Digital technology

DIGITAL CODES

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DIGITAL CODES

Background

- Encoding facilitates communication
  - between man and machine
  - between the machine and the machine
- How to adapt different ways of communication
  - Decimal system and binary system <- BCD (Binary Coded Decimal)
  - Alphabet and binary system <- ASCII (American Standard Code for Information Interchange)
- If errors occur in data transfer
  - Hamming –code
  - Manshester –code
- How to recover / detect communication errors
  - Checksum
  - Parity check
  - The codes can be accented (meaning the location of the bit in the string) or weightless

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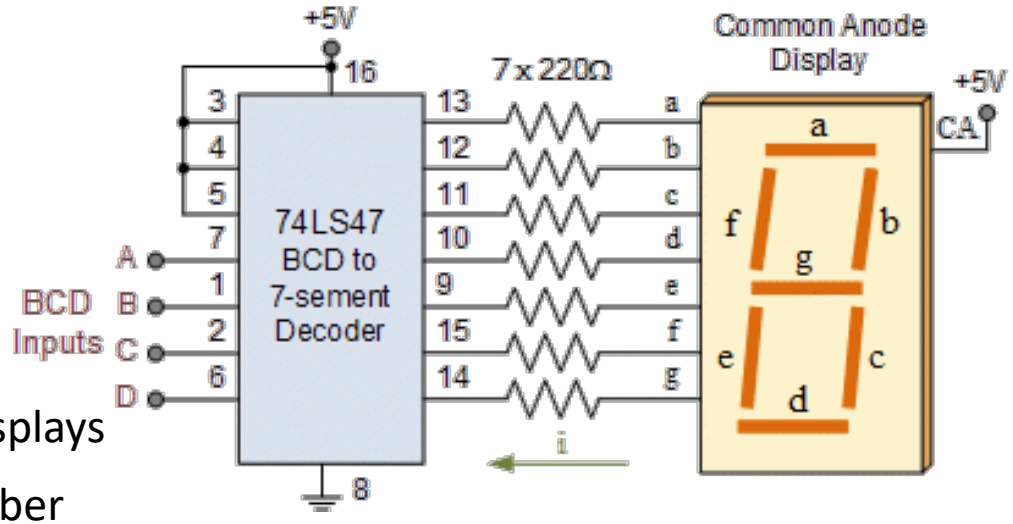
BCD -code



Lähde: Electronics Tutorials

- Accented code
- Used to change the binary number for decimal number displays
- A decimal number is represented by a four-bit binary number
- **BCD-5311:**
  - In the BCD-5311 code, the weight of the bits, i.e. the position value, goes in the order 5 3 1 1.
  - Example

	1	0	1	1	=	1*5+	0*3+	1*1+	1*1	=	7	
paino	5	3	1	1								

- **Natural BCD code:**
- In the natural BCD code, the weight of the bits is as in the normal binary number 8421.
  - Example

	0	1	0	1	=	0*8+	1*4+	0*2+	1*1	=	5	
paino	8	4	2	1								

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ASCII -code

- Used as a basic character set for data transfer in computers and printing devices
- The character consists of two hexadecimal digits

  $H1_{16}H2_{16}$
  - H1 is represented by three bits, giving the values 0 ... 7
  - H2 is represented by four bits, giving the values 0 ... F
  - From the base character 7-bit -> 128 characters
- Actual different characters 112. English alphabets (not ä, ö, å), uppercase and lowercase letters, and printer control character set such as LF (line feed), CR (carriage return)

Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	00	Null	32	20	Space	64	40	@	96	60	`
1	01	Start of heading	33	21	!	65	41	A	97	61	a
2	02	Start of text	34	22	"	66	42	B	98	62	b
3	03	End of text	35	23	#	67	43	C	99	63	c
4	04	End of transmit	36	24	$	68	44	D	100	64	d
5	05	Enquiry	37	25	%	69	45	E	101	65	e
6	06	Acknowledge	38	26	&	70	46	F	102	66	f
7	07	Audible bell	39	27	'	71	47	G	103	67	g
8	08	Backspace	40	28	(	72	48	H	104	68	h
9	09	Horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	Line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage return	45	2D	-	77	4D	M	109	6D	m

- Newer character sets
  - 8-bit (ANSI or PC8 standard) <- also special characters ä,ö,å,,,”
- Unicode Unicode
  - (originally 16-bit (UTF-16, Unicode Transformation Format), now 32-bit)
  - More than 130,000 different characters (v 12.1)
  - Covers almost all punctuation and symbols in the world
  - Current operating systems, programming languages, and applications include support for Unicode code

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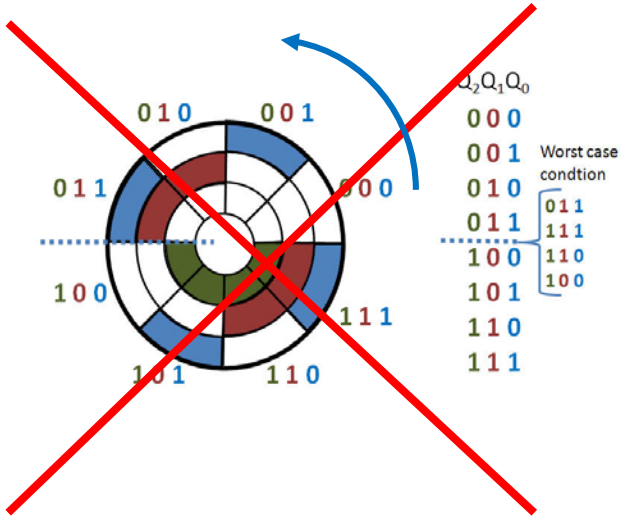
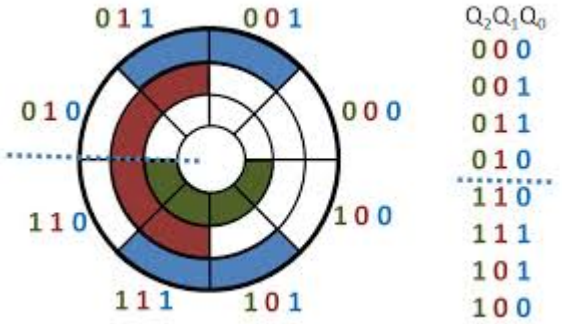
GRAY -code

- Often the representation of consecutive characters consists of a series of numbers
  - For example, the state of motor rotation is read as a binary code from an angle sensor
  - In this case, in a normal binary number sequence, there will be situations where all the characters in the number change. For example, 7 = 0111 and 8 = 1000 as binary numbers
  - This can easily cause a read error
- Solution
  - In a Gray-encoded sequence of numbers, the value of consecutive numbers can change for only one bit





Lähde: http://jjmk.dk/

Exercises

8. **Encode the decimal number 123_{10} with the code BCD5311. You can use a "pseudocode" that dosen't contain syntax.**