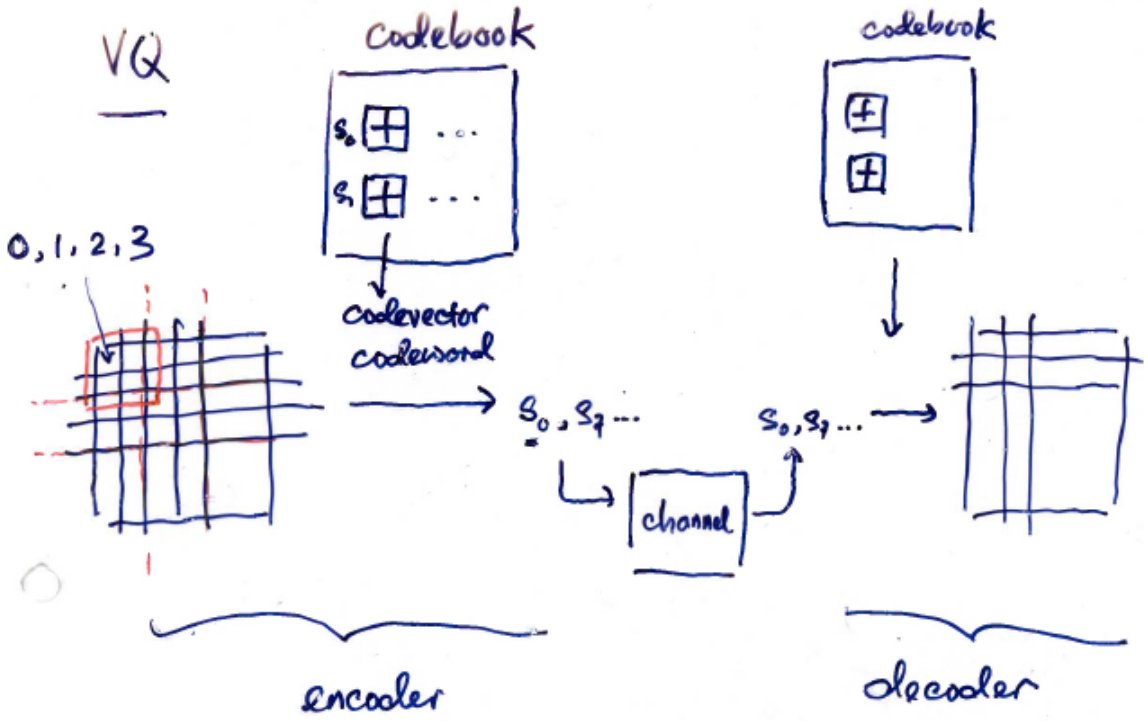
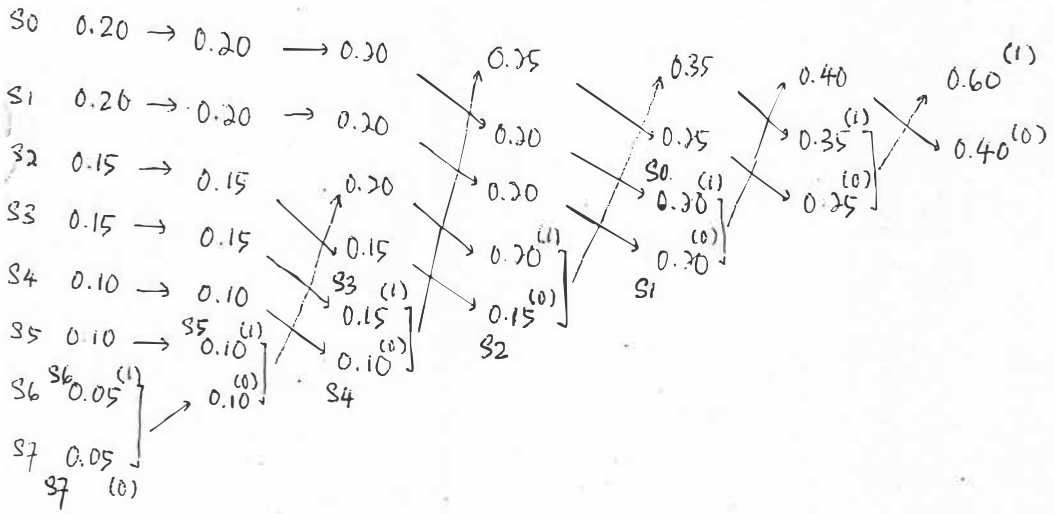
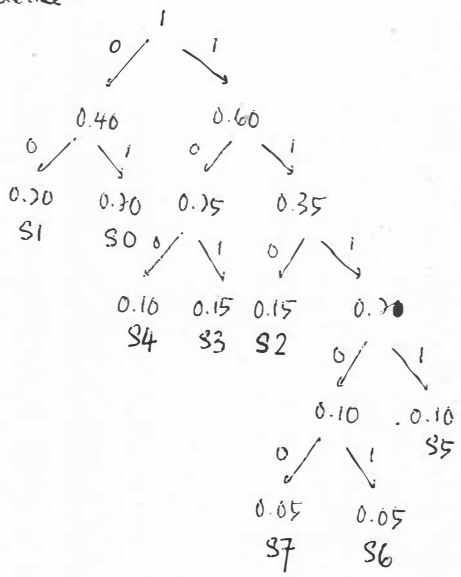

VQ
codebook
codebook
0, 1, 2, 3
codevector
codeword
$s_0, s_1 \ldots$
$s_0, s_1 \ldots$
channel
encoder
decoder

Symbols	s_0	s_1	s_2	s_3	s_4	s_5	s_6	s_7
Probabilities of occurrences	0.2	0.2	0.15	0.15	0.1	0.1	0.05	0.05

1 (b) To design a set of Huffman codewords :



Huffman codetree :



Designed Huffman code set :

s_0 : 01

s_1 : 00

s_2 : 110

s_3 : 101

s_4 : 100

s_5 : 1111

s_6 : 11101

s_7 : 11100

Other Huffman codesets are also possible.

Average number of bits/symbol

$= 2 \times 2 \times 0.2 + 2 \times 3 \times 0.15 + 3 \times 0.1 + 4 \times 0.1 + 2 \times 5 \times 0.05$

$= 2.9$ bits/symbol

For each 2×2 block :

Number of bits required for uncompressed block $= 4 \times 2 = 8$ bits

" " " " " symbol $= 2.9$ bits

$\therefore$ Compression ratio $= \frac{8}{2.9}$

$= 2.76$