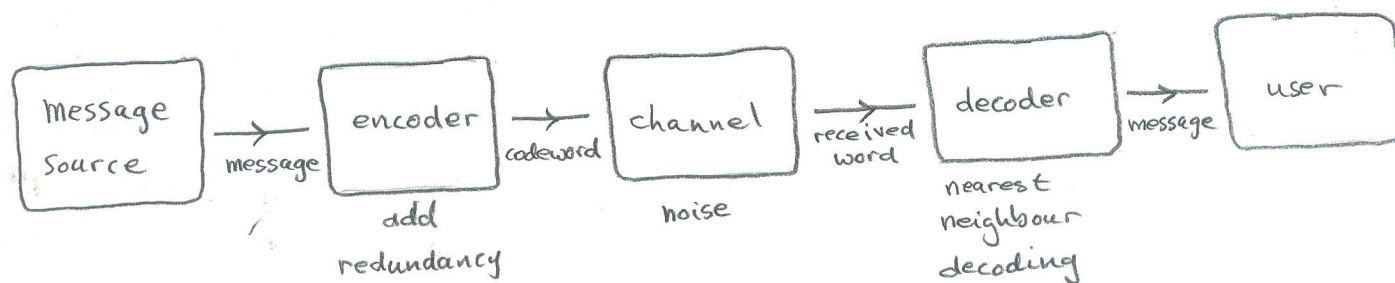
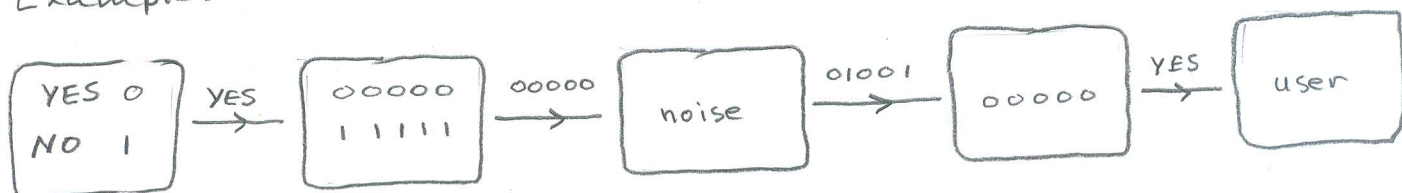


CODING THEORY

A digital communication system:



Example:



Definition A binary code C of length n is a subset of $(F_2)^n$, where $F_2 = \{0, 1\}$.

$(F_2)^n$ consists of all binary strings of length n , which are called vectors. The elements of C are called codewords.

In general, a q -ary code C of length n is a subset of $(F_q)^n$, where $F_q = \{0, 1, \dots, q-1\}$ and $(F_q)^n = \{a_1 a_2 \dots a_n : a_i \in F_q \text{ for } i=1, 2, \dots, n\}$.

Example The four messages N, W, E, S may be encoded using any one of the three 4-ary codes C_1, C_2, C_3 .

	C_1	C_2	C_3
N	0	00	000
W	1	11	111
E	2	22	222
S	3	33	333

Such simple codes are known as the repetition codes, in this case 4-ary repetition codes of lengths 1, 2 and 3 respectively.

They have the following properties:

C_1 cannot detect single errors.

C_2 can detect any single error, but it cannot correct it — for example, how are we going to correct the received vector 12?

C_3 can detect and correct any single error — for example, if we receive the vector 322, we decode to 222, because this is the codeword "nearest" to 322.

We call this decoding procedure nearest neighbour decoding.

