Tutorial n°3
Baseband coding

Exercise 1: ASCII coding

We want to transmit the word "HOW" using and 8-ary system.

1. Encode the word "HOW" into a sequence of bits, using 7-bit ASCII coding, followed by an eight bit for error detection, per character. The eight bit is chosen so that the number of ones un the 8 bits is an even number. How many total bits are there in the message?

2. Partition the bit stream into k = 3 bit segments. Represent each of the bit segments as an octal number (symbol). How many octal symbols are there in the message?

3. If the system were designed with 16-ary modulation, how many symbols would be used to represent the word "HOW"?

4. If the system were designed with 256-ary modulation, how many symbols would be used to represent the word "HOW"?

Below is the 7-bit ASCII coding table:

Bits				5	0	1	0	1	0	1	0	1
				6	0	0	1	1	0	0	1	1
1	2	3	4	7	0	0	0	0	1	1	1	1
0	0	0	0		NUL	DLE	SP	0	@	P	'	p
1	0	0	0		SOH	DC1	!	1	A	Q	a	q
0	1	0	0		STX	DC2	"	2	B	R	b	r
1	1	0	0		ETX	DC3	#	3	C	S	c	s
0	0	1	0		EOT	DC4	$	4	D	T	d	t
1	0	1	0		ENQ	NAK	%	5	E	U	e	u
0	1	1	0		ACK	SYN	&	6	F	V	f	v
1	1	1	0		BEL	ETB	'	7	G	W	g	w
0	0	0	1		BS	CAN	(	8	H	X	h	x
1	0	0	1		HT	EM	)	9	I	Y	i	y
0	1	0	1		LF	SUB	*	:	J	Z	j	z
1	1	0	1		VT	ESC	+	;	K	[	k	{
0	0	1	1		FF	FS	,	<	L	\	l		
1	0	1	1		CR	GS	—	=	M	]	m	}
0	1	1	1		SO	RS	.	>	N	^	n	—
1	1	1	1		SI	US	/	?	O	—	o	DEL

Exercise 2: Keypad

A wireless keypad has 17 keys. To transmit the information corresponding to the key pressed, the coding is done key by key.

Transmission between the keypad and the computer's receiver must be at a bit rate of 60 kbps.

Digital coding uses a DAC with a reference voltage V_{ref} = 6.4V.

Calculate the coding parameters:

1.   coding valence, number of DAC bits, noise margin;

2.   Symbol rate, message rate, empirical bandwidth required.

Exercise 3: Barcodes

The products in a company's stock are labeled with a chromatic matrix barcode. The matrix consists of colored blocks distributed on 4 rows and 8 columns, with 16 levels of colors.

Handling personnel photograph the code of an item when they remove it from the stock or when they add it to it, with a device coupled to a wireless transmission system.

The information is transmitted to a server linked to the inventory management database. To transmit an item code, the coding is done on a pad-by-pad basis.

The transmission between the photographing device and the computer receiver must be at a 64 kbps bit rate.

The digital coding uses a DAC of reference voltage V_{ref} = 3.2 V. Calculate:
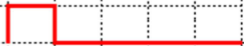
1.   coding valence, number of DAC bits, noise margin;

2.   Symbol rate, message rate, empirical bandwidth required.

Exercise 4: Who am I?

Fast local area networks use specific codings. This is the case of the 4B/5B coding used in 100BaseX and FDDi on optical fiber. Each sequence of 4 bits is coded on 5 bits as shown in the table below.

1 tile corresponds to a T_M duration and at the beginning of the transmission the voltage is considered to be zero.

Determine which coding is used to generate the signals and then complete the table, knowing that the electrical levels are +/-E, and that at the beginning of the transmission the electrical level is -E.

CODE 4 BITS				CODE 4B5B					SIGNAL
0	0	0	0	1	1	1	1	0	
0	0	0	1	0	1	0	0	1	
0	0	1	0	1	0	1	0	0	
0	0	1	1	1	0	1	0	1	
0	1	0	0	0	1	0	1	0	
0	1	0	1	0	1	0	1	1	
0	1	1	0	0	1	1	1	0	
0	1	1	1	0	1	1	1	1	
1	0	0	0	1	0	0	1	0	
1	0	0	1	1	0	0	1	1	
1	0	1	0	1	0	1	1	0	
1	0	1	1	1	0	1	1	1	
1	1	0	0	1	1	0	1	0	
1	1	0	1	1	1	0	1	1	
1	1	1	0	1	1	1	0	0	
1	1	1	1	1	1	1	0	1	
IDLE				1	1	1	1	1	
START 1				1	1	0	0	0	
START 2				1	0	0	0	1	
END 1				0	1	1	0	1	
END 2				0	0	1	1	1	
ERROR				0	0	1	0	0	