DASAR SISTEM

Departemen Ilmu Komputer/ Informatika
Universitas Diponegoro
Semester Gasal 2017/ 2018

REFERENSI

- **[Harris]** Digital Design And Computer Architecture, D.M. Harris And S.L. Harris, Morgan Kaufmann, 2013 (2nd Edition).
- **[Muchlas]** Muchlas. 2005. Rangkaian Digital. Gava Media. Jogjakarta

AGENDA

I - SISTEM DIGITAL

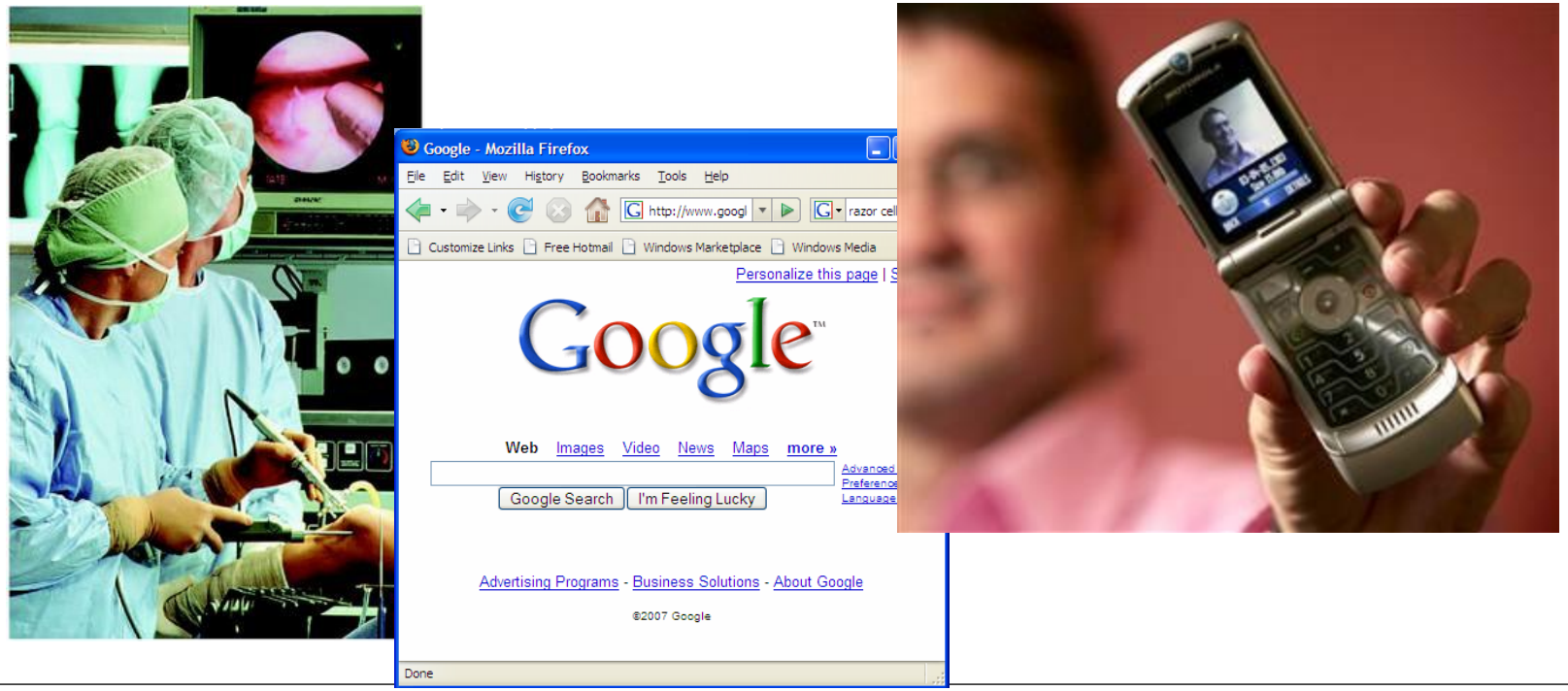
1. **Revolusi Digital**
2. Rangkaian Digital
3. Sistem Digital
4. Representasi Besaran Digital
5. Prinsip Perancangan Digital

II – SISTEM BILANGAN

1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. Sistem kode

Motivation

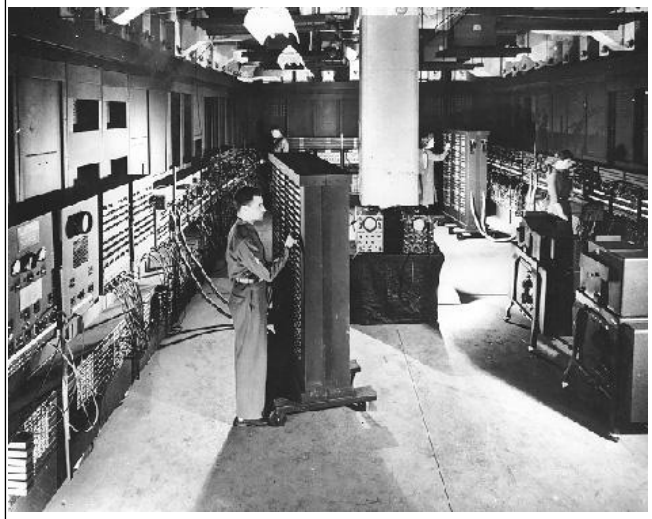
- Microelectronic technologies have revolutionized our world: cell phones, internet, rapid advances in medicine, etc.
- The semiconductor industry has grown from $21 billion in 1985 to $315 billion in 2013.



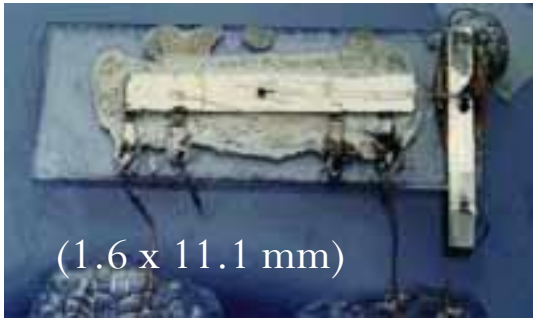
The Digital Revolution

Integrated Circuit: Many digital operations on the same material

Vacuum tubes

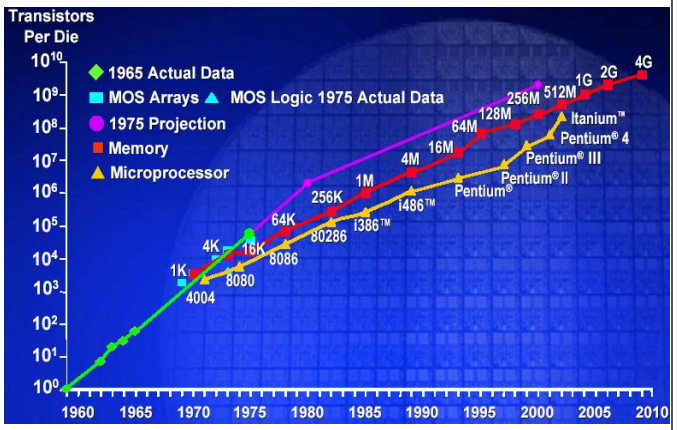


ENIAC



Integrated Circuit

Exponential Growth of Computation



Moore's Law

WWII

Stored Program Model

1949

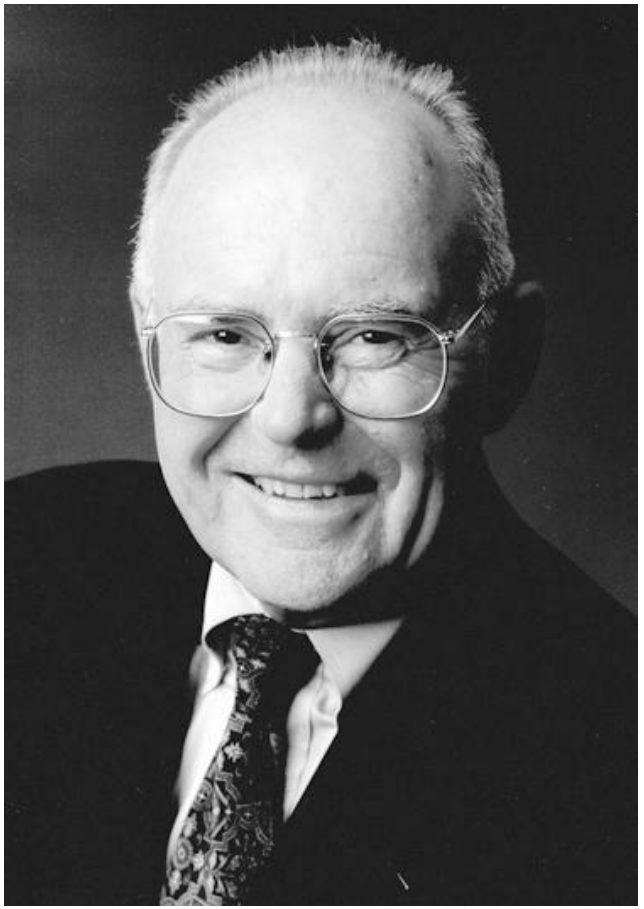
1965

Robert Noyce, 1927 - 1990

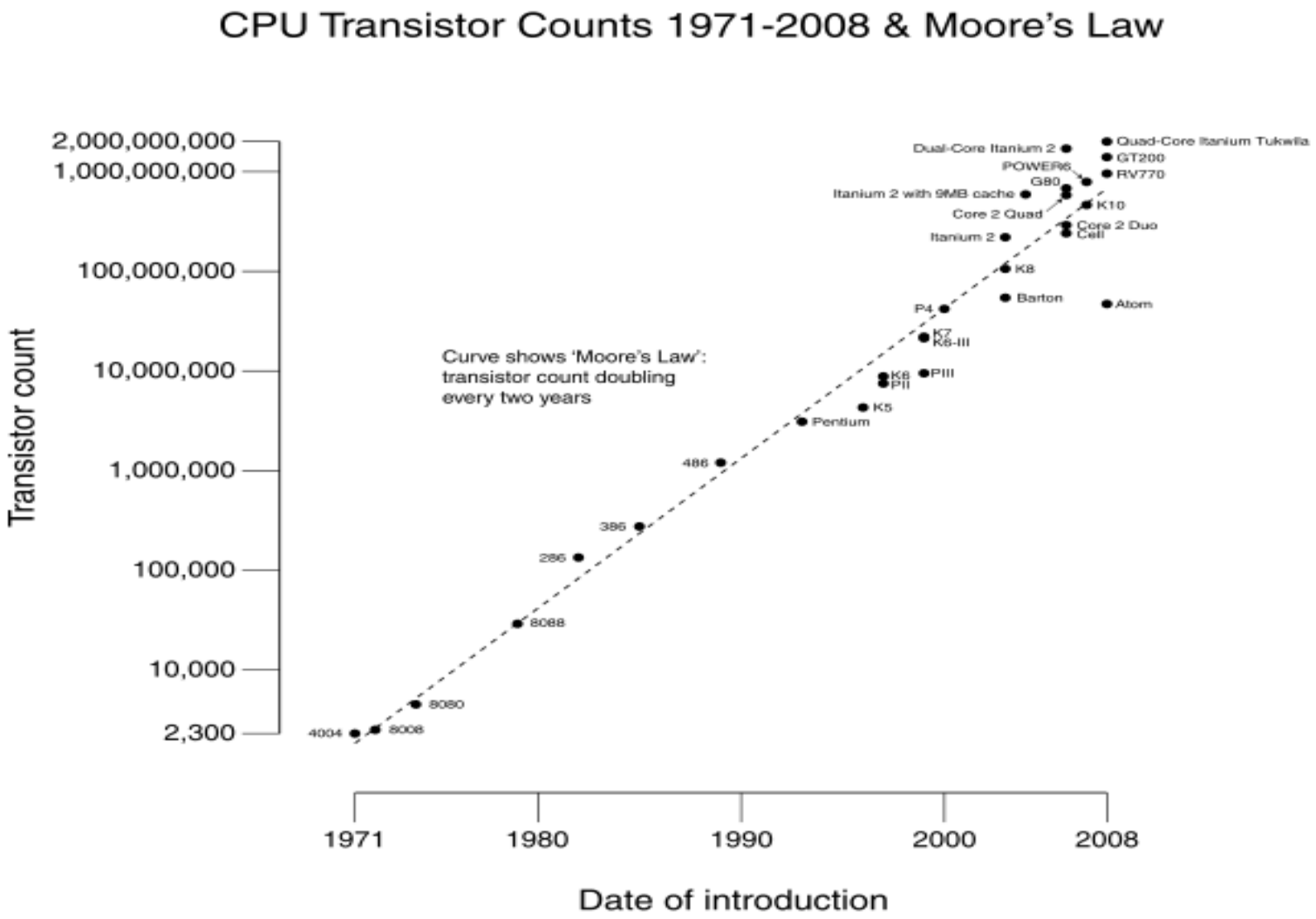
- Nicknamed "Mayor of Silicon Valley"
- Cofounded Fairchild Semiconductor in 1957
- Cofounded Intel in 1968
- Co-invented the integrated circuit

Gordon Moore

- Cofounded Intel in 1968 with Robert Noyce.
- **Moore's Law:** the number of transistors on a computer chip doubles every 2 years (observed in 1965)



Technology Trends: Moore's Law



- Since 1975, transistor counts have doubled every two years.

[Harris]

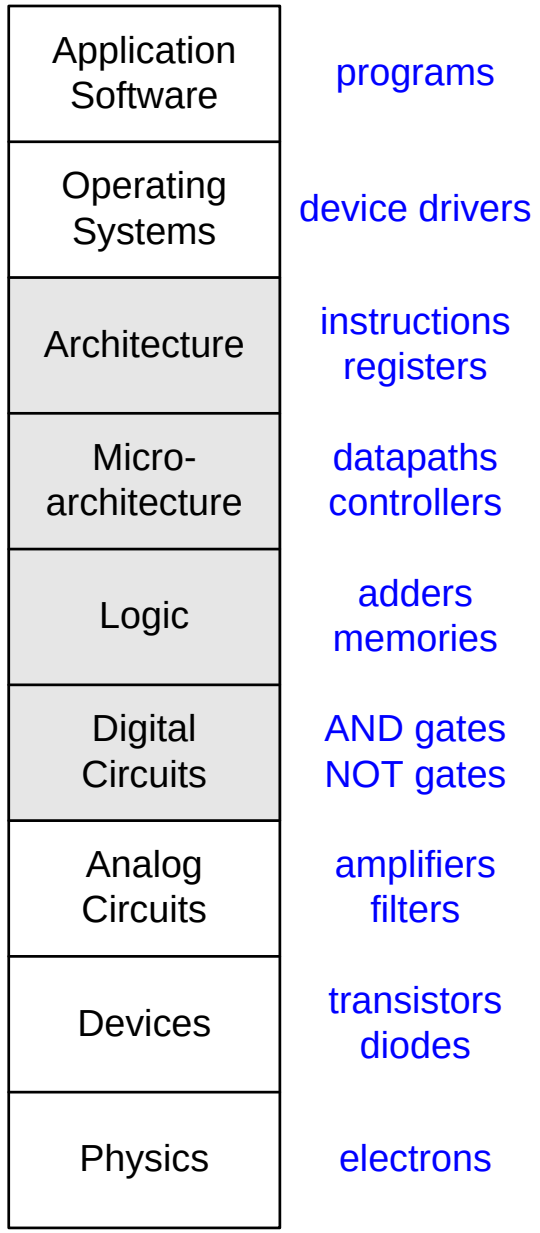
Principle of Abstraction

Smt 3 - AIK21332 : Sistem Operasi

Smt 2 - AIK21322 : Organisasi dan arsitektur komputer

Smt 1 - AIK21312 : Dasar Sistem

Abstraction: Hiding details when they aren't important



AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. **Rangkaian Digital**
3. Sistem Digital
4. Representasi Besaran Digital
5. Prinsip Perancangan Digital

II – SISTEM BILANGAN

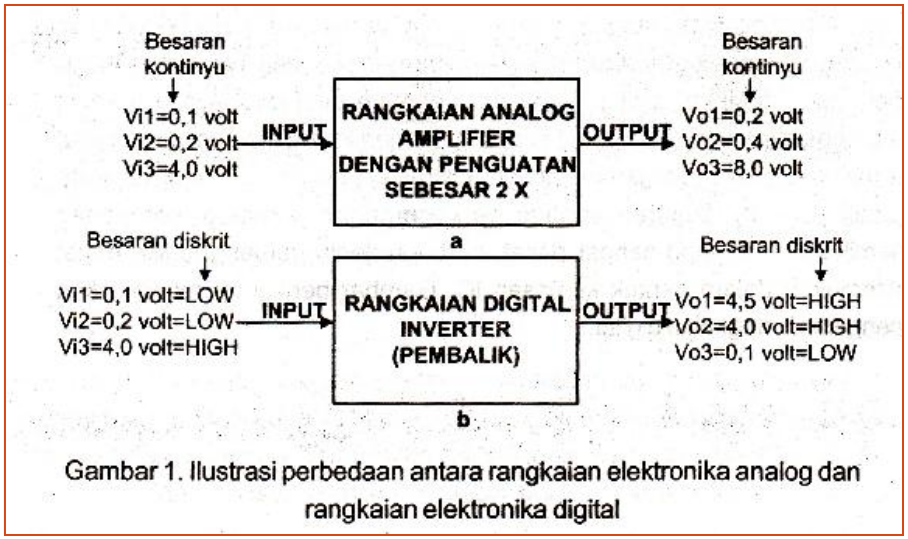
1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. Sistem kode

RANGKAIAN DIGITAL (1)

- Berdasarkan sifat sinyal yang diolah, terdapat dua jenis rangkaian elektronika yakni:
  - **Rangkaian analog**

    Rangkaian elektronika yang mengolah sinyal listrik **kontinyu**
  - **Rangkaian digital**

    Rangkaian elektronika yang mengolah sinyal listrik **diskrit**



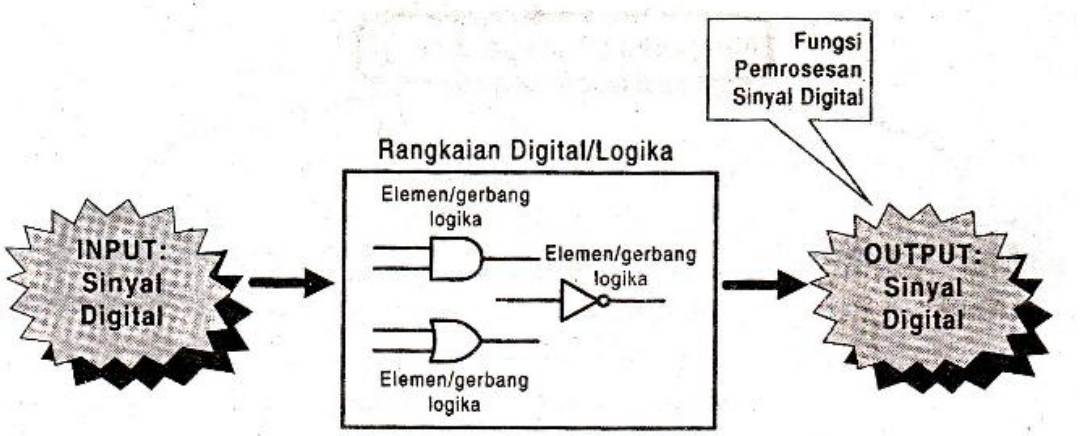
Gambar 1. Ilustrasi perbedaan antara rangkaian elektronika analog dan rangkaian elektronika digital

RANGKAIAN DIGITAL (2)

- Pengertian

  Kesatuan dari beberapa elemen logika atau beberapa gerbang logika yang membentuk fungsi pemrosesan sinyal digital

- Bentuk elemen logika terkecil adalah **Gerbang Logika**, contoh: OR, AND, NOT



Gambar 2. Penjelasan pengertian rangkaian digital/logika

RANGKAIAN DIGITAL (3)

- Contoh fungsi pemrosesan sinyal digital:
  - Penjumlahan biner (binary addition)
  - Pemilihan data digital (multiplexing)
  - Pendistribusian data digital (demultiplexing)
  - Pengkodean data (encoding)
  - Penafsiran data (decoding)

AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. **Sistem Digital**
4. Representasi Besaran Digital
5. Prinsip Perancangan Digital

II – SISTEM BILANGAN

1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. Sistem kode

SISTEM DIGITAL

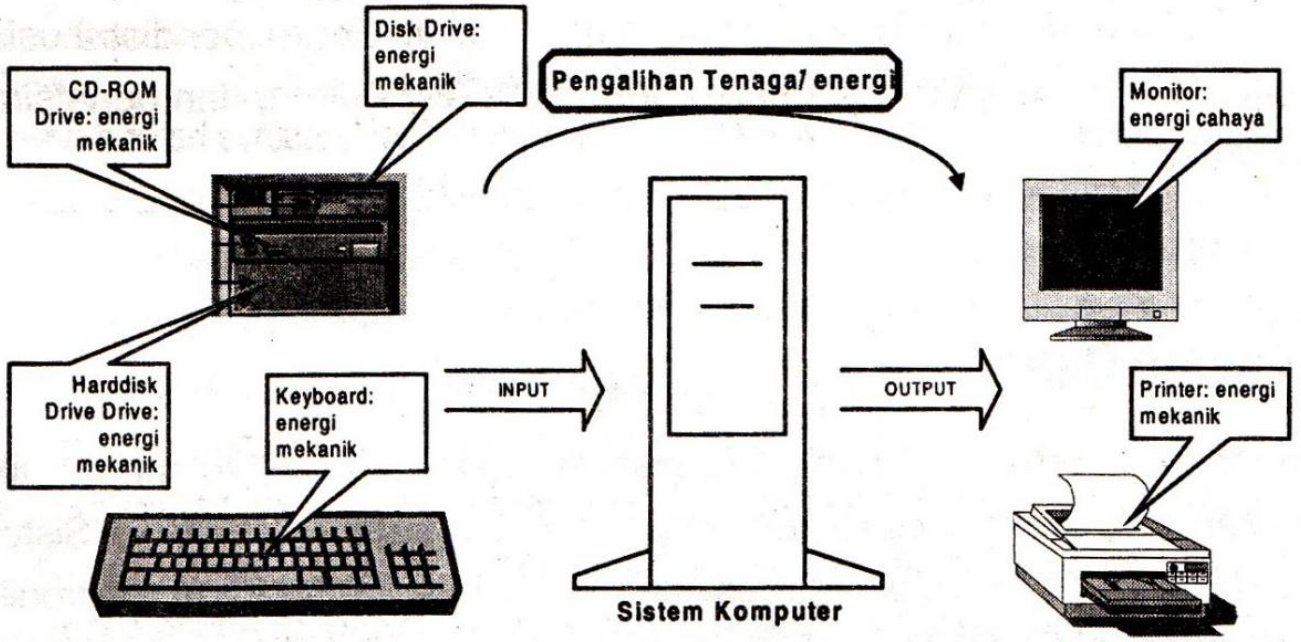
- Pengertian

  Sistem elektronika yang setiap rangkaian penyusunnya melakukan pengolahan sinyal diskrit

- Komponen sistem digital
  - **Sistem elektronika**
    - rangkaian elektronika
    - komponen elektronika
  - **Elemen/gerbang logika**

SISTEM DIGITAL (2)

- Komputer sebagai suatu sistem digital



Gambar 4. Komputer sebagai suatu sistem elektronika digital dalam bidang komputasi

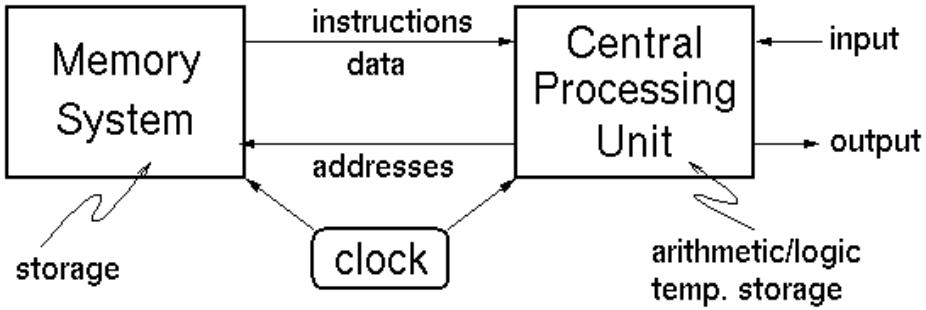
SISTEM DIGITAL (3)

- Perbedaan Rangkaian dan Sistem Digital

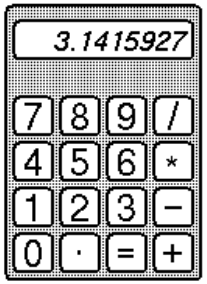
RANGKAIAN DIGITAL	SISTEM DIGITAL
1. Merupakan bagian dari sistem digital, bagian-bagiannya terdiri atas **beberapa elemen/gerbang logika** 2. Outputnya membentuk fungsi pemrosesan sinyal digital 3. Input dan outputnya berupa sinyal digital	1. Bagian-bagiannya terdiri atas **beberapa rangkaian digital, gerbang logika, dan komponen elektronika lainnya** 2. Outputnya merupakan fungsi pengalihan tenaga 3. Input dan outputnya berupa suatu tenaga/energi

Contoh Sistem Digital

- **Digital Computer**
  - Usually design to maximize performance. "Optimized for speed"



- **Handheld Calculator**
  - Usually designed to minimize cost.
  - "Optimized for low cost"
  - Of course, low cost comes at the expense of speed.



Contoh Sistem Digital (2)

- **Digital Watch**

Designed to minimize power.
Single battery must last for years.

- Low power operation comes at the expense of:
  - lower speed
  - higher cost

AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. Sistem Digital
4. **Representasi Besaran Digital**
5. Prinsip Perancangan Digital

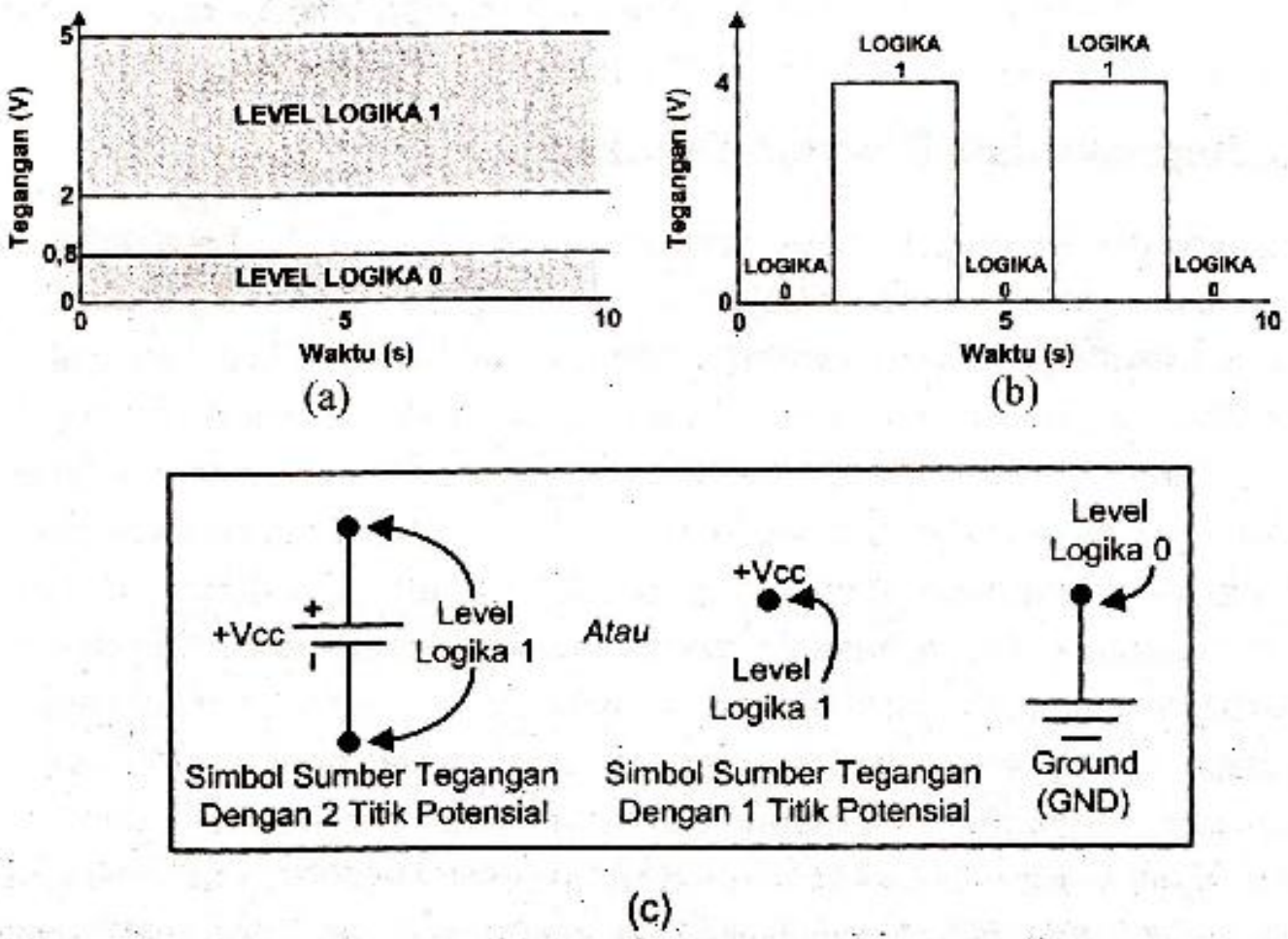
II – SISTEM BILANGAN

1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. Sistem kode

Representasi Besaran Digital

- Besaran digital merupakan besaran yang sifatnya diskrit (hanya memiliki dua keadaan saja)
  - Keadaan biner
  - Rendah – tinggi
  - Logika 0 – logika 1
- Implementasi bidang elektronika
  - Logika 0 : 0 volt - 0,8 volt
  - Logika 1 : 2 volt – 5 volt

Representasi Besaran Digital (2)



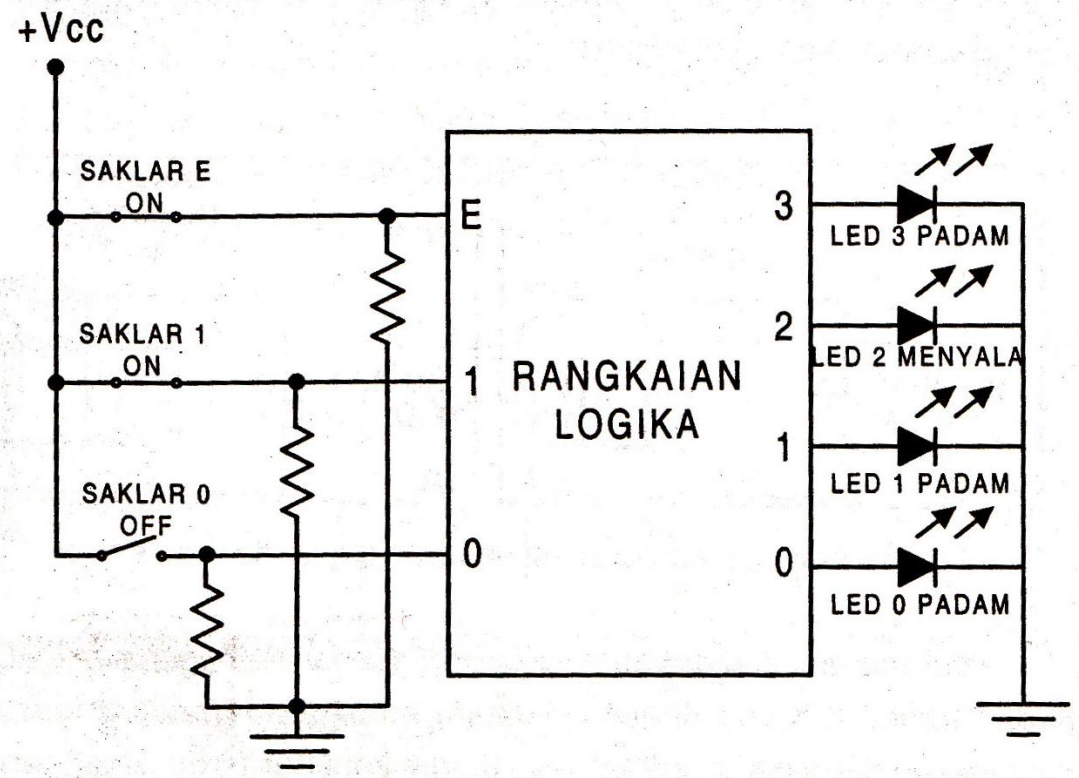
Gambar 5. Representasi besaran digital dengan tegangan listrik

Representasi Besaran Digital (3)

- Representasi besaran digital pada bidang elektronika

LEVEL LOGIKA 0	LEVEL LOGIKA 1
Tegangan listrik 0 s.d 0,8 V	Tegangan listrik 2 s.d 5 V
Titik potensial referensi 0	Titik potensial catu daya +Vcc
Diode dengan reverse bias	Diode dengan forward bias
Transistor dalam keadaan mati	Transistor dalam keadaan jenuh
Saklar dalam keadaan terbuka	Saklar dalam keadaan tertutup
Lampu/ LED dalam keadaan padam	lampu/LED dalam keadaan menyala

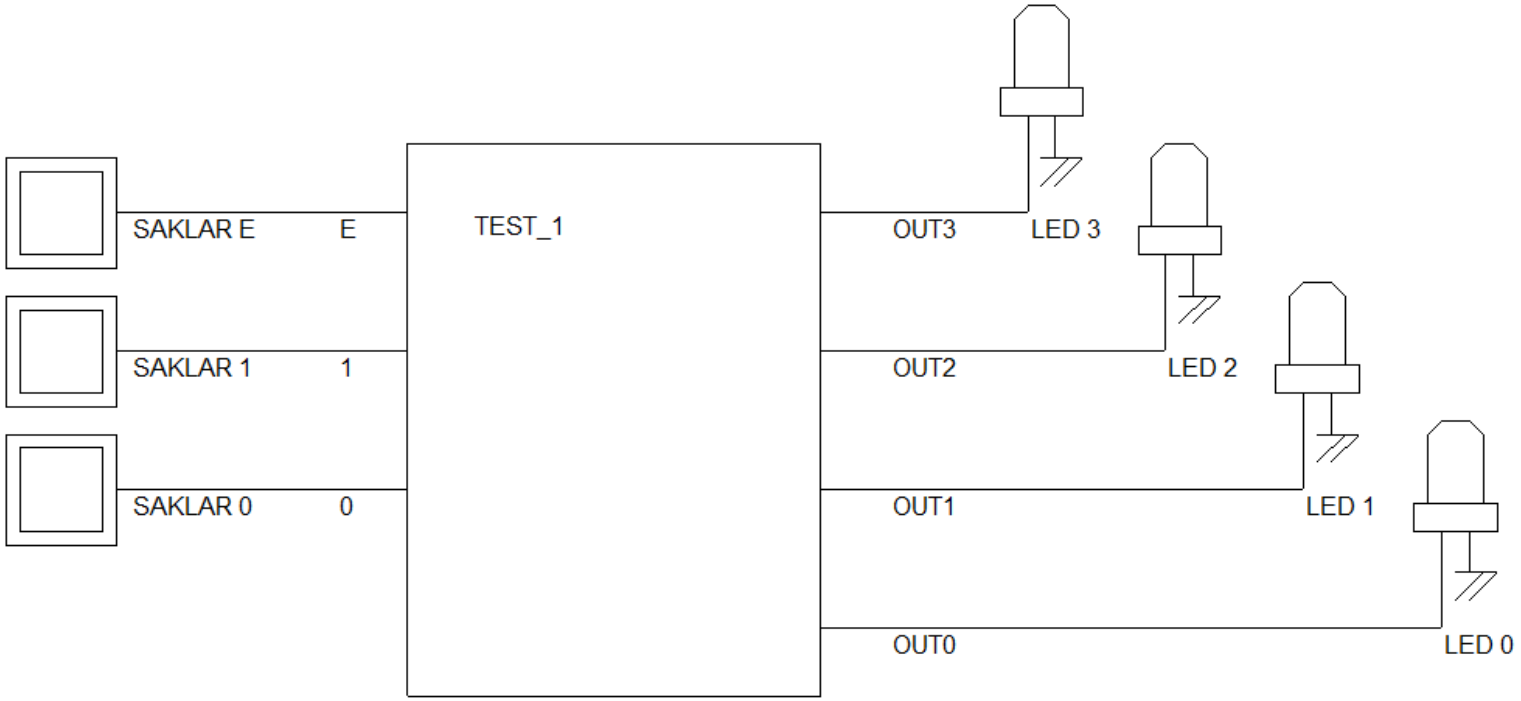
Representasi Besaran Digital (4)



Gambar 10. Representasi level logika menggunakan saklar dan LED

Representasi Besaran Digital (5)

- Simulasi DSCH, file TEST_1.SCH



TUGAS 1a

- Kerjakan dari buku Muchlash, 2005, Bagian1
  - soal nomor: 5, 7, dan 8
- Tuliskan pada kertas folio bergaris

AGENDA

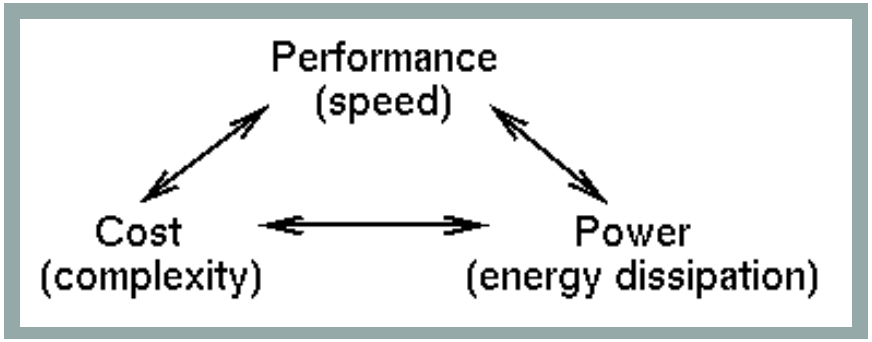
I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. Sistem Digital
4. Representasi Besaran Digital
5. **Prinsip Perancangan Digital**

II – SISTEM BILANGAN

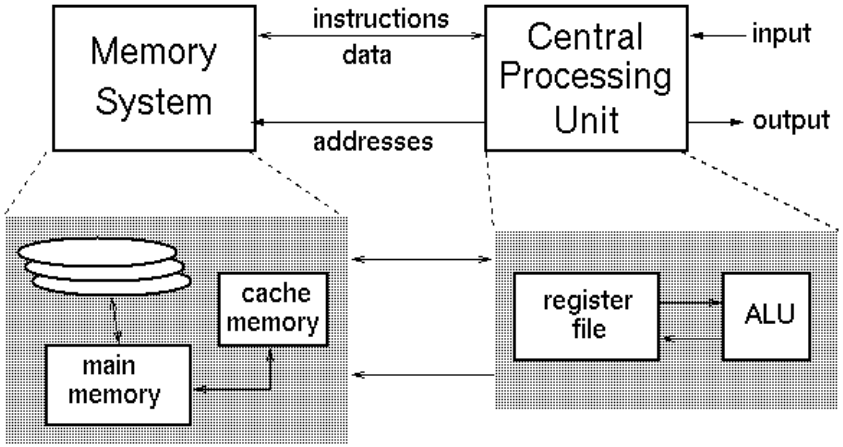
1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. Sistem kode

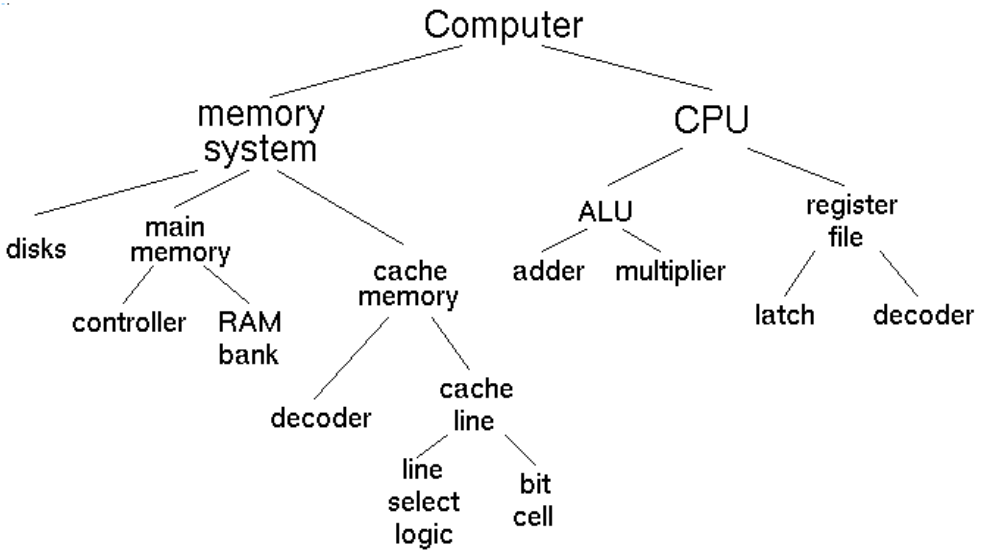
Basic Design Tradeoffs



- You can improve on one at the expense of worsening one or both of the others.
- These tradeoffs exist at every level in the system design - every sub-piece and component.
- Design Specification -
  - Functional Description.
  - Performance, cost, power constraints.
- As a designer you must make the tradeoffs necessary to achieve the function within the constraints.

Design Representation





Digital Design

Given a functional description and performance, cost, & power constraints, come up with an implementation using a set of primitives.

- How do we learn how to do this?
  1. Learn about the primitives.
  2. Learn about design representation.
  3. Learn formal methods to optimally manipulate the representations.
  4. Look at design examples.
  5. Use trial and error - CAD tools and prototyping.
- *Digital design is in some ways more an art than a science. The creative spirit is critical in combining primitive elements & other components in new ways to achieve a desired function.*
- Unlike art we have objective measures of a design:

  performance - cost - power

AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. Sistem Digital
4. Representasi Besaran Digital

II – SISTEM BILANGAN

1. **Sistem bilangan**
2. Konversi Sistem biner, oktal, dan heksadesimal ke/dari Sistem Desimal
3. Sistem kode

Sistem Bilangan

- Bilangan Desimal (basis 10)
  - 0,1,2,3,4,5,6,7,8,9
- Bilangan Biner (basis 2)
  - 0,1
- Bilangan Oktal (basis 8)
  - 0,1,2,3,4,5,6,7
- Bilangan Heksadesimal (basis 16)
  - 0,1,2,3,4,5,6,7,8,9,A,B,C,D,E,F

Decimal	Binary	Octal	Hex
0	000	0	0
1	001	1	1
2	010	2	2

Decimal	Binary	Octal	Hex
5	101	5	5
6	110	6	6
7	111	7	7
8	1000	10	8
9	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F
16	10000	20	10

AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. Sistem Digital
4. Representasi Besaran Digital

II – SISTEM BILANGAN

1. Sistem bilangan
2. **Konversi Sistem biner, oktal, dan heksadesimal ke/dari Sistem Desimal**
3. Sistem kode

Biner VS desimal

- Biner ke desimal
  - 1101_2
  - $1101,11_2$
- Desimal ke biner
  - 21_{10}
  - 227_{10}
  - $227,625_{10}$

Oktal VS desimal

- Oktal ke desimal
  - 154_8
  - $154,67_8$
- Desimal ke oktal
  - 85_{10}

Heksadesimal VS desimal

- Heksadesimal ke desimal
  - $5B_{16}$
  - $A7,C1_{16}$
- Desimal ke heksadesimal
  - 45_{10}

BINER VS Oktal dan Heksadesimal

- **Biner** → Oktal dan Heksadesimal
  - Biner ke oktal
    - $1010011101000110 1_2$
  - Biner ke heksadesimal
    - $1010011101000110 1_2$
- Oktal dan Heksadesimal → **Biner**
  - Oktal ke biner
    - 16245_8
  - Heksadesimal ke biner
    - $62B1C_{16}$

Binary to Hex Conversion

Four-bit Group	Decimal Digit	Hexadecimal Digit
0000	0	**0**
0001	1	**1**
0010	2	**2**
0011	3	**3**
0100	4	**4**
0101	5	**5**
0110	6	**6**
0111	7	**7**
1000	8	**8**
1001	9	**9**
1010	10	**A**
1011	11	**B**
1100	12	**C**
1101	13	**D**
1110	14	**E**
1111	15	**F**

AGENDA

I - SISTEM DIGITAL

1. Revolusi Digital
2. Rangkaian Digital
3. Sistem Digital
4. Representasi Besaran Digital

II – SISTEM BILANGAN

1. Sistem bilangan
2. Konversi Sistem biner, oktal, dan heksadesimal ke Sistem Desimal
3. **Sistem kode**

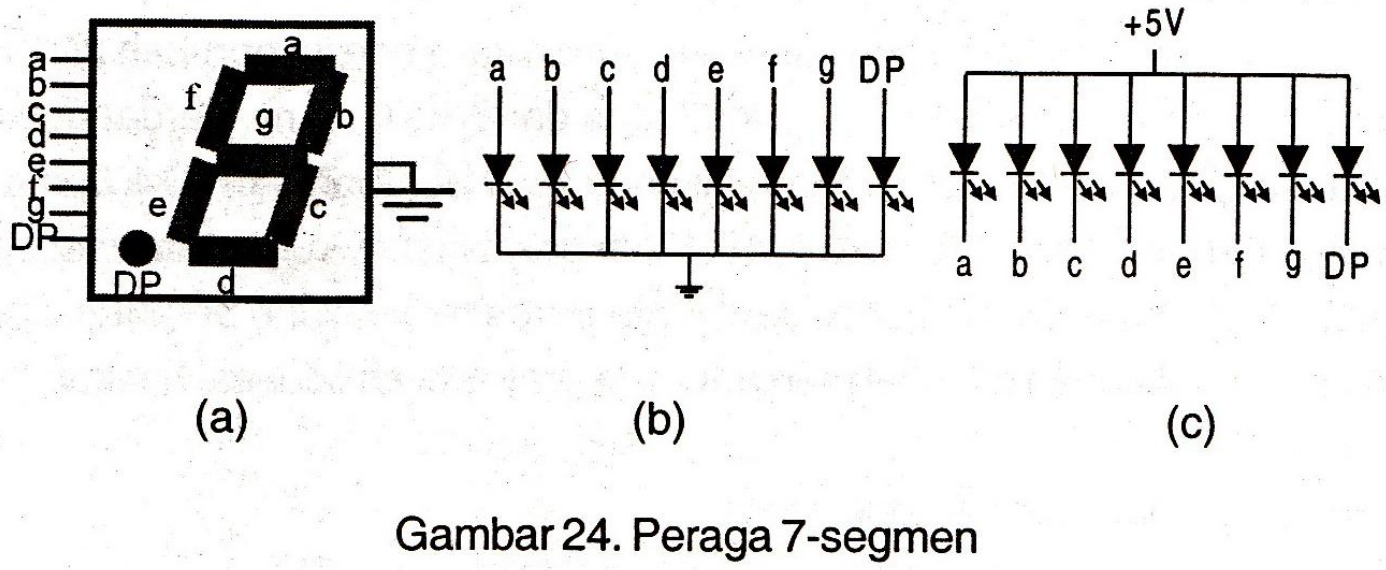
Sistem Kode

- Sistem kode
  - Kode BCD (Binary-Coded Decimal)
  - Kode Excess-3 (XS-3)
  - Kode Gray
  - Kode 7 Segment Display
  - Kode ASCII

BCD

- Hanya menggunakan kode biner yang merepresentasikan desimal 0 – 9
- Latihan, ubahlah ke bentuk desimal:
  - $0110\ 1000\ 0011\ 1001_{BCD}$
  - $0111\ 1100\ 0001_{BCD}$
- Simulasi DSCH:
  - EN_10_BCD.SCH
  - DEC_BCD_DEC.SCH
- Ubah ke biner dan BCD
  - 137_{10}

7 Segment Display



Gambar 24. Peraga 7-segmen

- Simulasi DSCH:
  - 7SEGTES.SCH

ASCII

- *American Standard Code for Information Interchange*
- Kode biner untuk merepresentasikan bilangan, huruf, dan simbol, sehingga disebut juga alfanumerik
- Deteksi kesalahan
  - Bit paritas ganjil
  - Bit paritas genap
- Tabel ASCII

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040		Space	64	40	100	@	@	96	60	140	`	`
1	1	001	SOH (start of heading)	33	21	041	!	!	65	41	101	A	A	97	61	141	a	a
2	2	002	STX (start of text)	34	22	042	"	"	66	42	102	B	B	98	62	142	b	b
3	3	003	ETX (end of text)	35	23	043	#	#	67	43	103	C	C	99	63	143	c	c
4	4	004	EOT (end of transmission)	36	24	044	$	$	68	44	104	D	D	100	64	144	d	d
5	5	005	ENQ (enquiry)	37	25	045	%	%	69	45	105	E	E	101	65	145	e	e
6	6	006	ACK (acknowledge)	38	26	046	&	&	70	46	106	F	F	102	66	146	f	f
7	7	007	BEL (bell)	39	27	047	'	'	71	47	107	G	G	103	67	147	g	g
8	8	010	BS (backspace)	40	28	050	(	(	72	48	110	H	H	104	68	150	h	h
9	9	011	TAB (horizontal tab)	41	29	051	)	)	73	49	111	I	I	105	69	151	i	i
10	A	012	LF (NL line feed, new line)	42	2A	052	*	*	74	4A	112	J	J	106	6A	152	j	j
11	B	013	VT (vertical tab)	43	2B	053	+	+	75	4B	113	K	K	107	6B	153	k	k
12	C	014	FF (NP form feed, new page)	44	2C	054	,	,	76	4C	114	L	L	108	6C	154	l	l
13	D	015	CR (carriage return)	45	2D	055	-	-	77	4D	115	M	M	109	6D	155	m	m
14	E	016	SO (shift out)	46	2E	056	.	.	78	4E	116	N	N	110	6E	156	n	n
15	F	017	SI (shift in)	47	2F	057	/	/	79	4F	117	O	O	111	6F	157	o	o
16	10	020	DLE (data link escape)	48	30	060	0	0	80	50	120	P	P	112	70	160	p	p
17	11	021	DC1 (device control 1)	49	31	061	1	1	81	51	121	Q	Q	113	71	161	q	q
18	12	022	DC2 (device control 2)	50	32	062	2	2	82	52	122	R	R	114	72	162	r	r
19	13	023	DC3 (device control 3)	51	33	063	3	3	83	53	123	S	S	115	73	163	s	s
20	14	024	DC4 (device control 4)	52	34	064	4	4	84	54	124	T	T	116	74	164	t	t
21	15	025	NAK (negative acknowledge)	53	35	065	5	5	85	55	125	U	U	117	75	165	u	u
22	16	026	SYN (synchronous idle)	54	36	066	6	6	86	56	126	V	V	118	76	166	v	v
23	17	027	ETB (end of trans. block)	55	37	067	7	7	87	57	127	W	W	119	77	167	w	w
24	18	030	CAN (cancel)	56	38	070	8	8	88	58	130	X	X	120	78	170	x	x
25	19	031	EM (end of medium)	57	39	071	9	9	89	59	131	Y	Y	121	79	171	y	y
26	1A	032	SUB (substitute)	58	3A	072	:	:	90	5A	132	Z	Z	122	7A	172	z	z
27	1B	033	ESC (escape)	59	3B	073	;	;	91	5B	133	[	[	123	7B	173	{	{
28	1C	034	FS (file separator)	60	3C	074	<	<	92	5C	134	\	\	124	7C	174			|
29	1D	035	GS (group separator)	61	3D	075	=	=	93	5D	135	]	]	125	7D	175	}	}
30	1E	036	RS (record separator)	62	3E	076	>	>	94	5E	136	^	^	126	7E	176	~	~
31	1F	037	US (unit separator)	63	3F	077	?	?	95	5F	137	_	_	127	7F	177	&#127;	DEL

Source: www.LookupTables.com

TUGAS 1b

- Kerjakan dari buku Muchlas, 2005, Bagian 2.
  - Soal nomor 2,3,5, 6
- Tuliskan pada kertas folio bergaris