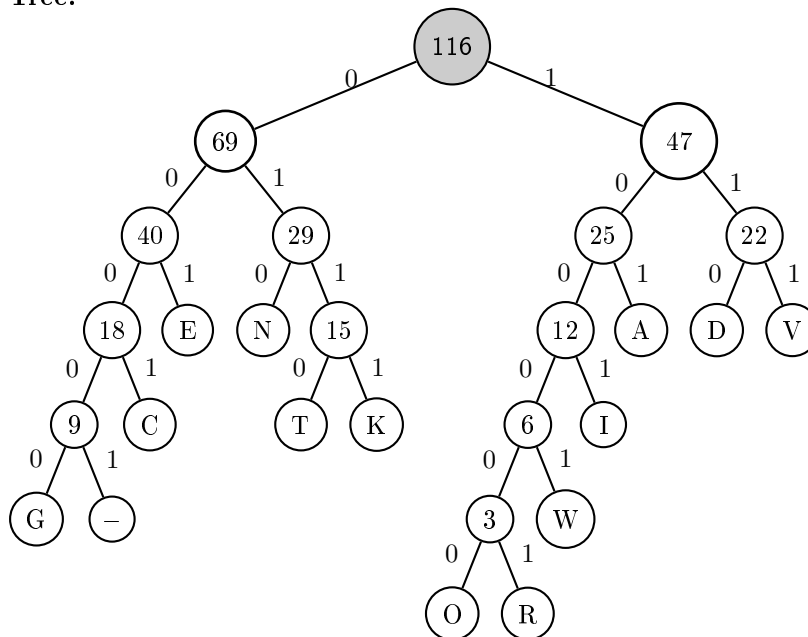## 10.1 Why are Special Encoding and the use of Zig-Zag Order necessary for the compression? Would the compression be possible using only DCT and Quantization?

10.2 Different Encoding Algorithms

10.2.1 Huffman Encoding Representation

Symbol	Frequency
E	22
N	14
A	13
D	12
V	10
C	9
T	8
K	7
I	6
G	5
'space'	4
W	3
O	2
R	1

Symbol	Encoding
V	111
D	110
A	101
N	010
E	001
I	1001
K	0111
T	0110
C	0001
W	10001
'space'	00001
G	00000
R	000001
O	000000

Tree:

10.2.2 Arithmetic Encoding Representation

Symbol	Frequency	Probability (as fraction)	Interval reduced to ten-bit precision (as fractions)	(in binary)
E	22	22/116	$[0, 194/1024)$	$[0.0000000000, 0.0011000010)$
N	14	14/116	$[194/1024, 318/1024)$	$[0.0011000010, 0.0100111101)$
A	13	13/116	$[318/1024, 433/1024)$	$[0.0100111101, 0.0110110000)$
D	12	12/116	$[433/1024, 538/1024)$	$[0.0110110000, 0.1000011010)$
V	10	10/116	$[538/1024, 627/1024)$	$[0.1000011010, 0.1001110011)$
C	9	9/116	$[627/1024, 706/1024)$	$[0.1001110011, 0.1011000010)$
T	8	8/116	$[706/1024, 777/1024)$	$[0.1011000010, 0.1100001001)$
K	7	7/116	$[777/1024, 839/1024)$	$[0.1100001001, 0.1101000111)$
I	6	6/116	$[839/1024, 892/1024)$	$[0.1101000111, 0.1101111100)$
G	5	5/116	$[892/1024, 936/1024)$	$[0.1101111100, 0.1110101000)$
'space'	4	4/116	$[936/1024, 971/1024)$	$[0.1110101000, 0.1111001011)$
W	3	3/116	$[971/1024, 998/1024)$	$[0.1111001011, 0.1111100110)$
O	2	2/116	$[998/1024, 1015/1024)$	$[0.1111100110, 0.1111110111)$
R	1	1/116	$[1015/1024, 1)$	$[0.1111110111, 1.0000000000)$

10.2.3 How many bit are necessary to encode the string "ADVANCED NETWORKING" under each encoding?

In the arithmetic encoding only 10 bits are needed to encode the whole string, because this is the precision given for our arithmetic encoding. When using the Huffman-Encoding Algorithm in total "ADVANCED NETWORKING" is encoded to "101 110 111 110 010 0001 001 110 00001 010 001 0110 10001 100000 100001 0111 1001 010 00000" which has 73 bits.

10.3 Traditional Video Encoding

10.2.1 What are the roles of each type of frame in traditional video encoding (I, P, and B), and what kind of information is encoded in each of the types?

10.2.1 Different frame losses have different effects in overall video res-construction, what is the effect of loss of frames I, P, and B?

10.4 How can motion estimation be achieved with the use of Macro-Blocks (block-matching algorithm)?

10.5 Explain the components and steps in MPEG-1 encoding and decoding.

10.6 Bonus Question