



Introduction to Computer Science

2016-2017

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Computer Fundamentals

1. Binary Representation: the power of 0 and 1
2. Data Storage: how to record 0 and 1
3. Logic Table and Circuit: how to process 0 and 1



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Lecture No (1)

Binary Representation

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Objectives

- Understand why the binary representation of numbers is important
- Understand the different ways of representing numbers
 -
- Be able to convert from binary to decimal and decimal to binary



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Arabic Numerals

0123456789

Arabic numerals or **Hindu numerals** are the ten digits (0, 1, 2, 3, 4, 5, 6, 7, 8, 9). They are descended from the Hindu-Arabic numeral system developed by Indian mathematicians. The Indian numerals were adopted by the Persian mathematicians in India, and passed on to the Arabs further west. From there they were transmitted to Europe in the Middle Ages. The use of Arabic numerals spread around the world through European trade, books and colonialism. Today they are the most common symbolic representation of numbers in the world

-http://en.wikipedia.org/wiki/Arabic_numerals

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Decimal Numeral Numbers

- It is based on the Arabic numeral system.
- It uses positional notation
 - Use same symbols for different orders of magnitude, but in different places, e.g., ones place, tens place, hundreds place.
- Each next-place (order) digit adds $10^0, 10^1, 10^2, 10^3$, etc.

- Example: In decimal, 1472 means

2	- is in the ones place so multiply it by 10^0 (1)	= 2
7	- is in the tens place so multiply it by 10^1 (10)	= 70
4	- is in the one-hundreds place so multiply it by 10^2 (100)	= 400
1	- is in the one-thousands place so multiply it by 10^3 (1000)	= 1000

$1000+400+70+2=1472$

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Binary Numeral Numbers

- It is based on the binary representation (0, 1).
- It also uses positional notation
 - Use the same symbols for different orders of magnitude, but in different places, e.g., ones place, twos place, fours place.
- Each next-place (order) digit adds $2^0, 2^1, 2^2, 2^3$, etc.
- Example: In binary, 1101 means
 - 1 - is in the ones place so multiply it by 2^0 (1) = 1
 - 0 - is in the twos place so multiply it by 2^1 (2) = 0
 - 1 - is in the fours place so multiply it by 2^2 (4) = 4
 - 1 - is in the eights place so multiply it by 2^3 (8) = 8
 - => $8+4+0+1 = 13$
 - Binary 1101 = Decimal 13
 - 1101 B = 13 D

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Binary Numeral Numbers

- It is based on the binary representation (0, 1).
- It also uses positional notation
 - Use the same symbols for different orders of magnitude, but in different places, e.g., ones place, twos place, fours place.
- Each next-place (order) digit adds $2^0, 2^1, 2^2, 2^3$, etc.
- Example: In binary, 1101 means
 - 1 - is in the ones place so multiply it by 2^0 (1) = 1
 - 0 - is in the twos place so multiply it by 2^1 (2) = 0
 - 1 - is in the fours place so multiply it by 2^2 (4) = 4
 - 1 - is in the eights place so multiply it by 2^3 (8) = 8
 - => $1 \times 2^3 + 1 \times 2^2 + 0 \times 2^1 + 1 \times 2^0 = 8+4+0+1 = 13$
 - Binary 1101 = Decimal 13
 - 1101 B = 13 D

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Binary Numeral Numbers

Decimal	Binary
0	0
1	1
2	10
3	11
4	100
5	101
6	110
7	111

Binary	Decimal
0	0
1	1
10	2
100	4
1000	8
10000	16
100000	32
1000000	64

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From Binary to Decimal

- For an 8-bit binary, what is the largest number in decimal?

Binary 11111111 = ?

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Binary Arithmetic - subtraction

Use the same principles as subtracting two decimal numbers: borrow from the next place

$$\begin{array}{r} \quad * * \\ \quad 11101 \\ - \quad 00111 \\ \hline \quad 10110 \end{array}$$

Check the answer:

$$11101_2 = 29$$

$$00111_2 = 7$$

$$10110_2 = 22$$

Binary Arithmetic

- Multiplication in binary is also similar to its decimal counterpart
- Division in binary is also similar to its decimal counterpart

End of Binary Representation

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Lecture No (2)

Data Storage

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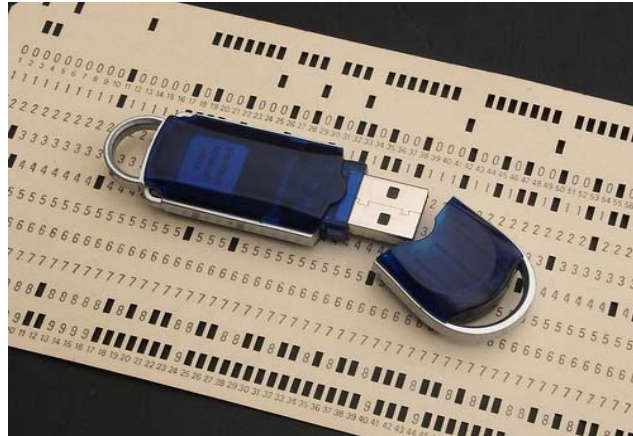
<http://www.RCSTSD.com>

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Objectives

- Understand how a computer stores binary data
- Understand the data encoding



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Question?

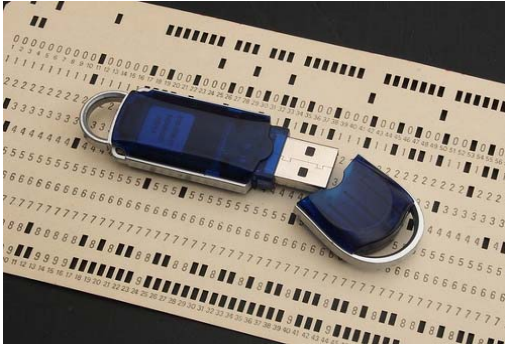
You are a "forensic computer scientist" and are given a disk drive. You inspect the disk drive and find that it contains a list of 1s and 0s. What do you do?



001010010100101001010101
010101010101010100101000
0101111010101010101111
1111101111110111111111
001010010100101001010101
010101010101010100101000
0101111010101010101111
1111101111110111111111

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Data Density



- Machine readable
- Electronic computer readable
- Human readable

- Standard IBM punch card, 7-3/8 inch by 3-1/4 inch, 80 columns (~1950)
- 1 GB memory stick (~2000)
- Standard A4 paper, 8 inch by 11 inch, 50 lines and 30 columns (human)

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Storing Data

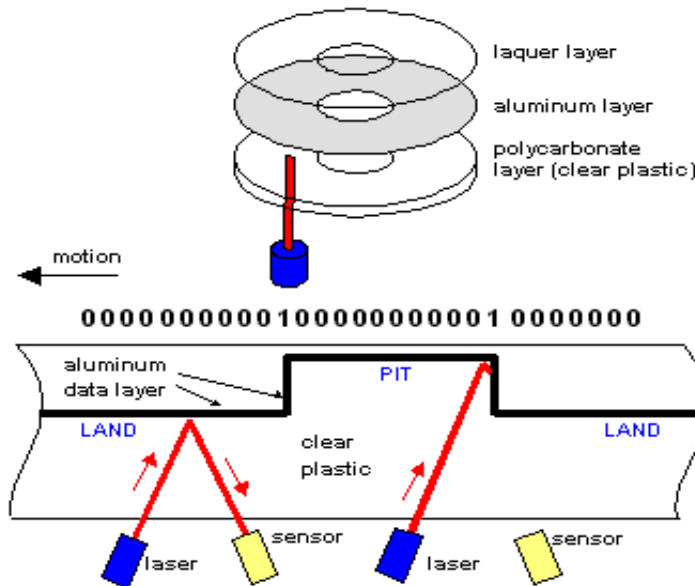
There are many ways to store binary data

- On papers with holes (punch card)
- On papers with inks (scantron)
- Using electronic charges (CCD for pictures)
- Using magnetized material
 - Magnetic tape (audio, video, data)
 - Computer Hard Disk Drive (HDD)
- Storing data as “pits” or “lands” (CD-ROM)
 - differences in reflected light to optically read them

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How CD-ROM work?

From Computer Desktop Encyclopedia
© 1998 The Computer Language Co. Inc.



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Storing Data

- Transistors
 - A semiconductor device used to switch and amplify electronic signals
 - For CPU (Central Processing Unit)
 - For memory
 - For flash memory (memory stick)
 - Flash memory is not volatile, keeping the state of the data when power is off. **It is portable** (~1998)



Data formats media change, but the underlying data remains basically constant

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Bits

- Bits are the individual zeros and ones that are stored by computers.
- A Bit can have two different states (0 or 1), and is a single digit long.
- Any system that has two states can be thought of as a bit:
 - 0 or 1
 - off or on
 - yes or no
 - true or false
 - high or low
 - open or closed

Bytes

- A Byte is a group of eight Bits grouped together.
- One Byte (8 Bits) can be used to represent:
 - Numbers from 00000000 to 11111111 in binary
 - Numbers from 0 to 255 in decimal
 - Numbers from 00 to FF in Hexadecimal

Word

- Multiple Bytes can be grouped together to form Words.
- The length of a Word varies depending on the hardware and operating system, and a Word can be:
 - 4 Bytes long (32 Bits)
 - 8 Bytes long (64 Bits)
 - 16 Bytes long (128 Bits - this is not common)

Question?

Explain in basic terms the meaning of the following: "The old monitor only supports 8-bit color, my monitor supports 24-bit color".



Encoding

One of key ideas of understanding computing

- Encoding text involves transforming it into an "encoded" number (e.g., ASCII code)
- Music (e.g, au), video (e.g., mpg), pictures (e.g, gif) and almost everything else can be represented as an "encoded" numbers
- Once the data is transformed into encoded numbers, it can then be translated into a binary number

Example of Encoding

ASCII Code: stands for American Standard Code for Information Interchange
--<http://www.asciitable.com/>

- When a string is stored in a computer's memory, each character is given a number representation which is assigned to it in the ASCII Table

ASCII Table

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

Source: www.LookupTables.com

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ASCII Table - Extended

128	Ç	144	É	160	á	176	☐	192	Ł	208	⊥	224	α	240	≡
129	ü	145	æ	161	í	177	☐	193	ł	209	⊥	225	β	241	±
130	é	146	Æ	162	ó	178	☐	194	ṽ	210	⊥	226	Γ	242	≥
131	â	147	ô	163	ú	179	|	195	ṽ	211	⊥	227	π	243	≤
132	ä	148	ö	164	ñ	180	†	196	—	212	⊥	228	Σ	244	∫
133	à	149	ò	165	Ñ	181	†	197	†	213	⊥	229	σ	245	∫
134	â	150	û	166	ª	182	||	198	†	214	⊥	230	μ	246	+
135	ç	151	ù	167	º	183	π	199	||	215	⊥	231	τ	247	±
136	ê	152	ÿ	168	¿	184	¶	200	⊥	216	⊥	232	Φ	248	°
137	ë	153	Ö	169	┌	185	||	201	⊥	217	┘	233	⊙	249	.
138	è	154	Ü	170	┐	186	||	202	⊥	218	┘	234	Ω	250	.
139	ï	155	◊	171	½	187	¶	203	⊥	219	■	235	δ	251	√
140	î	156	£	172	¼	188	¶	204	⊥	220	■	236	∞	252	∞
141	ï	157	₣	173	¡	189	⊥	205	=	221	■	237	φ	253	²
142	Ä	158	£	174	«	190	┘	206	⊥	222	■	238	ε	254	■
143	Å	159	ƒ	175	»	191	┘	207	⊥	223	■	239	∩	255	

Source: www.LookupTables.com

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Example of Encoding

Encoding "Hello CDS 130"

Words Broken into Bytes				
Word	Byte 1	Byte 2	Byte 3	Byte 4
0	H	e	l	l
1	o		C	D
2	S		1	3
3	0			

String broken to words,
words broken to characters (bytes)

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Example of Encoding

Encoding "Hello CDS 130"

Characters Represented as Numbers				
Word	Byte 1	Byte 2	Byte 3	Byte 4
0	71	101	118	118
1	111	32	67	68
2	83	32	49	51
3	48	32	32	32

Characters to ASCII number

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Example of Encoding

Encoding "Hello CDS 130"

Character Numbers in Binary				
Word	Byte 1	Byte 2	Byte 3	Byte 4
000	0100 0111	0111 0101	0111 0110	0111 0110
001	0110 1111	0010 0000	0100 0011	0100 0100
010	0101 0011	0010 0000	0011 0001	0011 0011
011	0011 0000	0010 0000	0010 0000	0010 0000

ASCII number to binary number

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Question?

What is 01001010 01011010?

Encoding your name initials to binary using ASCII table?

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End of Data Storage

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Lecture No (3)

**Logic Circuits and
Logic Tables**

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Motivation

We know how binary numbers work, now we need to make machines that can compute on these numbers

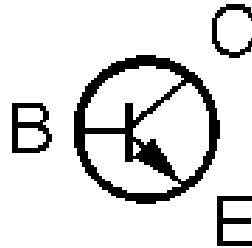
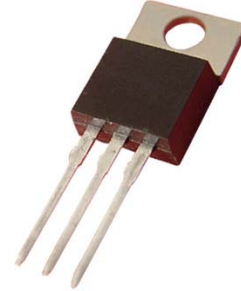
Watch:
http://www.ted.com/talks/george_dyson_at_the_birth_of_the_computer.html

Objectives

- Understand how transistor works
- Explain what a logic circuit and logic table are
- Explain how logic circuits can be combined to manipulate binary numbers and do calculations

Transistors

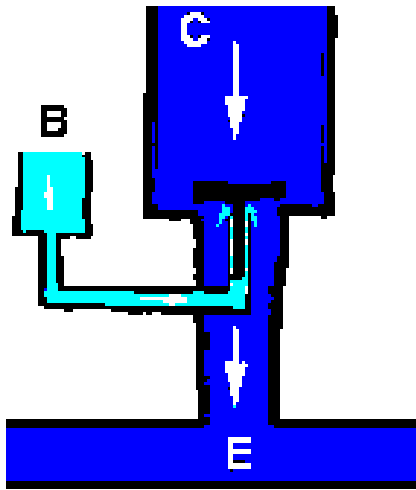
- A transistor is a semiconductor device used to switch and amplify (with gain X 100) electronic signals
- It has three pins
 - Base (B): acting as gate
 - Emitter (E): acting as drain
 - Collector (C): acting as source



Transistors

- When a small current is applied between Base and Emitter, a large current is generated between Collector and Emitter; the gain or amplification is about 100 times.
- It acts as an electronic switch: on and off, high and low, 1 and 0.
- The large current is also necessary for cascading the state through other transistors for complex calculations.

The Hydraulic Analogy



<http://www.satcure-focus.com/tutor/page4.htm>

- It is often easier to think of electronic current flow in terms of water flow.
- A small water flow from B pushes the black plunger upward, allowing a large flow from C to E. This is the amplification.

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Transistors

- Small size and minimal weight, allowing the development of miniaturized electronic devices.
- Highly automated manufacturing processes, resulting in low per-unit cost.
- Lower possible operating voltages, making transistors suitable for small, battery-powered applications.
- No warm-up period for cathode heaters required after power application.
- Lower power dissipation and generally greater energy efficiency.
- Higher reliability and greater physical ruggedness.
- Extremely long life. Some transistorized devices have been in service for more than 50 years.

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Transistors

“About 60 million transistors were built this year [2002] ... for [each] man, woman, and child on Earth.”

--

http://en.wikipedia.org/wiki/Transistor#cite_note-11

Logic Circuits

- Using transistors, we can create logic circuits
- Each circuit has one output and several inputs
- The relationship between the inputs and the output determines the type of circuit
- The logic circuit can be defined by the logic table

Logic Table

- Logic tables are used to define the inputs and outputs of logic circuits
- Each input and output has two possible states
- We sometimes use
 - 1 or 0
 - true or false

Type - AND gate



Symbol

$$A \cdot B$$

Boolean Algebra

INPUT		OUTPUT
A	B	A AND B
0	0	0
0	1	0
1	0	0
1	1	1

Logic table

- The diagram of the AND gate looks like a capital letter D with two "prongs" on the left (the inputs) and one "prong" on the right (the output).
- if either of the inputs is 0, then the output of the AND gate is 0. Thus, in order to get an AND gate to output 1, **both** inputs to it must be 1

Type - OR gate



Symbol

$$A + B$$

Boolean Algebra

INPUT		OUTPUT
A	B	A OR B
0	0	0
0	1	1
1	0	1
1	1	1

Logic table

- if either of the inputs is 1, then the output of the OR gate is 1. Thus, in order to get an OR gate to output 0, **both** inputs to it must be 0

Type - NOT gate



Symbol

$$\bar{A}$$

Boolean Algebra

INPUT	OUTPUT
A	NOT A
0	1
1	0

Logic table

- The operation of reversing the input state

Type - NAND gate



Symbol

$$\overline{A \cdot B}$$

Boolean Algebra

INPUT		OUTPUT
A	B	A NAND B
0	0	1
0	1	1
1	0	1
1	1	0

Logic table

- The output of the NAND gate is the negation, or **reverse** of the output of an AND gate with the same inputs (0 negated equals 1, and 1 negated equals 0).

Type - NOR gate



Symbol

$$\overline{A + B}$$

Boolean Algebra

INPUT		OUTPUT
A	B	A NOR B
0	0	1
0	1	0
1	0	0
1	1	0

Logic table

- NOR stands for "Negated OR". Thus, the output of the NOR gate is the negation, or reverse of the output of an OR gate with the same inputs.

Type - XOR gate



Symbol

$$A \oplus B$$

Boolean Algebra

INPUT		OUTPUT
A	B	A XOR B
0	0	0
0	1	1
1	0	1
1	1	0

Logic table

- EOR stands for "Exclusive OR". The thing to remember about EOR gates is this: An EOR gate will output 1 **only** if one of the inputs is 1 and the other input 0. If both inputs are the same (1 and 1, or 0 and 0), then EOR outputs 0

Adding Binary Numbers

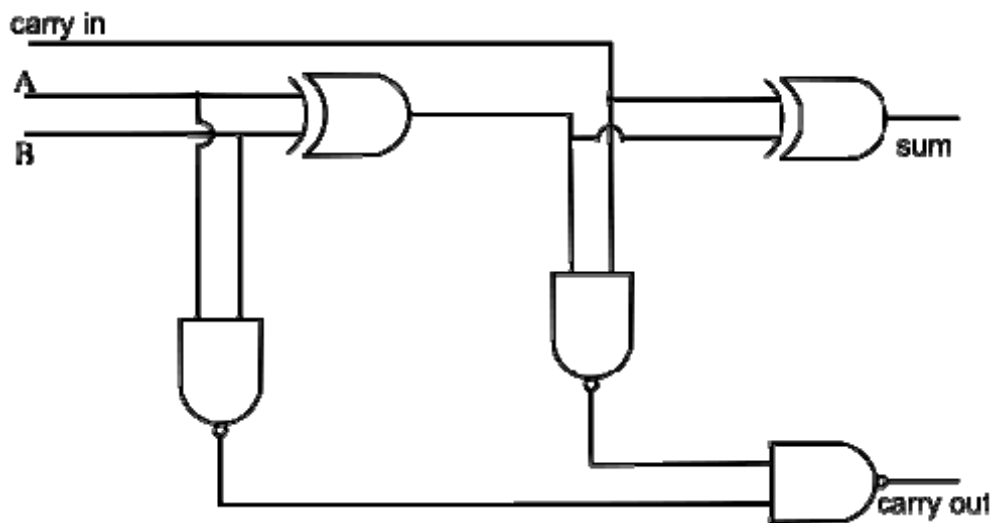
- When adding two binary numbers, the most complex operation is $1+1+1=11$
- This only happens when we carry data from a previous column

- You can think of the problems as

$$\text{carry in} + \text{Digit A} + \text{Digit B} = \text{result} + \text{carry out}$$

- If you can do this operation, you can repeat it to add any two binary numbers

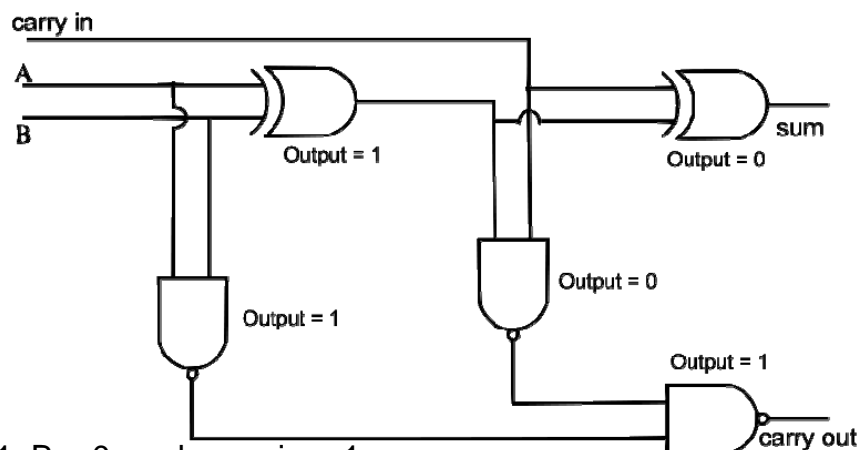
Adding Binary Numbers



Two EOR gates and three NAND gates

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Adding Binary Numbers



If A = 1, B = 0, and carry in = 1:

The upper left EOR gate output is 1

The lower left NAND gate output is 1

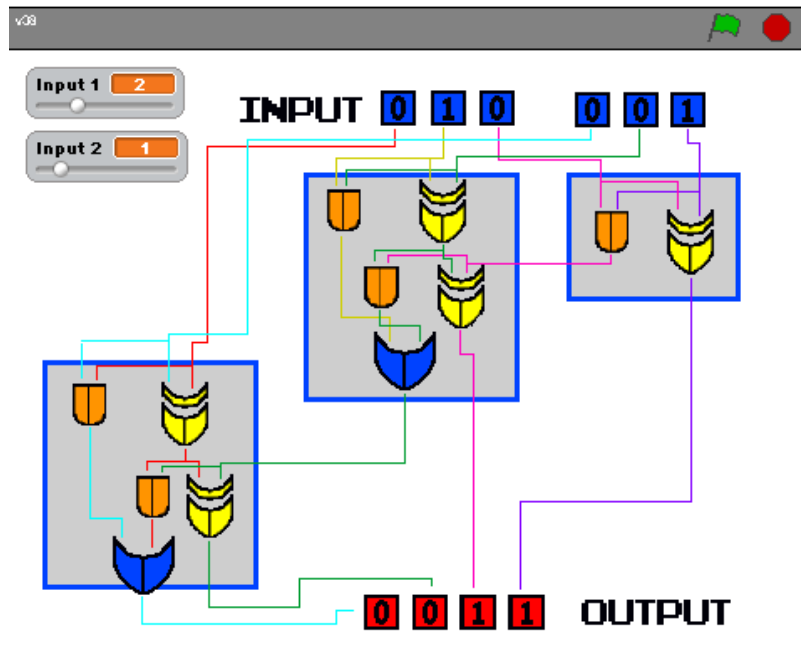
The center NAND gate output is 0

The upper right EOR gate (sum) output is 0

The lower right NAND gate (carry out) output is 1

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A 3-bit Adding Machine



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Question?

Is there a largest number?

Is there a largest number in computer?

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Computer

A computer is a machine that manipulates data according to a set of instructions called a computer program

--<http://en.wikipedia.org/wiki/Computing>

By now, we shall know the basic of a computer:

- Machine: electronic machine built upon electronic logic circuits
- Manipulate: the operation of logic circuits
- Data: encoded into binary data

Next, we need to learn (1) how scientific data are obtained or generated, and (2) how to “program”?

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Why do programmers always mix up Halloween and Christmas?

Because Oct 31 equals Dec 25.

The End

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Lecture No (4)

Number Systems

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Common Number Systems

System	Base	Symbols	Used by humans?	Used in computers?
Decimal	10	0, 1, ... 9	Yes	No
Binary	2	0, 1	No	Yes
Octal	8	0, 1, ... 7	No	No
Hexa-decimal	16	0, 1, ... 9, A, B, ... F	No	No

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Quantities/Counting (1 of 3)

Decimal	Binary	Octal	Hexa-decimal
0	0	0	0
1	1	1	1
2	10	2	2
3	11	3	3
4	100	4	4
5	101	5	5
6	110	6	6
7	111	7	7

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Quantities/Counting (2 of 3)

Decimal	Binary	Octal	Hexa-decimal
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

Introduction to Computer Science

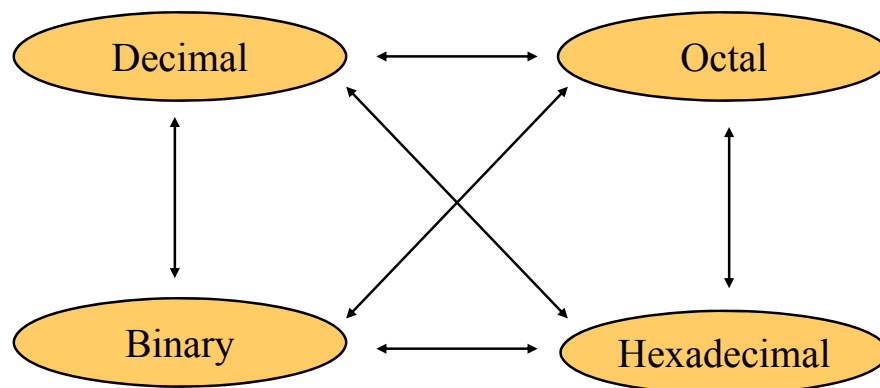
Quantities/Counting (3 of 3)

Decimal	Binary	Octal	Hexa- decimal
16	10000	20	10
17	10001	21	11
18	10010	22	12
19	10011	23	13
20	10100	24	14
21	10101	25	15
22	10110	26	16
23	10111	27	17

Introduction to Computer Science

Conversion Among Bases

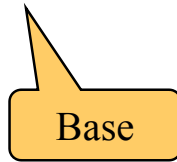
- The possibilities:



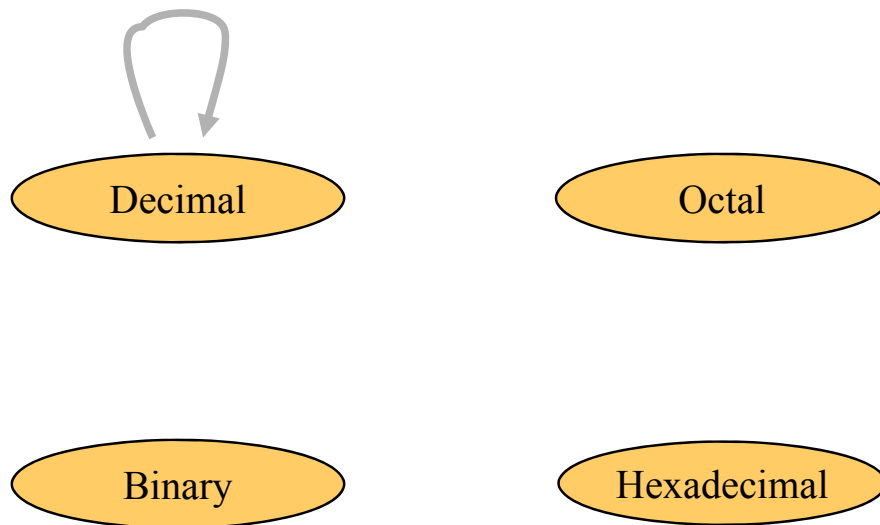
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Quick Example

$$25_{10} = 11001_2 = 31_8 = 19_{16}$$



Decimal to Decimal (just for fun)



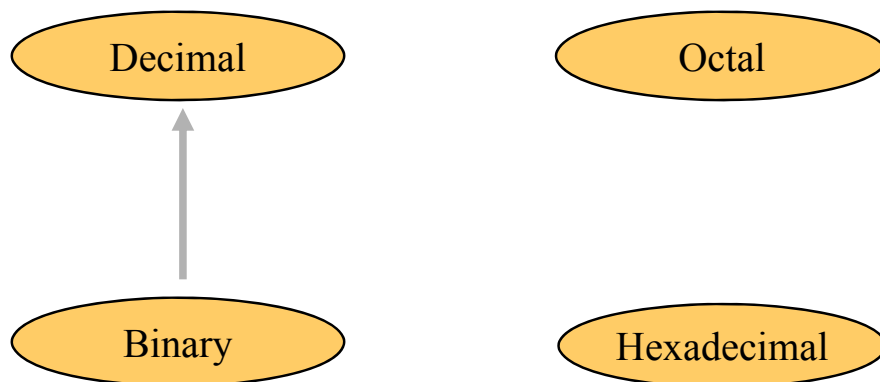
$$125_{10} \Rightarrow \begin{array}{r} 5 \times 10^0 = 5 \\ 2 \times 10^1 = 20 \\ 1 \times 10^2 = 100 \\ \hline 125 \end{array}$$

Weight

Base

Introduction to Computer Science

Binary to Decimal



Introduction to Computer Science

Binary to Decimal

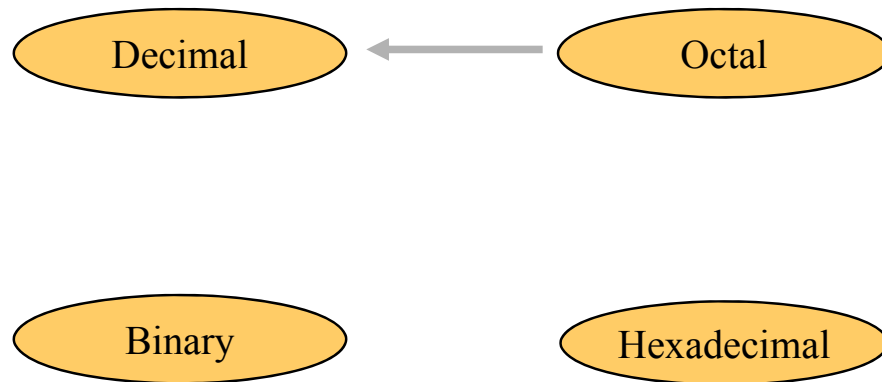
- Technique
 - Multiply each bit by 2^n , where n is the “weight” of the bit
 - The weight is the position of the bit, starting from 0 on the right
 - Add the results

Example

Bit “0”

$$101011_2 \Rightarrow \begin{array}{r} 1 \times 2^0 = 1 \\ 1 \times 2^1 = 2 \\ 0 \times 2^2 = 0 \\ 1 \times 2^3 = 8 \\ 0 \times 2^4 = 0 \\ 1 \times 2^5 = 32 \\ \hline 43_{10} \end{array}$$

Octal to Decimal



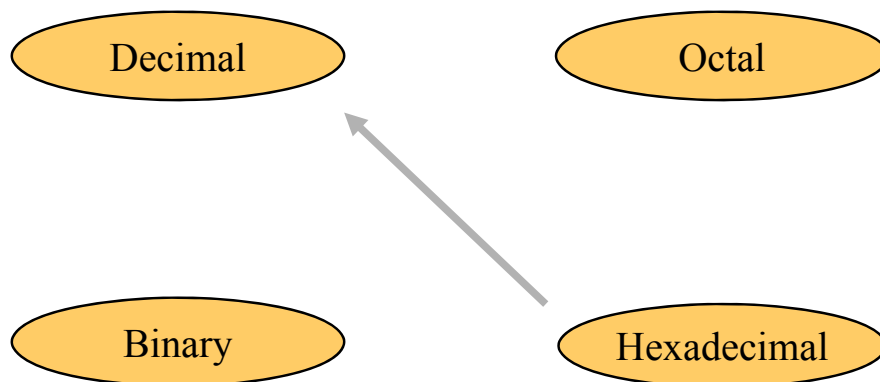
Octal to Decimal

- Technique
 - Multiply each bit by 8^n , where n is the “weight” of the bit
 - The weight is the position of the bit, starting from 0 on the right
 - Add the results

Example

$$\begin{array}{r} 724_8 \Rightarrow \\ 4 \times 8^0 = 4 \\ 2 \times 8^1 = 16 \\ 7 \times 8^2 = 448 \\ \hline 468_{10} \end{array}$$

Hexadecimal to Decimal



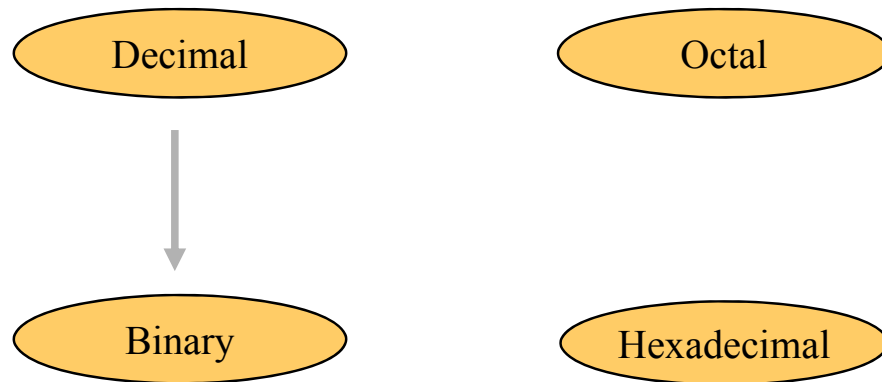
Hexadecimal to Decimal

- Technique
 - Multiply each bit by 16^n , where n is the “weight” of the bit
 - The weight is the position of the bit, starting from 0 on the right
 - Add the results

Example

$$\begin{array}{r} ABC_{16} \Rightarrow \\ C \times 16^0 = 12 \times 1 = 12 \\ B \times 16^1 = 11 \times 16 = 176 \\ A \times 16^2 = 10 \times 256 = 2560 \\ \hline 2748_{10} \end{array}$$

Decimal to Binary



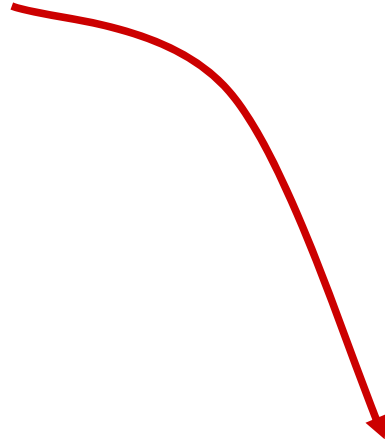
Decimal to Binary

- Technique
 - Divide by two, keep track of the remainder
 - First remainder is bit 0 (LSB, least-significant bit)
 - Second remainder is bit 1
 - Etc.

Example

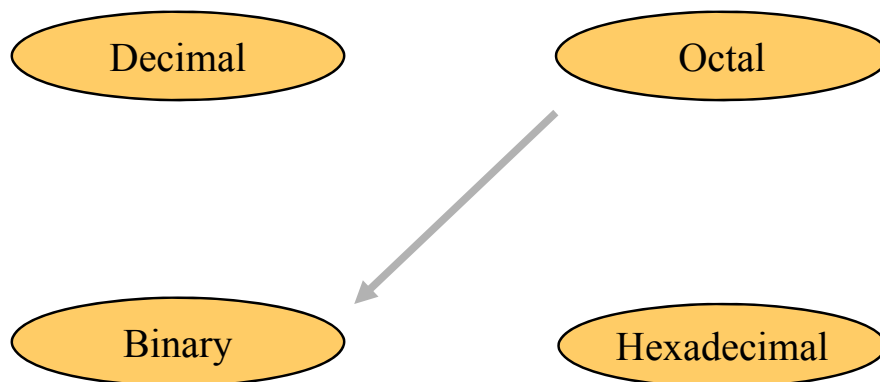
$$125_{10} = ?_2$$

2	|	125	
2	|	62	1
2	|	31	0
2	|	15	1
2	|	7	1
2	|	3	1
2	|	1	1
		0	1



$$125_{10} = 1111101_2$$

Octal to Binary



Octal to Binary

- Technique
 - Convert each octal digit to a 3-bit equivalent binary representation

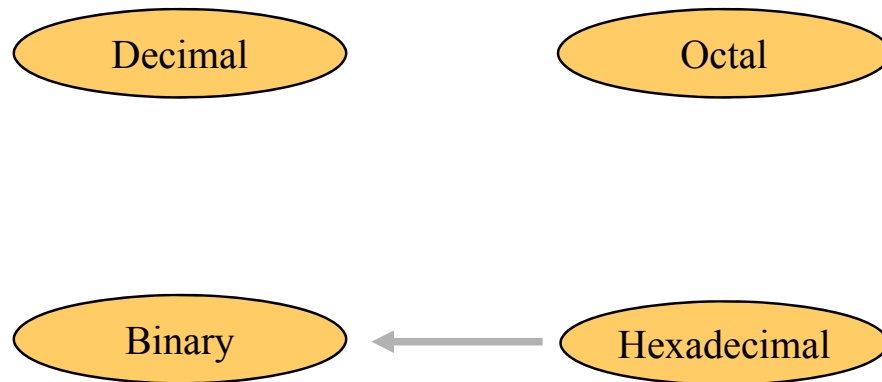
Example

$$705_8 = ?_2$$

$$\begin{array}{ccc} 7 & 0 & 5 \\ \downarrow & \downarrow & \downarrow \\ 111 & 000 & 101 \end{array}$$

$$705_8 = 111000101_2$$

Hexadecimal to Binary



Hexadecimal to Binary

- Technique
 - Convert each hexadecimal digit to a 4-bit equivalent binary representation

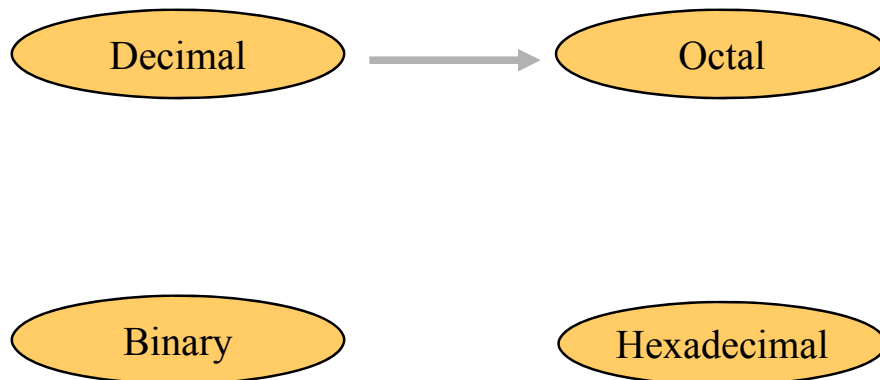
Example

$$10AF_{16} = ?_2$$

1	0	A	F
↓	↓	↓	↓
0001	0000	1010	1111

$$10AF_{16} = 0001000010101111_2$$

Decimal to Octal



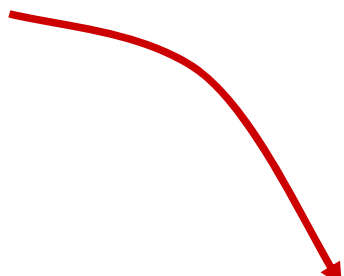
Decimal to Octal

- Technique
 - Divide by 8
 - Keep track of the remainder

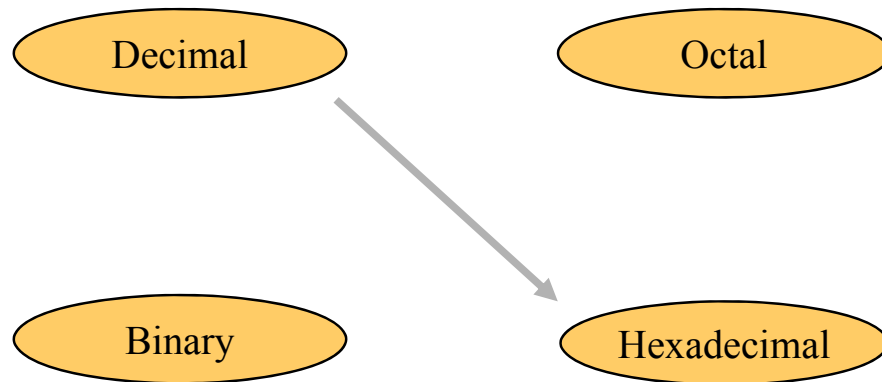
Example

$$1234_{10} = ?_8$$

$$\begin{array}{r|l} 8 & 1234 \\ \hline 8 & 154 \quad 2 \\ \hline 8 & 19 \quad 2 \\ \hline 8 & 2 \quad 3 \\ \hline & 0 \quad 2 \end{array}$$


$$1234_{10} = 2322_8$$

Decimal to Hexadecimal



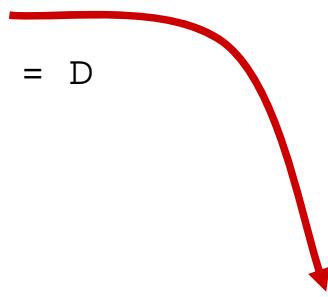
Decimal to Hexadecimal

- Technique
 - Divide by 16
 - Keep track of the remainder

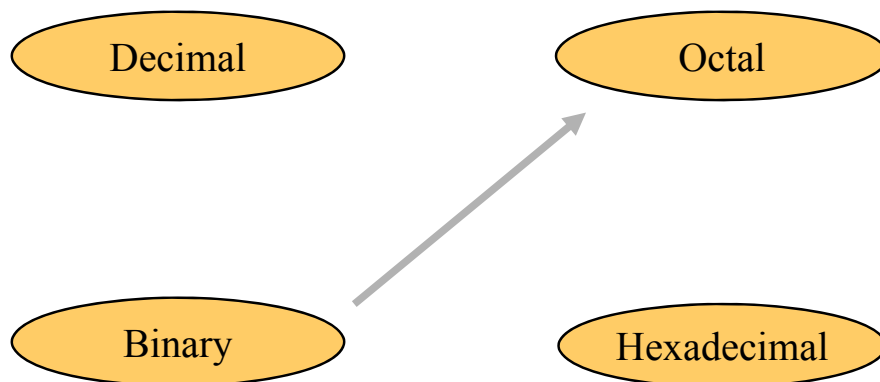
Example

$$1234_{10} = ?_{16}$$

$$\begin{array}{r|l} 16 & 1234 \\ \hline 16 & \underline{77} & 2 \\ 16 & \underline{4} & 13 = D \\ & 0 & 4 \end{array}$$


$$1234_{10} = 4D2_{16}$$

Binary to Octal

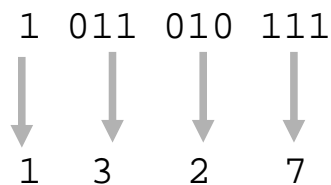


Binary to Octal

- Technique
 - Group bits in threes, starting on right
 - Convert to octal digits

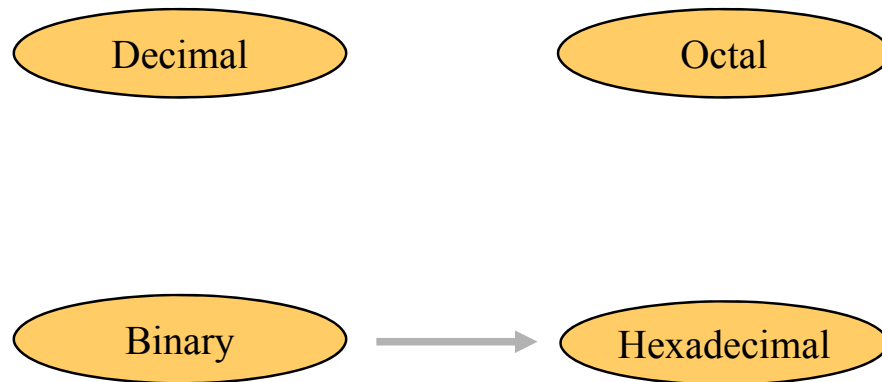
Example

$$1011010111_2 = ?_8$$



$$1011010111_2 = 1327_8$$

Binary to Hexadecimal

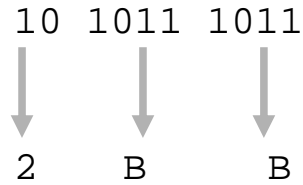


Binary to Hexadecimal

- Technique
 - Group bits in fours, starting on right
 - Convert to hexadecimal digits

Example

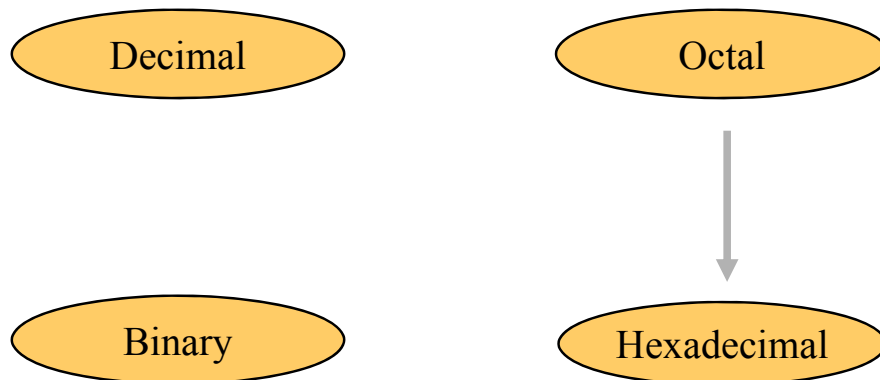
$$1010111011_2 = ?_{16}$$



$$1010111011_2 = 2BB_{16}$$

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Octal to Hexadecimal



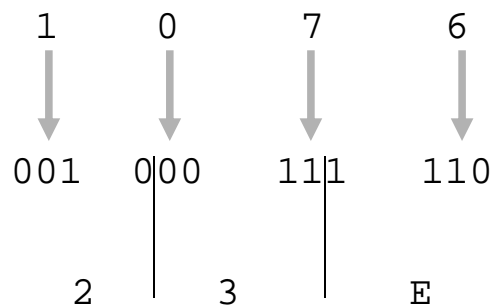
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Octal to Hexadecimal

- Technique
 - Use binary as an intermediary

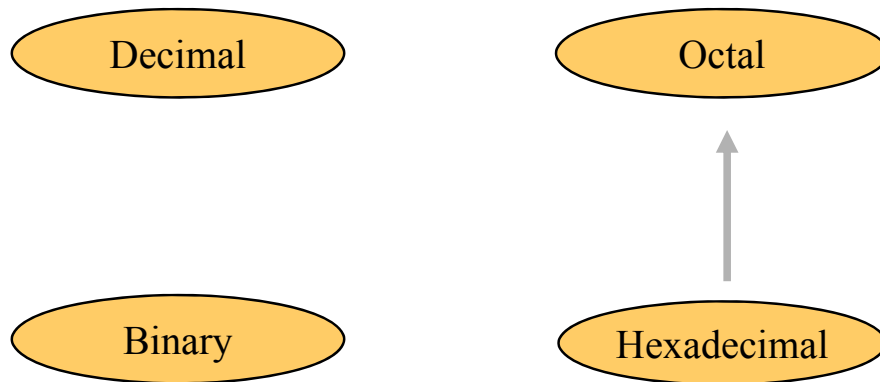
Example

$$1076_8 = ?_{16}$$



$$1076_8 = 23E_{16}$$

Hexadecimal to Octal

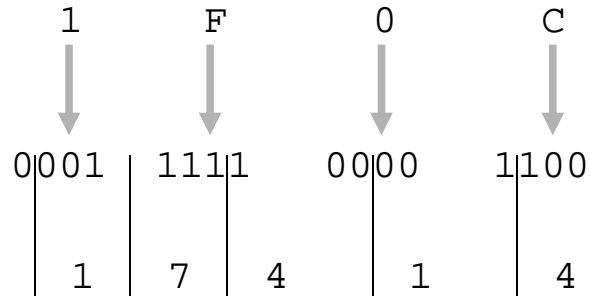


Hexadecimal to Octal

- Technique
 - Use binary as an intermediary

Example

$$1F0C_{16} = ?_8$$



$$1F0C_{16} = 17414_8$$

Introduction to Computer Science

Exercise – Convert ...

Decimal	Binary	Octal	Hexa-decimal
33			
	1110101		
		703	
			1AF

Don't use a calculator!

Introduction to Computer Science

Exercise – Convert ...

Answer

Decimal	Binary	Octal	Hexa-decimal
33	100001	41	21
117	1110101	165	75
451	111000011	703	1C3
431	110101111	657	1AF



Introduction to Computer Science

Common Powers (1 of 2)

- Base 10

Power	Preface	Symbol	Value
10^{-12}	pico	p	.000000000001
10^{-9}	nano	n	.000000001
10^{-6}	micro	μ	.000001
10^{-3}	milli	m	.001
10^3	kilo	k	1000
10^6	mega	M	1000000
10^9	giga	G	1000000000
10^{12}	tera	T	1000000000000

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Common Powers (2 of 2)

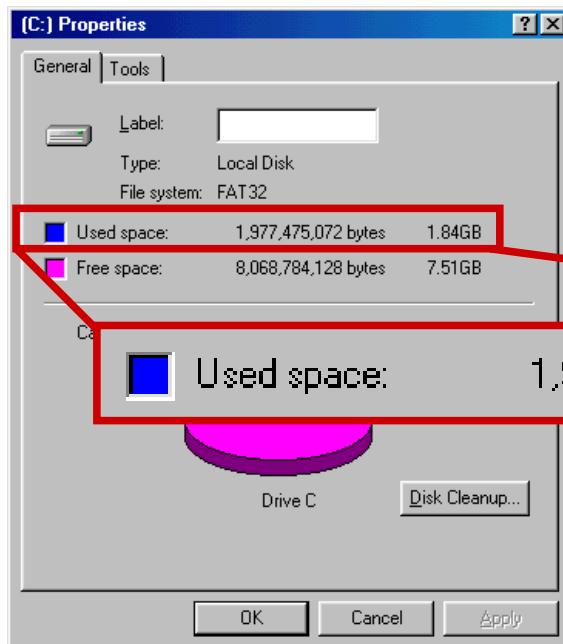
- Base 2

Power	Preface	Symbol	Value
2^{10}	kilo	k	1024
2^{20}	mega	M	1048576
2^{30}	Giga	G	1073741824

- What is the value of “k”, “M”, and “G”?
- In computing, particularly w.r.t. memory, the base-2 interpretation generally applies

Introduction to Computer Science

Example



In the lab...

1. Double click on My Computer
2. Right click on C:
3. Click on Properties

Introduction to Computer Science

Exercise – Free Space

- Determine the “free space” on all drives on a machine in the lab

Drive	Free space	
	Bytes	GB
A:		
C:		
D:		
E:		
etc.		

Introduction to Computer Science

Review – multiplying powers

- For common bases, add powers

$$a^b \times a^c = a^{b+c}$$

$$2^6 \times 2^{10} = 2^{16} = 65,536$$

or...

$$2^6 \times 2^{10} = 64 \times 2^{10} = 64k$$

Introduction to Computer Science

Binary Addition (1 of 2)

- Two 1-bit values

A	B	A + B
0	0	0
0	1	1
1	0	1
1	1	10

“two”

Binary Addition (2 of 2)

- Two n -bit values
 - Add individual bits
 - Propagate carries
 - E.g.,

$$\begin{array}{r} \overset{1}{1}0101 \\ + \overset{1}{1}1001 \\ \hline 101110 \end{array} \qquad \begin{array}{r} 21 \\ + 25 \\ \hline 46 \end{array}$$

Multiplication (1 of 3)

- Decimal (just for fun)

$$\begin{array}{r} 35 \\ \times 105 \\ \hline 175 \\ 000 \\ 35 \\ \hline 3675 \end{array}$$

Multiplication (2 of 3)

- Binary, two 1-bit values

A	B	A × B
0	0	0
0	1	0
1	0	0
1	1	1

Multiplication (3 of 3)

- Binary, two n -bit values
 - As with decimal values
 - E.g.,

$$\begin{array}{r} 1110 \\ \times 1011 \\ \hline 1110 \\ 1110 \\ 0000 \\ 1110 \\ \hline 10011010 \end{array}$$

Fractions

- Decimal to decimal (just for fun)

$$\begin{array}{r} 3.14 \Rightarrow \\ 4 \times 10^{-2} = 0.04 \\ 1 \times 10^{-1} = 0.1 \\ 3 \times 10^0 = 3 \\ \hline 3.14 \end{array}$$

Fractions

- Binary to decimal

$$\begin{array}{r} 10.1011 \Rightarrow \\ 1 \times 2^{-4} = 0.0625 \\ 1 \times 2^{-3} = 0.125 \\ 0 \times 2^{-2} = 0.0 \\ 1 \times 2^{-1} = 0.5 \\ 0 \times 2^0 = 0.0 \\ 1 \times 2^1 = 2.0 \\ \hline 2.6875 \end{array}$$

Fractions

- Decimal to binary

3.14579

11.001001...

.14579
 $\times \quad 2$
0.29158
 $\times \quad 2$
0.58316
 $\times \quad 2$
1.16632
 $\times \quad 2$
0.33264
 $\times \quad 2$
0.66528
 $\times \quad 2$
1.33056
etc.

Exercise – Convert ...

Decimal	Binary	Octal	Hexa-decimal
29.8			
	101.1101		
		3.07	
			C.82

Don't use a calculator!

Exercise – Convert ...

Answer

Decimal	Binary	Octal	Hexa-decimal
29.8	11101.110011...	35.63...	1D.CC...
5.8125	101.1101	5.64	5.D
3.109375	11.000111	3.07	3.1C
12.5078125	1100.10000010	14.404	C.82



The End

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Lecture No (5)

**ALGORITHMS AND
FLOWCHARTS**

Introduction to Computer Science

<http://www.RCSTSD.com>

ROYAL College of Science and Technology - 2017

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ALGORITHMS AND FLOWCHARTS

- A typical programming task can be divided into two phases:
- ***Problem solving phase***
 - produce an ordered sequence of steps that describe solution of problem
 - this sequence of steps is called an ***algorithm***
- ***Implementation phase***
 - implement the program in some programming language

Steps in Problem Solving

- First produce a general algorithm (one can use ***pseudocode***)
- Refine the algorithm successively to get step by step detailed ***algorithm*** that is very close to a computer language.
- ***Pseudocode*** is an artificial and informal language that helps programmers develop algorithms. Pseudocode is very similar to everyday English.

An **algorithm** must possess the following **properties**

(i) Finiteness : An algorithm must terminate in a finite number of steps.

(ii) Definiteness : Each step of the algorithm must be precisely and unambiguously stated.

(iii) Effectiveness : Each step must be effective, in the sense that it should be easily convertible into program statement.

(iv) Generality : The algorithm must be complete in itself so that it can be used to solve all problems of a specific type for any input data.

(v) Input / Output : Each algorithm must take zero, one or more inputs.

Pseudocode & Algorithm

- **Example 1:** Write an algorithm to determine a student's final grade and indicate whether it is passing or failing. The final grade is calculated as the average of four marks.

Pseudocode & Algorithm

Pseudocode:

- *Input a set of 4 marks*
- *Calculate their average by summing and dividing by 4*
- *if average is below 50*
 - Print "FAIL"*
 - else*
 - Print "PASS"*

Pseudocode & Algorithm

- Detailed Algorithm
- Step 1: Input M1,M2,M3,M4
- Step 2: $GRADE \leftarrow (M1+M2+M3+M4)/4$
- Step 3: if (GRADE < 50) then
 Print “FAIL”
 else
 Print “PASS”
 endif

The Flowchart






- A graphical representation of the sequence of operations in an information system or program. Information system flowcharts show how data flows from source documents through the computer to final distribution to users. Different symbols are used to draw each type of flowchart.

The Flowchart

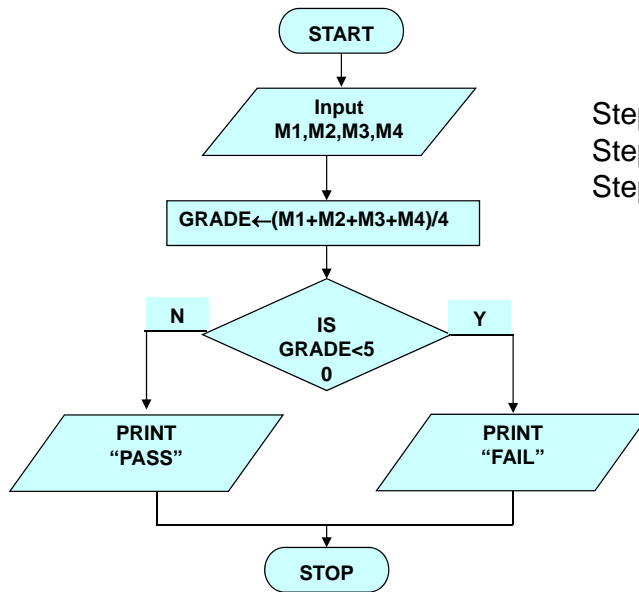
A Flowchart

- shows logic of an algorithm
- emphasizes individual steps and their interconnections
- e.g. control flow from one action to the next

Flowchart Symbols

Flow Chart Symbol	Meaning	Explanation
	Start and end	The symbol denoting the beginning and end of the flow chart.
	Step	This symbol shows that the user performs a task. (Note: In many flow charts steps and actions are interchangeable.)
	Decision	This symbol represents a point where a decision is made.
	Action	This symbol means that the user performs an action. (Note: In many flow charts steps and actions are interchangeable.)
	Flow line	A line that connects the various symbols in an ordered way.

Example



Step 1: Input M1, M2, M3, M4
Step 2: $GRADE \leftarrow (M1 + M2 + M3 + M4) / 4$
Step 3: if (GRADE < 50) then
 Print "FAIL"
 else
 Print "PASS"
 endif

Example 2

- Write an algorithm and draw a flowchart to convert the length in feet to centimeter.

Pseudocode:

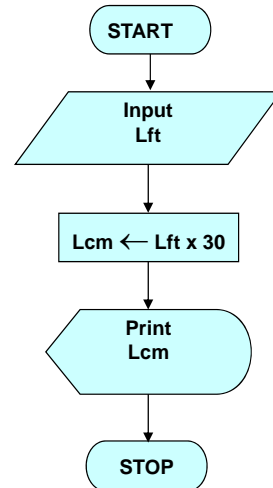
- *Input the length in feet (Lft)*
- *Calculate the length in cm (Lcm) by multiplying LFT with 30*
- *Print length in cm (LCM)*

Example 2

Algorithm

- Step 1: Input Lft
- Step 2: $Lcm \leftarrow Lft \times 30$
- Step 3: Print Lcm

Flowchart



Example 3

Write an algorithm and draw a flowchart that will read the two sides of a rectangle and calculate its area.

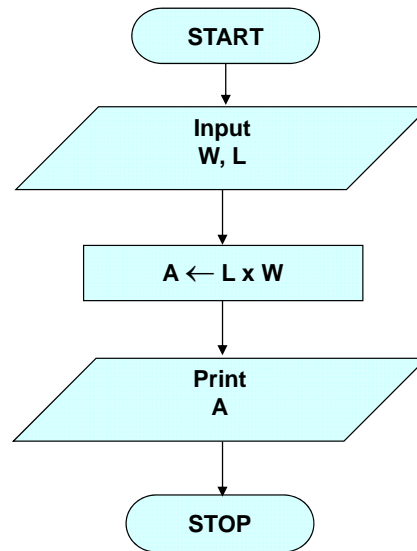
Pseudocode

- *Input the width (W) and Length (L) of a rectangle*
- *Calculate the area (A) by multiplying L with W*
- *Print A*

Example 3

Algorithm

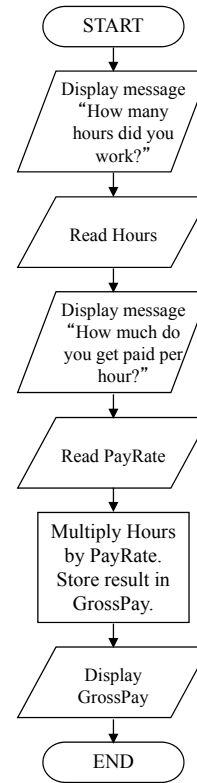
- Step 1: Input W,L
- Step 2: $A \leftarrow L \times W$
- Step 3: Print A



Introduction to Flowcharting

What is a Flowchart?

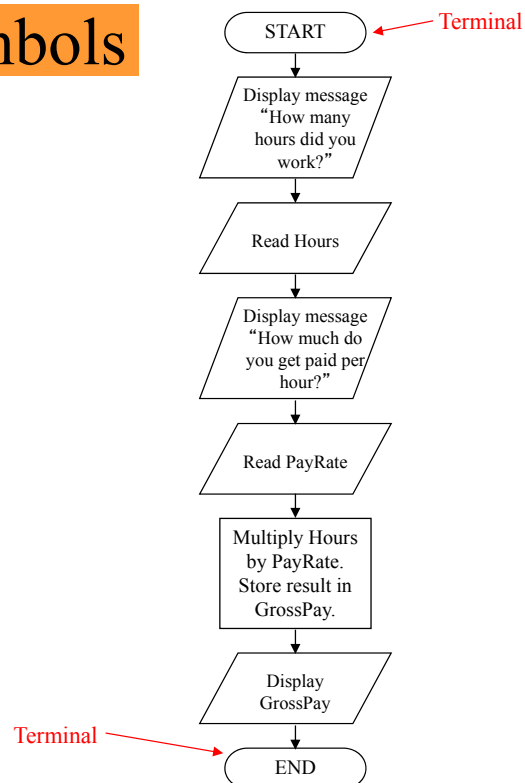
- A flowchart is a diagram that depicts the “flow” of a program.
- The figure shown here is a flowchart for the pay-calculating program shown in Program 1-1.



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Basic Flowchart Symbols

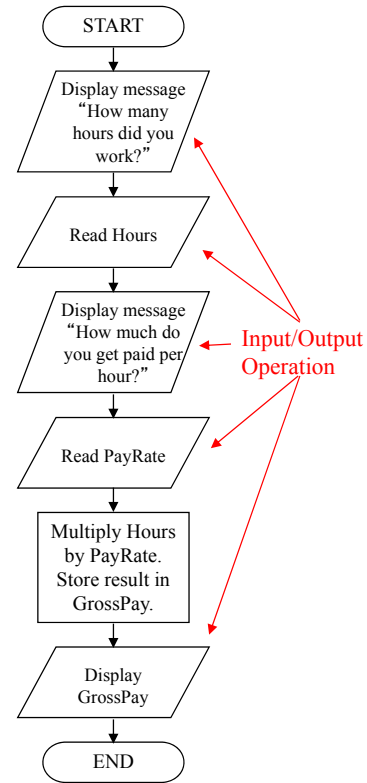
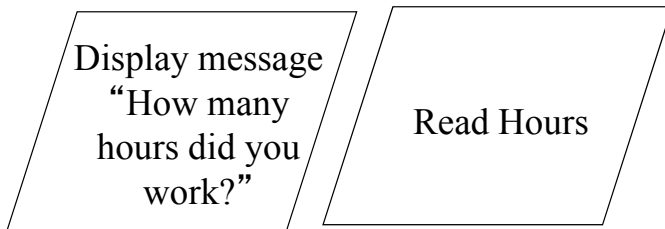
- Terminals
 - represented by rounded rectangles
 - indicate a starting or ending point



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Basic Flowchart Symbols

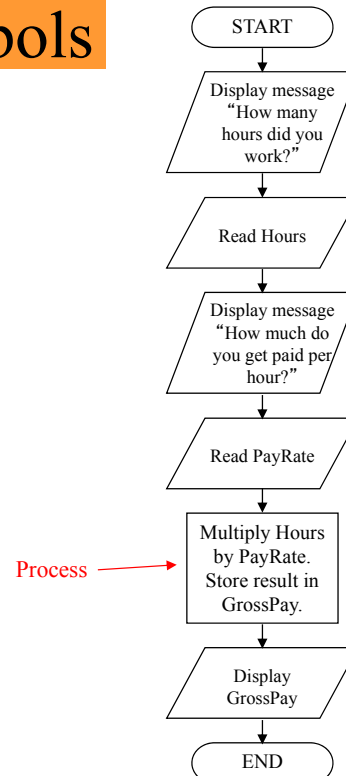
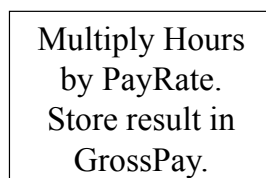
- Input/Output Operations
 - represented by parallelograms
 - indicate an input or output operation



Introduction to Computer Science

Basic Flowchart Symbols

- Processes
 - represented by rectangles
 - indicates a process such as a mathematical computation or variable assignment



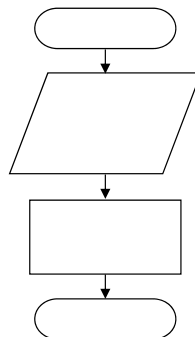
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Four Flowchart Structures

- Sequence
- Decision
- Repetition
- Case

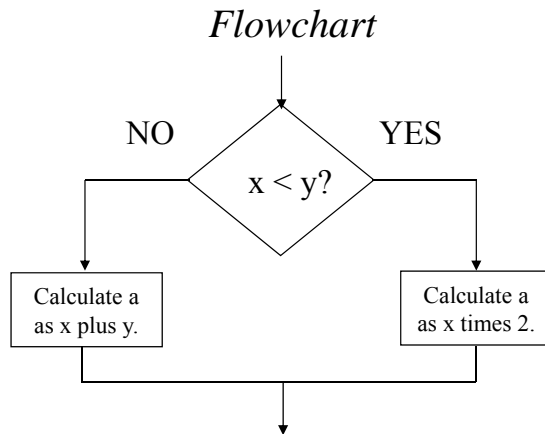
Sequence Structure

- A series of actions are performed in sequence
- The pay-calculating example was a sequence flowchart.



Decision Structure

- The flowchart segment below shows how a decision structure is expressed in C++ as an if/else statement.



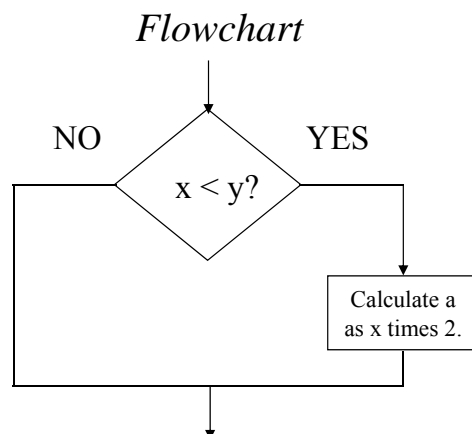
C++ Code

```
if (x < y)
    a = x * 2;
else
    a = x + y;
```

Introduction to Computer Science

Decision Structure

- The flowchart segment below shows a decision structure with only one action to perform. It is expressed as an if statement in C++ code.



C++ Code

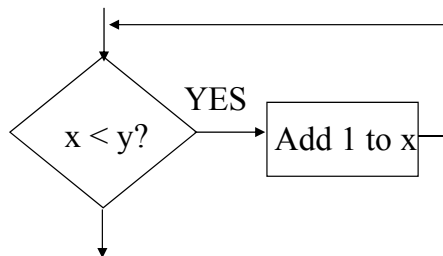
```
if (x < y)
    a = x * 2;
```

Introduction to Computer Science

Repetition Structure

- The flowchart segment below shows a repetition structure expressed in C++ as a while loop.

Flowchart



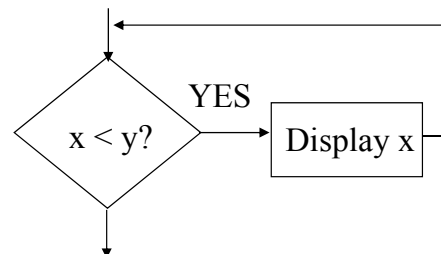
C++ Code

```
while (x < y)
    x++;
```

Introduction to Computer Science

Controlling a Repetition Structure

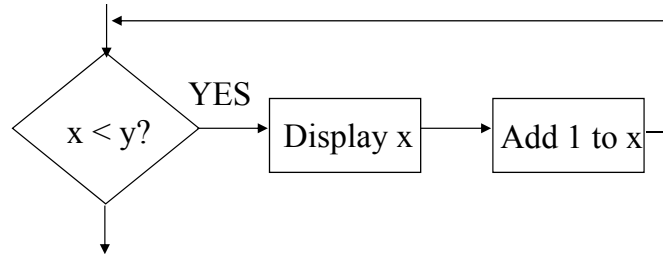
- The action performed by a repetition structure must eventually cause the loop to terminate. Otherwise, an infinite loop is created.
- In this flowchart segment, x is never changed. Once the loop starts, it will never end.
- QUESTION: How can this flowchart be modified so it is no longer an infinite loop?



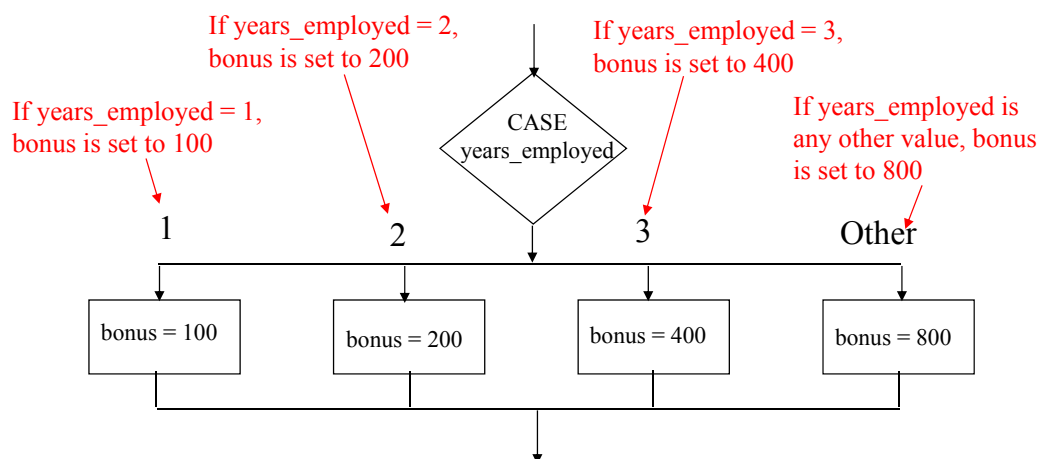
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Controlling a Repetition Structure

- ANSWER: By adding an action within the repetition that changes the value of x .

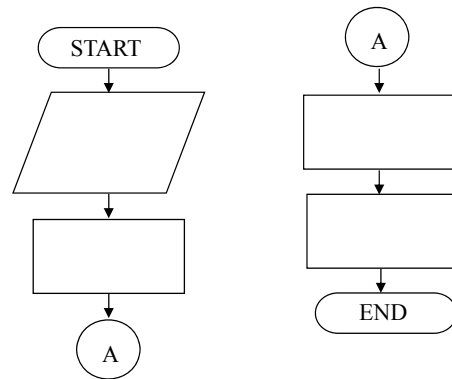


Case Structure



Connectors

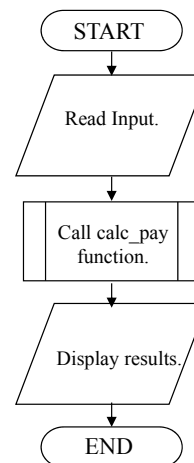
- The “A” connector indicates that the second flowchart segment begins where the first segment ends.



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Modules

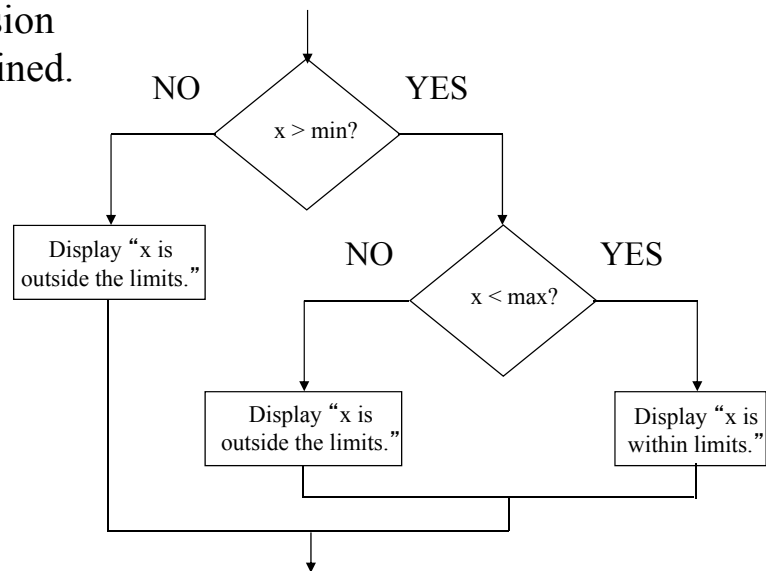
- The position of the module symbol indicates the point the module is executed.
- A separate flowchart can be constructed for the module.



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Combining Structures

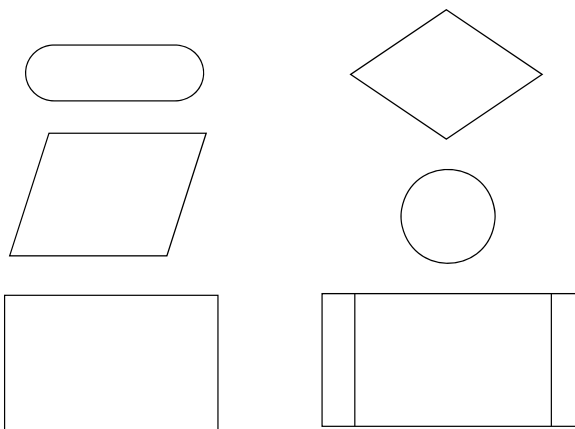
- This flowchart segment shows two decision structures combined.



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Review

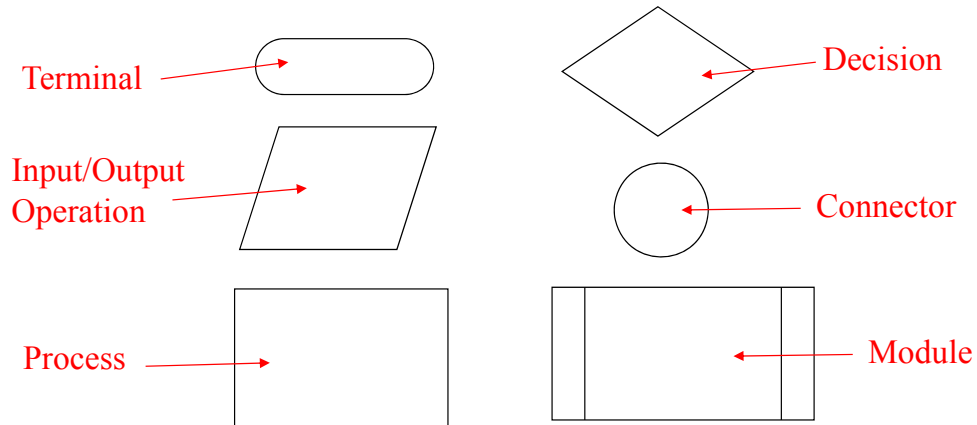
- What do each of the following symbols represent?



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Answer

- What do each of the following symbols represent?



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Review

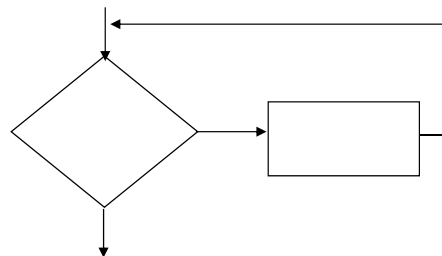
- Name the four flowchart structures.

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Answer

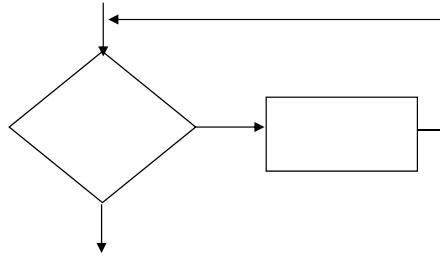
- Sequence
- Decision
- Repetition
- Case

Review



Answer

- Repetition

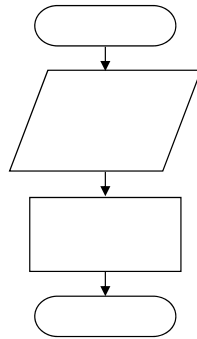


Review



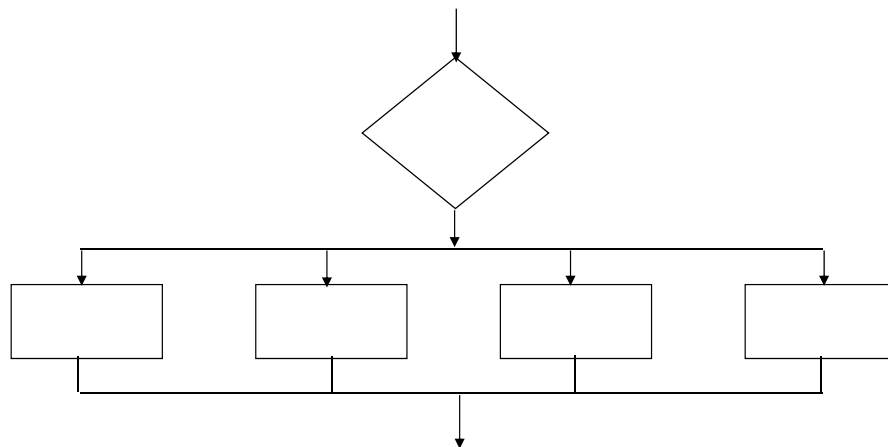
Answer

- Sequence



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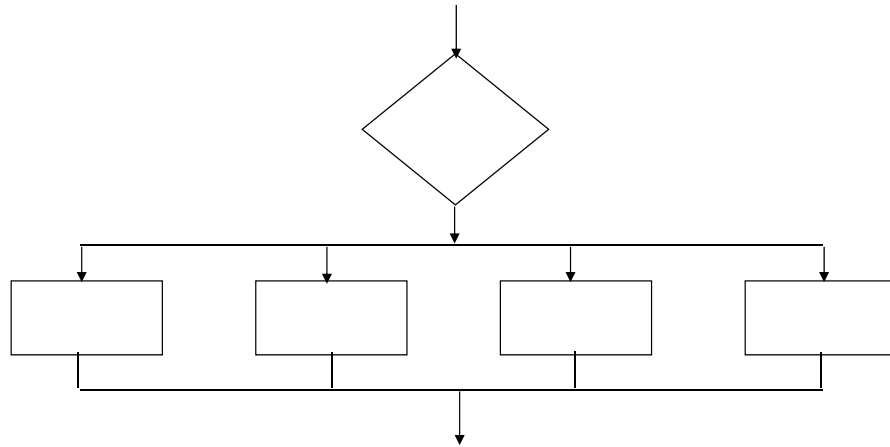
Review



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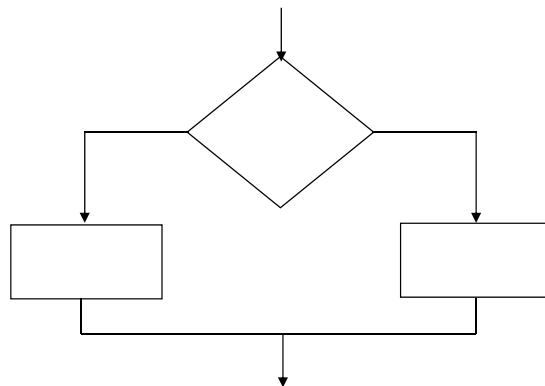
Answer

- Case



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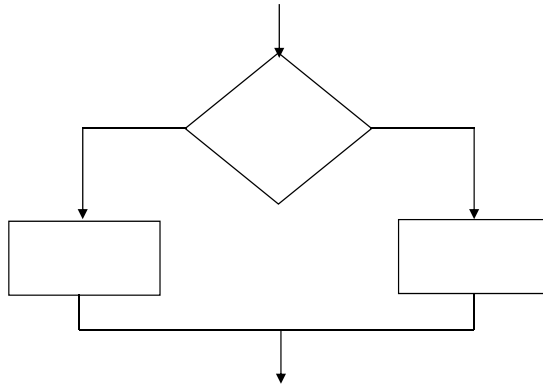
Review








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Answer

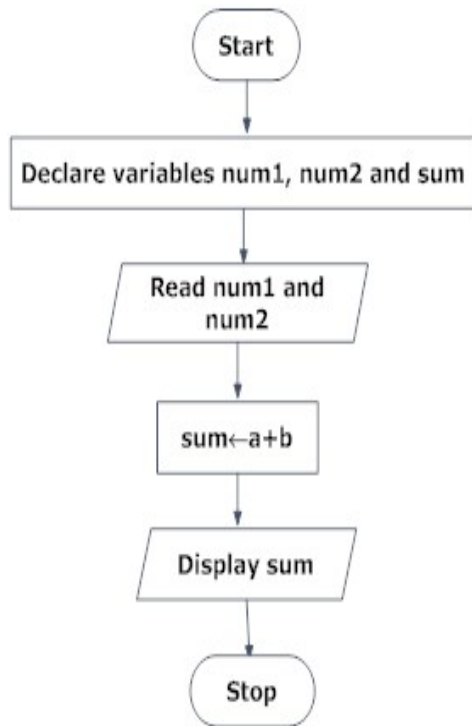
- Decision



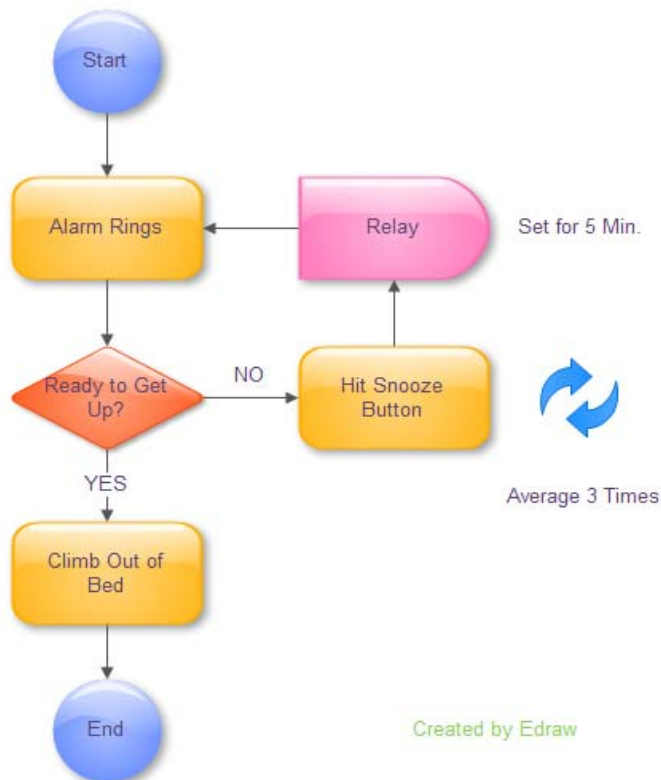
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Symbol	Name	Function
	Start/end	An oval represents a start or end point.
	Arrows	A line is a connector that shows relationships between the representative shapes.
	Input/Output	A parallelogram represents input or output.
	Process	A rectangle represents a process.
	Decision	A diamond indicates a decision.

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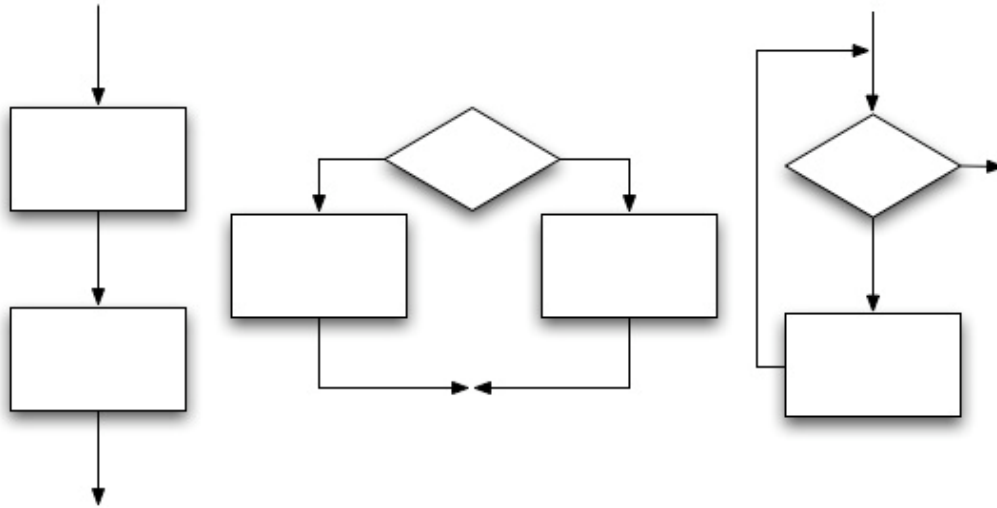


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Examples ???



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Lecture No (6)

LAN Standards, Physical Connectivity, and Media Access

LAN Standards

Standards are required so that different manufacturers can create equipment that will interoperate without special configuration.

Standards groups include:

ISO. International Organization for Standardization establishes standards for networking operation.

ANSI. American National Standards Institute is the US representative to ISO.

EIA/TIA. Electronics Industries Alliance/Telecommunications Industry Association is an industry based standards group.

IEEE. Institute of Electrical and Electronics Engineers is an international professional organization that sets communications standards. IEEE Project 802 sets standards for cabling and data transmission on local area networks.

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Physical Connectivity

Network Interface Card (NIC). Also known as Network Card or Ethernet Adapter. Transmits and receives signals to the LAN. Computers can not communicate on LAN without this device.

Each Network Card has a Media Access Control (**MAC**) address. This is also known as the **physical address** or **Ethernet address**.

MAC address is a unique 12 digit hexadecimal number that is hard coded into each network interface. The first half of a MAC address is the manufacturer's ID. The second half a serial number.

00-04-AC-F3-1C-D4

Manufacturer ID

Serial number

Introduction to Computer Science

Cable and Wireless

Physical cabling is also known as **bounded media**.

Transmissions are bound to the physical media.
To communicate, hosts *must* be physically connected to that media.

Physical cabling is usually located in a building's **plenum**.

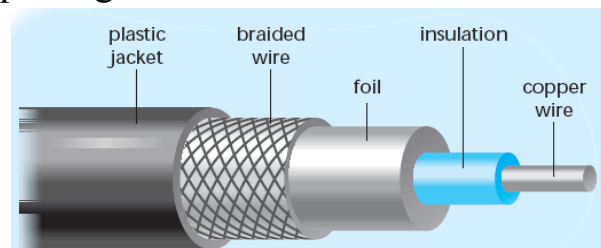
Wireless network is known as **unbounded media**.

Transmissions are not bound to a physical cable.
To communicate, hosts *do not need* to be physically connected.

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Coaxial Cable

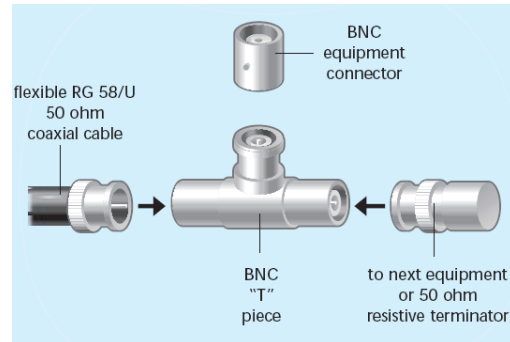
- Coaxial cable is often used in older LANs.
- Known as **RG58**, **Thinnet**, and **10Base2**.
- Maximum bandwidth of 10 Mbps.
- Maximum segment length of 185 meters (605 feet).
- Maximum of 30 hosts per segment.



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Coaxial Cable

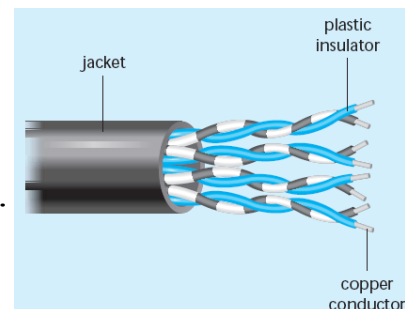
- Hosts on an RG58 network require a network card with an RG58 adapter.
- To add the host to the network, the cable section must have an RG58 connector on both ends with a “T” piece fitted between them.
- Both ends of the segment should be terminated using a piece of equipment known as a **terminator**.
- A terminator stops signals on the network echoing back when they reach the end of the **segment**.



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Twisted Pair Cable

- The most common cabling technology in use today.
- Consists of **four pairs** of copper wires **twisted** around each other. Twists are used because they reduce interference.
- Maximum length: 100 meters (328 feet).
- Maximum bandwidth: 1000 Mbps.



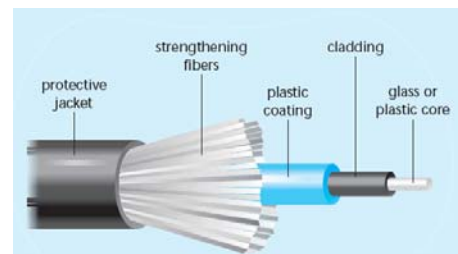
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Twisted Pair Cable

- Connect to networking devices such as network interface cards and switches using **RJ45** connectors.
- One end must connect to a host, the other to a networking device such as a switch. You can only connect two computers together if you use a **crossover cable**, which uses different wiring.

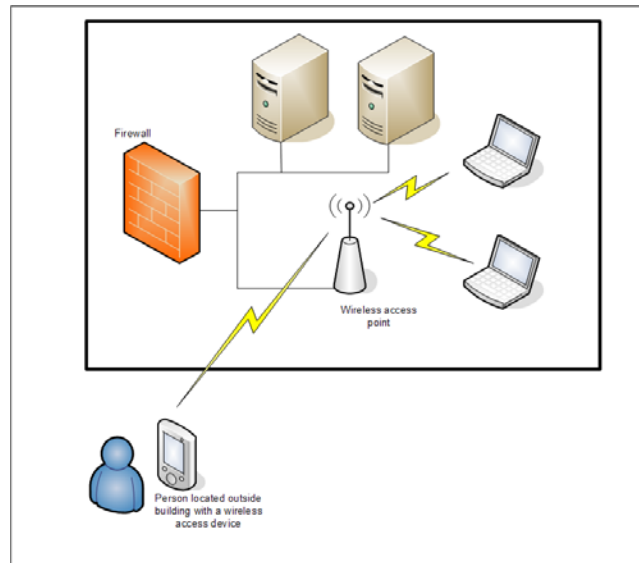
Fiber Optic Cable

- Fiber optic cable has better data security than twisted pair or RG58. You can't intercept the signals without breaking the cable.
- Fiber optic cable is **immune to electromagnetic interference**, something that can cause problems for twisted pair or RG58.
- The disadvantages of fiber optic cable is that it is **very expensive** and that it is **not very flexible**. Bend it too far and it will break the core, rendering the cable useless.
- Fiber optic cable is mostly use as a **backbone** to connect LANs together, rather than connecting hosts together on a LAN.



Wireless

- Wireless networks **do not require** physical infrastructure like cables.
- Wireless networks have **short range**.
- Wireless networks have **limited bandwidth**.
- Transmissions can be **intercepted easily** by a person outside building with a wireless access device.



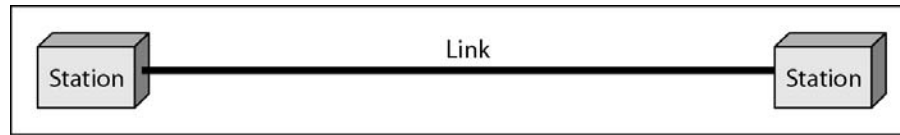
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How to classify networks?

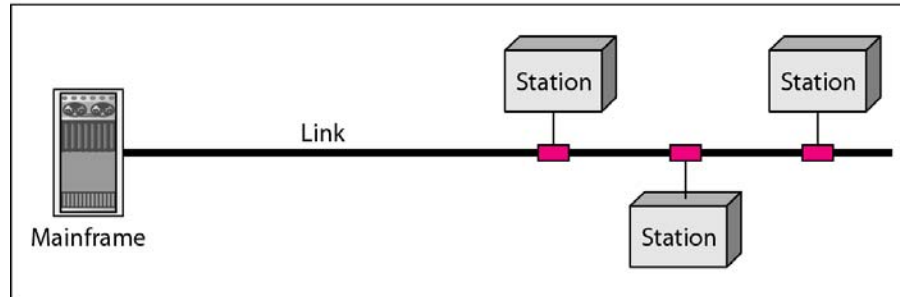
- By Scale
 - Personal area network (PAN)
 - Local Area Network (LAN)
 - Campus Area Network (CAN)
 - Metropolitan area network (MAN)
 - Wide area network (WAN)
- By Connection Method
 - Optical fiber
 - Ethernet
 - Wireless LAN
 - HomePNA
 - Power line communication
- By Network Topology
 - Bus network
 - Star network
 - Ring network
 - Mesh network

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Type of Connections



a. Point-to-point



b. Multipoint

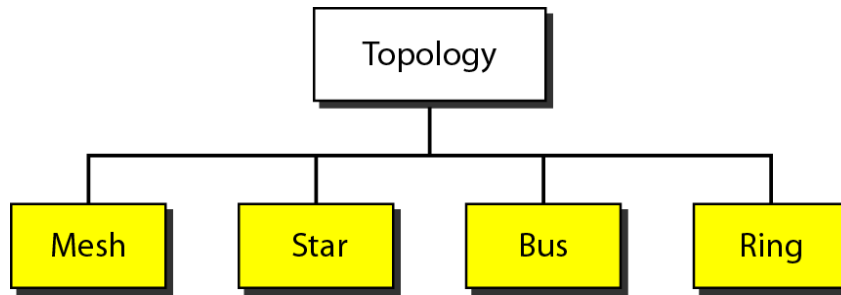
Types of connections: point-to-point and multipoint

LAN Topologies

Physical topology is the actual location and arrangement of physical connections between devices on the network.

Logical topology is the path that a given datagram travels between two devices. Often there is more than one way to get from one host to another.

Physical topology

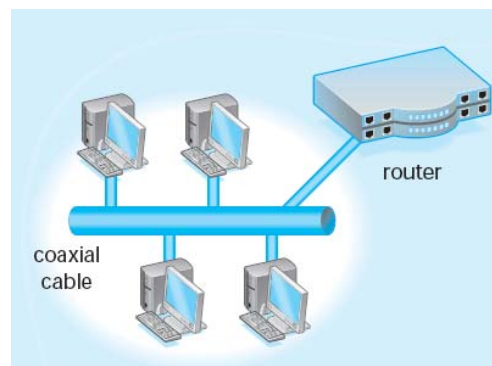


Categories of physical topology

physical topology: design or layout of the network

Bus Topology

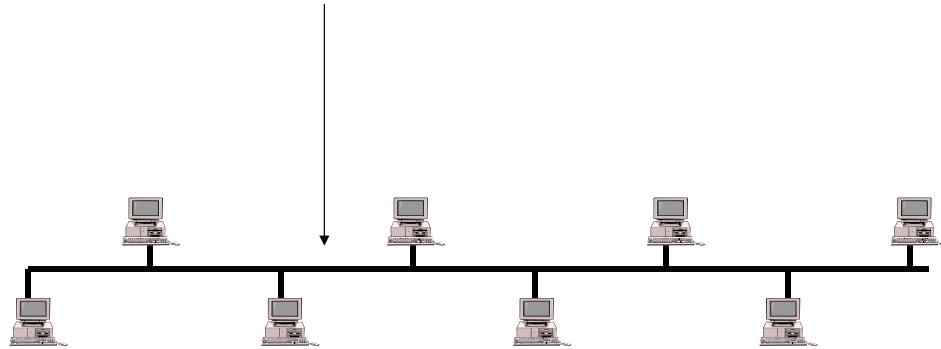
- All network devices connected to a common cable in logical linear fashion.
- Transmissions are sent along the length of the bus segment.



- Adding hosts to the network requires **breaking** the network.
- Failure of **one** host can cause **failure** of network.

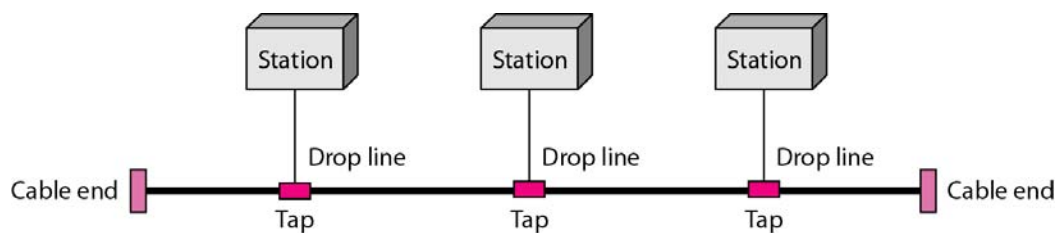
Bus Topology

- Each node is connected one after the other (like christmas lights)
- Nodes communicate with each other along the same path called the *backbone*



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Bus Topology



Multipoint

Advantages:

- Easy to install
- Less cables

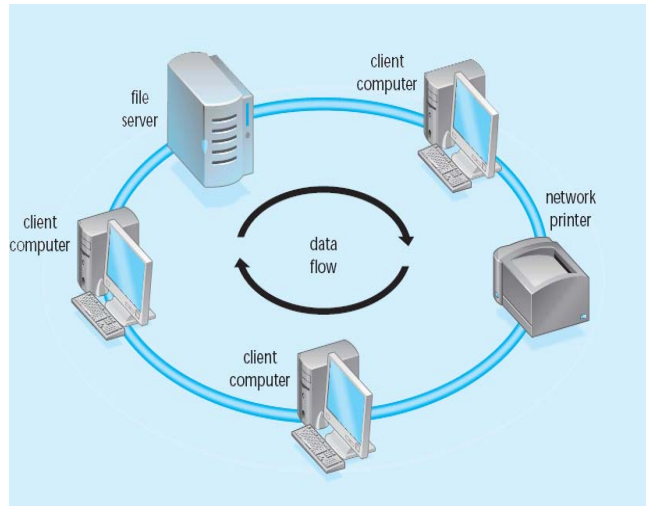
Disadvantages:

- Hard to detect fault isolation.
- Bus cable is too important

A bus topology connecting three stations

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Ring Topology

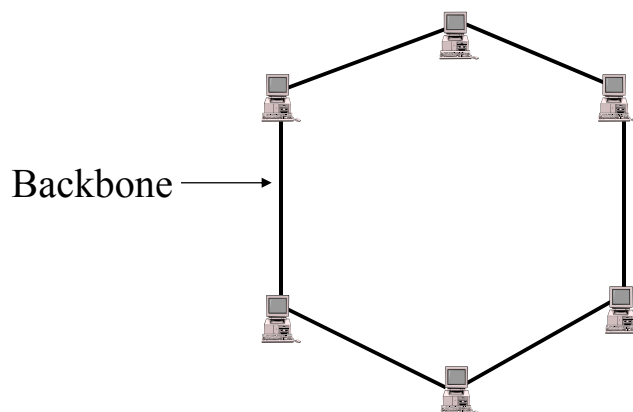


- Network is connected in an endless loop.
- No termination required.
- Uncommon topology today, more common in 1980s.

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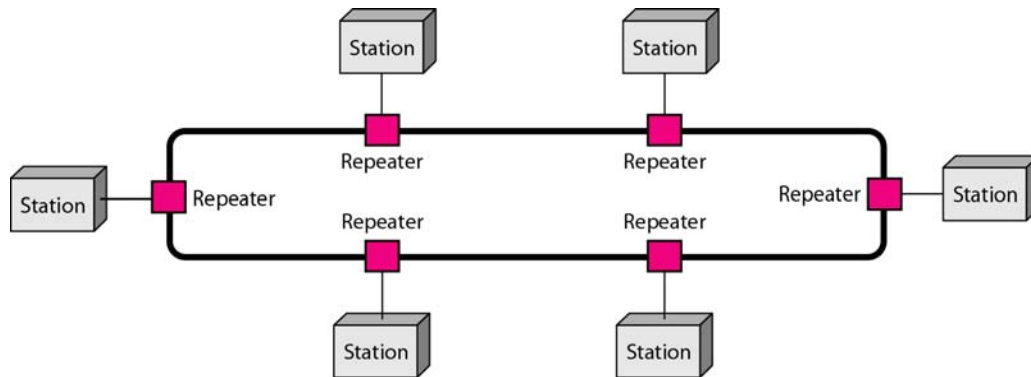
Ring Topology

- The ring network is like a bus network, but the “end” of the network is connected to the first node
- Nodes in the network use tokens to communicate with each other



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Ring Topology



A ring topology connecting six stations

Point to point with 2 devices on both sides

Advantages:

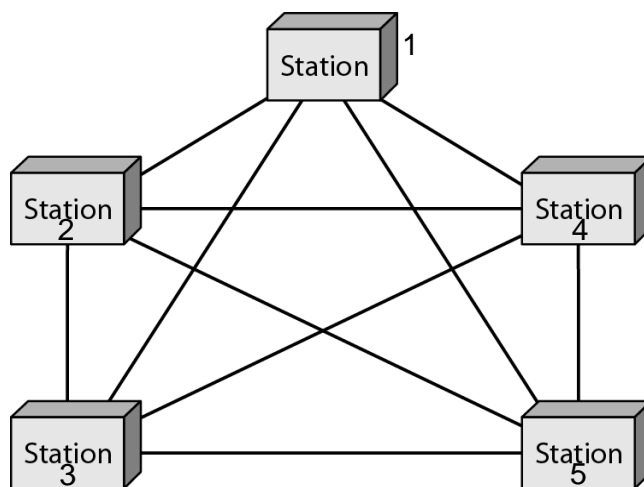
- Easy to install
- Maintain: add move delete
- Fault isolation

Disadvantages:

- Unidirectional traffic

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Mesh Topology



A fully connected mesh topology (five devices)

Example: telephone regional offices

Advantages:

- no traffic problems
- Robust. No link failure no effect on others.
- Privacy security
- Easy to detect the abnormal situation.

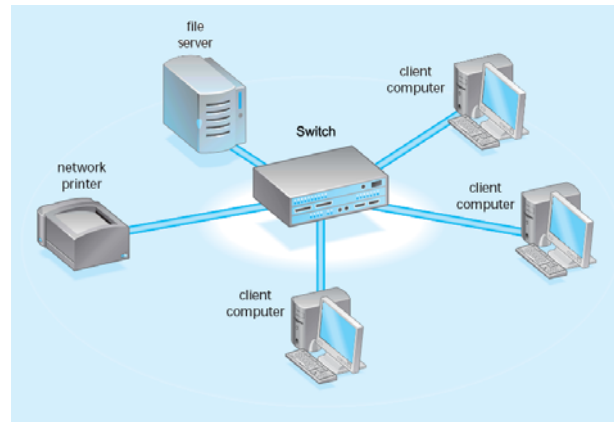
Disadvantages:

- Amount of cables, i/o ports
- Efficiency and effectiveness
- Space
- Cost

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Star Topology

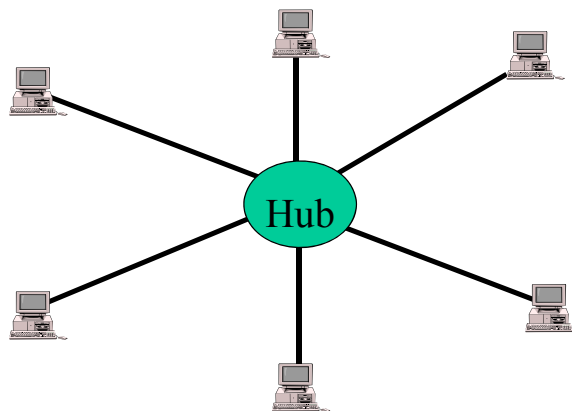
- Connection from each device to a central location, usually a switch.
- Most commonly used physical topology.
- Failure of one cable does not bring down network.



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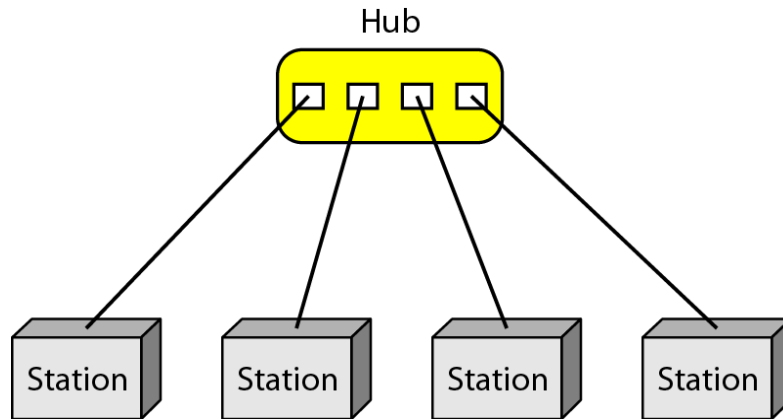
Star Topology

- Each node is connected to a device in the center of the network called a *hub*
- The hub simply passes the signal arriving from any node to the other nodes in the network
- The hub does not route the data



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Star Topology



A star topology connecting four stations

Less expensive. One link and I/O port connecting to the hub. No direct traffic between two devices.

Advantages:

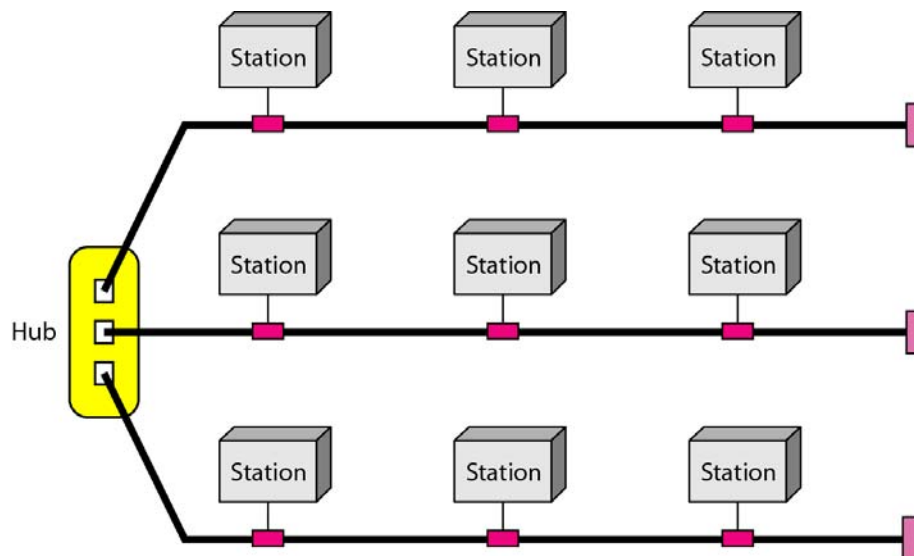
- Easy to install
- Less cables
- Maintain: add, move, delete
- Robustness

Disadvantages:

- Hub is too important
- The hub represents a single source of failure

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Hybrid Topology



A hybrid topology: a star backbone with three bus networks

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Access Control Methods

- Two primary access control methods exist for computers to communicate with each other over the network
 - Token based access
 - Carrier Sense Multiple Access with Collision Detection (CSMA/CD)

Token based access

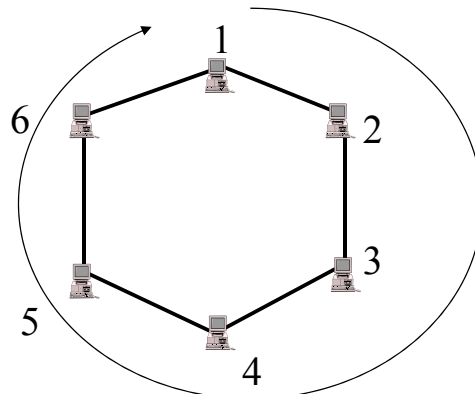
- Used in bus and ring network topologies (token ring)
- Each computer in the network can only send its data if it has the *token*. This prevents collisions that occur when data is sent at the same time over the network
- The token is a special pattern of bits/bit in a frame that is directly detectible by each node in the network
- A computer may only transmit information if it is in possession of the token
- The message is sent to all other computers in the network

Types of LAN's

- The three most popular types of LAN's are:
 - Token ring
 - Ethernet
 - FDDI (Fiber Distributed Data Interface)

Operation of token ring

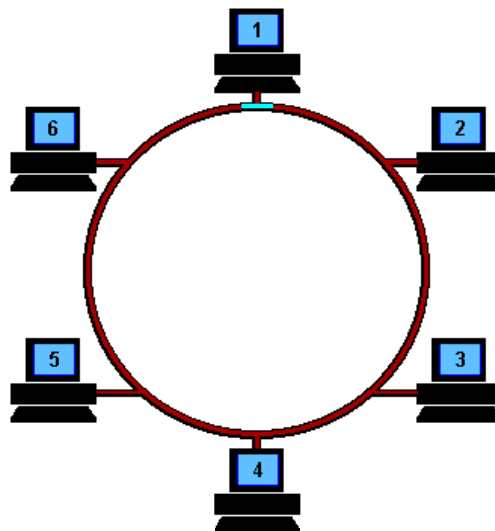
- As an example, suppose node # 1 wants to send information to node # 4 over the network
- Initially, an empty frame (network packet) circulates in the network



- When node # 1 receives the empty frame, it inserts a token in the token bit part of the frame. This operation may just be an insertion of a “1” bit
- The node then inserts the message it wants to send as well as the address of the receiving node in the frame
- The frame is then successively received and examined by each node in the network. First it is sent to node #2. Node #2 examines the frame and compares the address in the frame to its own address. Since addresses do not match, it passes the frame onto node #3, which does the same thing
- When the frame is received by node #4, the address of the node matches the destination address within the frame. The node copies the message and changes the token bit in the frame to “0”
- The frame is then sent over to node #5. This node also compares addresses and sends it to node #6 which does the same procedure
- When node #1 receives the frame, it examines the token bit and recognizes that it has been changed to “0”. Node #1 then concludes that the message has been received by the intended node: node #4. Node #1 then empties the frame and releases the empty frame back into the network for circulation

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Let's see an animation of the token ring



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CSMA/CD

- Usually used in a bus topology
- Used in *Ethernet* LAN's
- Unlike the token ring, all nodes can send whenever they have data to transmit
- When a node wants to transmit information, it first “listens” to the network. If no one is transmitting over the network, the node begins transmission
- It is however possible for two nodes to transmit simultaneously thinking that the network is clear
- When two nodes transmit at the same time, a *collision* occurs
- The first station to detect the collision sends a jam signal into the network
- Both nodes back off, wait for a random period of time and then re-transmit

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<http://www.RCSTSD.com>

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CSMA/CD

Stands for Carrier Sense Multiple Access with Collision Detection.

- Each device listens to media for transmissions. When media is clear, initiates transmission and listens for collision.
- If collision occurs, device waits for random amount of time before attempting transmission again.
- Commonly used on physical networks.

Begin Transmission

0011010001010001001000111001
0011010001010001001000111001



Begin Transmission
Wait for network
Wait random amount
silence
of time

COLLISION!



0011010001010001001000111001

Wait random amount
Begin Transmission
of time
Wait for network
silence

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Ethernet

- First network to provide CSMA/CD
- Developed in 1976 by Xerox PARC (Palo Alto Research Center) in cooperation with DEC and Intel
- Is a fast and reliable network solution
- One of the most widely implemented LAN standards
- Can provide speeds in the range of 10Mbps- 10 Gbps
- Used with a bus or star topology

Ethernet data packet - datagram drawn on board.

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Types of Ethernet LANs

- 10Base-T
 - Operates at 10 Mbps
 - IEEE 802.3 standard
- Fast Ethernet (100Base-T)
 - Operates at 100 Mbps
- Gigabit Ethernet
 - Operates at 1 Gbps
 - Uses fiber optic cable
- 10 Gbps Ethernet
 - Latest development of ethernet
 - Uses fiber optic cable
 - Developed to meet the increasing bandwidth needs of the LAN market
- Wireless Ethernet
 - IEEE 802.11 standard
 - Operates at around 2.4 Gbps

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Fiber-Distributed Data Interface (FDDI)

- Fiber-Distributed Data Interface (FDDI) provides a standard for data transmission in a local area network that can extend in range up to 200 kilometers (124 miles).
- The FDDI protocol uses as its basis the token ring protocol.
- In addition to covering large geographical areas, FDDI local area networks can support thousands of users.
- As a standard underlying medium it uses optical fiber (though it can use copper cable, in which case one can refer to CDDI).
- FDDI uses a dual-attached, counter-rotating token-ring topology.

Fiber-Distributed Data Interface (FDDI)

- An FDDI network contains two token rings, one for possible backup in case the primary ring fails.
- FDDI has a larger maximum-frame size than standard 100 Mbit/s ethernet, allowing better throughput.
- A small number of devices (typically infrastructure devices such as routers and concentrators rather than host computers) connect to both rings - hence the term "dual-attached".
- Host computers then connect as single-attached devices to the routers or concentrators.

Summary

- Standards are set by industry, professional and government organizations to ensure that devices can interoperate.
- NICs have MAC addresses and are needed to communicate with other devices on the LAN.
- RG58 cable has a maximum bandwidth of 10 Mbps and is found in older LANs.
- Twisted pair is commonly used today and connects using an RG58 connector.
- Star Topologies are most commonly used today. A switch often sits at the center of a star topology.
- CSMA/CD transmits and then listens to see if there was a collision. CSMA/CA sends an intent to transmit message.

Introduction to Computer Science

Required Reading

- **W. Stallings, “Data and Computer Communications (8th edition),” Prentice-Hall, 2007.**

>> **Chapter 15 –**

Local Area Network Overview

Introduction to Computer Science

Discussion Questions

- ❖ What is the difference between a physical and a logical network?
- ❖ What is the difference between a bus and a star topology?
- ❖ Which media access method sends an intent to transmit signal?
- ❖ What is a MAC address?

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Lecture No (8)

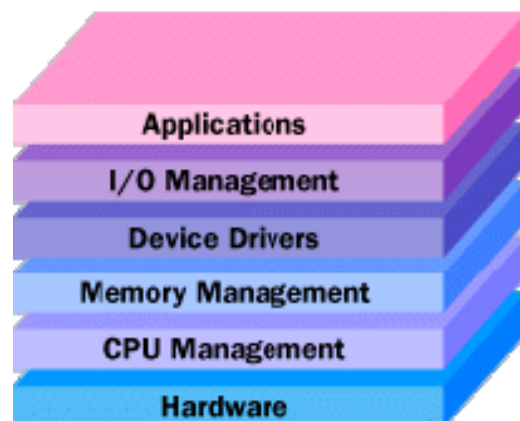
Operating System and Computer Security

Software

- Operating Systems
 - Run wide variety of tasks
 - Run when computer is started
 - Only one OS operates at a time
- Applications
 - Run specified tasks
 - Only run when initiated
 - Can run multiple applications at a time

What does Operating System do

- Manages all the resource in a computer (including processor, memory, i/o devices)
- Provides an interface between the hardware and application software.



Mostly used OS

- Desktop
 - Windows
 - Mac OS
 - Unix/Linux and their siblings.
- PDA
 - Palm
 - Pocket PC
 - Embedded Linux OS

Macintosh Operating System

- **Evolved** from 1984's original MacOS
- 1984 Mac was first commercial computer with Graphical User Interface (GUI) and mouse
- Currently MacOS 9, MacOS X
- Inventor of trash can, alias (shortcut), pull-down menus, etc.

Evolution is progressive change or improvement

Mac OS Details

- Control Strip
- Alias (same as shortcut)
- Single-button Mouse (can be customized)
- Sherlock 2 (global search utility, copied in Windows 2000 and Windows ME)
- Easy to use, hard to troubleshoot

Windows OS

- Windows is built on top of MS-DOS, the MicroSoft-Disk-Operating-System, based QDOS.
- Windows 1.0 very delayed, very poor quality
- Windows 3.1 (c. 1992) first usable version, still very limited in comparison to MacOS 6
- Windows 95 revolutionary for Intel based computers, but, just a copy of Mac OS

Revolution is non-progressive change, major drastic change

Windows 95

- Stole Recycle Bin, Shortcuts, and Menu System from Macintosh OS
- Excellent user-friendliness for operations
 - Like MacOS, suffers from un-friendliness for troubleshooting
- Excellent multi-tasking capabilities (run multiple programs)-uses virtual memory



Multi-tasking

- The ability to run several programs at the same time.
- CPU can only run one program at a time. OS will switch programs for it. Since the switching is so fast, it looks like running multiple programs at the same time.
- Two multi-task mechanism
 - Cooperative multi-tasking (program voluntarily release CPU)
 - Preemptive multi-tasking.(OS deprives the CPU control when time is up)

Windows History

- Windows 95 for home machines, stable, simple
- Windows NT 4.0 for business/office computers

- Windows 98 replaces 95, very unstable, just a facelift
 - W98 Release 2 much better, still sucked
- Windows 2000 replaces Win NT 4.0
 - Incredibly stable, not very backwards compatible
- Windows ME (Millennium Edition) replaced W98 (fall 2000)
 - Almost no new features
 - Seems a little more stable than W98
 - Faster Startup

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Windows XP

- Released 2002
- Home version and business version based on same OS
 - Previously, Win NT & 95 different, 2000 and ME different
- More stable than Win 98/ME, not as stable as W2000

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Linux and Unix

- Unix was the first usable OS and still widely used today. It runs on special computers, e.g. Sun, Silicon Graphics, HP, DEC
- Linux was a miracle, initialized by Linus Torvalds and maintained by programmers all over the world.
- Both are based on a stable command line OS
 - By comparison, Windows based on unstable command line OS, MS-DOS
- Both Linux and Unix use an X-Windows GUI



Ranking the Operating Systems

Stability

- Unix
- Linux
- Mac OS X
- Windows 2000
- Windows XP Pro
- Windows XP Home
- Mac OS 9
- DOS
- Windows 95
- Windows 98
- Windows ME

Ease of Use

- Mac OS 9
- Windows ME/98/95
- Mac OS X
- Windows 2000/NT
- Linux
- Unix
- **DOS!**

Operating System Types

- Multiuser – Two or more users work with the computer at the same time
- Multitasking – Two or more processes running at the same time.
- Multithreading – Two or more parts of the same process running at the same time.

Future of Operating Systems

- Microsoft must address stability problems in home computers – Windows XP was a small step
- Linux becomes more popular, but only for advanced users and in server market.
- Macintosh's market penetration more based on hardware appeal rather than software
 - In old days, Macs succeeded because they were the only GUI on the block. People bought Macs for the software
 - Windows is such a good copy that hardware, reliability, and price is now a big reason for the purchase of a Macintosh

Computer security challenges

- Virus
- Email Virus
- Worm
- Trojan Horse
- Spam

Virus

- Viruses are fragments of computer code that can piggyback on the normal programs
 - When normal program is infected by virus, virus will run first every time you start the program.
- Viruses can duplicate themselves and infect other programs.
- Original virus are less and less popular now.
 - People don't copy files from others, but would rather download from the original source.
 - Anti-virus software is widely used.



Email virus

- An e-mail virus moves around in e-mail messages, and usually replicates itself by automatically mailing itself to dozens of people in the victim's e-mail address book.
- Two kinds
 - Executable attachment (.exe .vbs .com .bat files).
 - Macro language viruses.

Fact about email virus

- **BOTTOM LINE :There is **NO** such thing as an E-mail text virus!**
- You can not get a virus or any system damaging software by reading an e-mail*. E-mails (that is, the ACTUAL message can not contain viruses)
- Email viruses always resides in the attachment. So don't run any suspect attachment files.

Worm

- A worm is a **computer program** that has the ability to copy itself from machine to machine by taking advantage of the security hole in the system.
- Security holes are bugs in the OS.
- This is the most serious threat now
 - Your Computer can be infected by just plugging in the internet.
 - MSblast and SoBig are the recent worms that damage hundreds of thousand computers.

Trojan Horse (back door)

- A Trojan horse is simply a computer program. The program claims to do one thing (it may claim to be a game) but instead does damage when you run it (it may erase your hard disk).
- Trojan horse usually does replicate itself.



Suggestions to secure your computer

- Use anti-virus software.
- Update your computer regularly.
- Be careful with the email attachments
 - Safe: .jpg .bmp .pdf .txt
 - Unsafe: .exe .doc .xls .ppt ...
- Avoid email software by Microsoft (outlook, outlook express...). They are mostly targeted.
- Use firewall or router to protect you from worm attack.

Spam (junk mail)

- Spamming is business
 - Most effective way to stop it is legislation. Most states passed law to restrict it, but none fully banned it.
- How spammers get your mail.
 - Web search
 - Sending test emails
 - Exchange or buy from other spammers
- A case study: How an HTML email can reveal your identity.

Suggestions to fight spam

- Never reply junk emails
- Moreover, never even open them.
- Don't post your actual email address in the website.
 - Sparty_at_msu.edu
 - Sparty@NOSPAMMINGmsu.edu
 - Use a picture of your email address.
- When send group emails, put all the recipients in the BCC field to protect other people.

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Lecture No (9)

Introduction to Cybercrime

Introduction to Cybercrime and Security

What is Cybercrime?

- Using the Internet to commit a crime.
 - Identity Theft
 - Hacking
 - Viruses
- Facilitation of traditional criminal activity
 - Stalking
 - Stealing information
 - Child Pornography

Cybercrime Components

- Computers



- Cell Phones



- PDA's



- Game Consoles



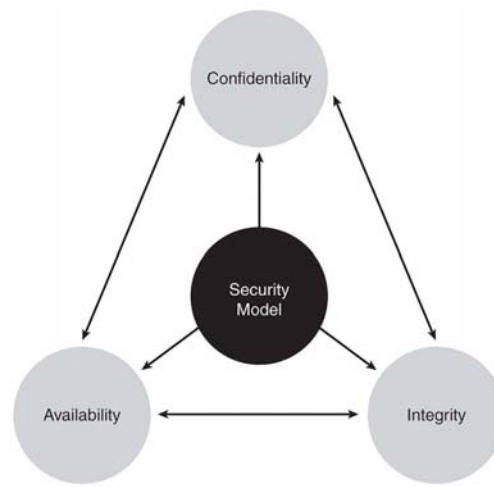
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Computer Security

- Confidentiality
 - Only those authorized to view information
- Integrity
 - Information is correct and hasn't been altered by unauthorized users or software
- Availability
 - Data is accessible to authorized users

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Computer Security



CIA Triangle

Introduction to Computer Science

Computer Security - Threats



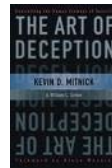
- Malware
 - Software that has a malicious purpose
 - Viruses
 - Trojan horse
 - Spyware

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Computer Security - Threats



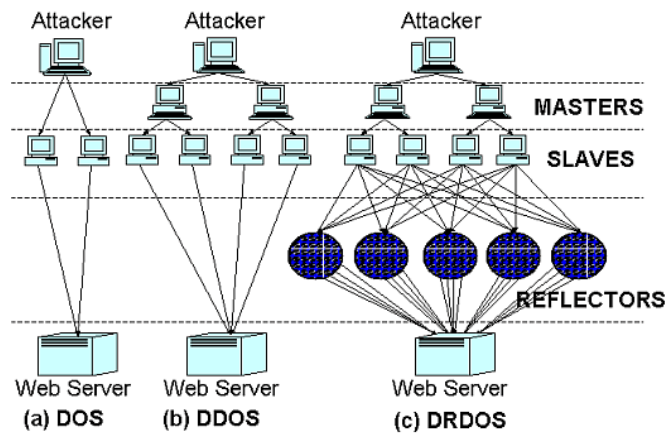
- Intrusions
 - Any attempt to gain unauthorized access to a system
 - Cracking
 - Hacking
 - Social Engineering
 - War-driving



Computer Security - Threats

- Denial-of-Service (DOS)
 - Prevention of legitimate access to systems
 - Also Distributed-Denial-of-Service (DDoS)
 - Different types:
 - Ping-of-Death
 - Teardrop
 - Smurf
 - SYN

Computer Security - Threats



DoS and DDoS Models

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Computer Security - Terminology

- People
 - Hackers
 - White Hat – Good guys. Report hacks/vulnerabilities to appropriate people.
 - Black Hat – Only interested in personal goals, regardless of impact.
 - Gray Hat – Somewhere in between.



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Computer Security - Terminology

- Script Kiddies
 - Someone that calls themselves a ‘hacker’ but really isn’t
- Ethical Hacker
 - Someone hired to hack a system to find vulnerabilities and report on them.
 - Also called a ‘sneaker’

Computer Security - Terminology

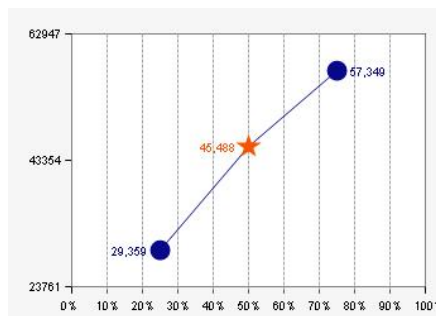
- Security Devices
 - Firewall
 - Barrier between network and the outside world.
 - Proxy server
 - Sits between users and server. Two main functions are to improve performance and filter requests.
 - Intrusion Detection Systems (IDS)
 - Monitors network traffic for suspicious activity.

Computer Security - Terminology

- Activities
 - Phreaking
 - Breaking into telephone systems (used in conjunction with war-dialing)
 - Authentication
 - Determines whether credentials are authorized to access a resource
 - Auditing
 - Reviewing logs, records, or procedures for compliance with standards

Computer Security - Careers

- Information Security Analyst
US National Average Salary



Median salary courtesy cbsalary.com

Knowledge Check

☒ “I have internet access but I don’t shop online, this means I won’t become a victim of Cyber Crime.”

☒ *Is this statement True or False?*

FALSE!

Knowledge Check

☒ “Identity Theft is a type of crime in which personal information is stolen to carry out criminal activities.”

☒ *Is this statement True or False?*

TRUE!

Knowledge Check

☒ “Cyber Crime is a type of crime carried out by criminals using computers, or similar devices, with a connection to the internet.”

☒ *Is this statement True or False?*

TRUE!

Knowledge Check

☒ “The Internet is so big that things like fraud or identity theft shouldn't really concern you; the probability you will be targeted is very small unless you use the Internet a lot.”

☒ *Is this statement True or False?*

FALSE!

What is Cyber Crime?

- ☒ **Criminal activity** (electronic device with a connection to the internet.)
- ☒ **44% of adults** were victims in 2014.
- ☒ Device can become infected **within 5 minutes**.
- ☒ Cost the UK **£27bn (2011)**.



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Identity Theft

- ☒ Using **another's personal details to obtain credit, loans**.
- ☒ **9.9 million people** affected per year.
- ☒ **19 victims every minute**.
- ☒ **If caught early it can be resolved**.



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How do they do it?

- ☒ **Phishing – Criminals pose as ‘legitimate companies’.**
- ☒ **Email hundreds of people from the Suckers List.**
- ☒ **people reply criminals now have everything they need to steal your identity.**

AVOID THEFT

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Tips to Prevent ID Theft

- 1. Shred anything with your details on.**
- 2. Check your statements and report anything suspicious.**
- 3. Ensure your home network is secure.**
- 4. Ignore emails saying “You’ve Won...” or from somebody you’re suspicious about.**

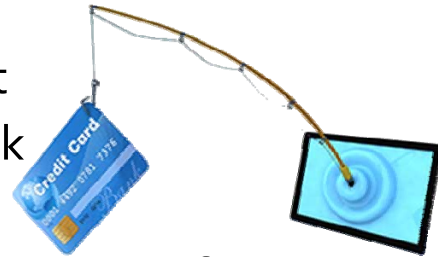


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Phishing

A bad day 'phishing', beats a good day working:

- ☒ **2,000,000** emails sent
- ☒ **100,000** delivered to recipient
- ☒ **5,000** click on the Phishing link
- ☒ **100** enter personal details
- ☒ **£1,200** from each person who enters information
- ☒ Potential Reward: **£120,000**



David Levi made **over £360,000** from **160** people

Introduction to Computer Science

PHISHING EMAIL

A screenshot of an email titled "Reminder: Please Submit Your Refund Payment" from customers@hmrc.gov.uk. The email body contains a message about a computer system upgrade and a request to submit a form. Three blue callout boxes with white text point to specific parts of the email: "GENUINE EMAIL? LOOKS IT!" points to the sender's email address; "ATTACHMENT BIG DANGER" points to the "Verify_Form.htm (14 KB)" attachment; and "DID YOU MAKE A TAX RETURN?" points to the "Dear Applicant:" salutation. A fourth callout box, "GENERIC GREETINGS", points to the "Dear Applicant:" salutation.

Reminder: Please Submit Your Refund Payment
customers@hmrc.gov.uk" <[customers@hmrc.gov.uk]>
Extra line breaks in this message were removed.
Sent: Wed 26/05/2010 12:00
To: undisclosed-recipients

Message | Verify_Form.htm (14 KB)

Dear Applicant:

Following an upgrade of our computer systems, some of our
your payments and latest tax returns over the last 12 months
have made over payments of ?256.99 Due to the high volume
the on line application, the telephone help line is unable to
In order to process your refund you will need to complete the
Your refund may take up to 4 weeks to process please make sure
correctly.

As we are upgrading our records we require the completed form
details by 15 June 2010

Please submit the form attached to confirm the refund.

S. M.Roberts
Senior Manager
HM Revenue & Customs

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TAX REFUND ID: A29R119

**GENUINE EMAIL?
LOOKS IT!**

**ATTACHMENT
BIG DANGER**

**DID YOU MAKE
A TAX RETURN?**

**GENERIC
GREETINGS**

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Prevention Tips

- ☒ Be cautious of emails that request your details. Companies will not ask via email.
- ☒ From someone you don't know/contains an attachment - delete it.
- ☒ Call the sender to confirm that it was them that sent it.



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Mass Market Scam Mail (MMSM)

- ☒ Receiving a letter or email saying someone has won a lottery or a prize.
- ☒ A person will input their details to claim the “prize”.
- ☒ Criminals then obtain personal details, inc. bank details to steal money.



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Prevention Tips



- ☒ You cannot win money/a prize if you haven't entered into any competition.
- ☒ You do not have to pay a fee to claim a legitimate prize.
- ☒ Do not give personal information
- ☒ Delete the email straight away!

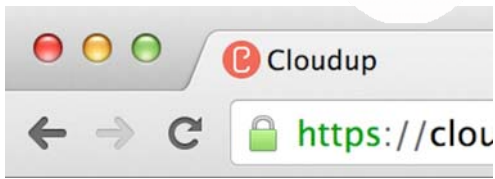
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Common Scams – Online Shopping

- ☒ Deceitful shopping's scams reliant on the secrecy of the internet.
- ☒ Whilst majority of auction sellers are genuine, there're some who sell fake goods.
- ☒ Sellers use these sites to "sell" popular items.

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✓  one is fake?



Dashes not used

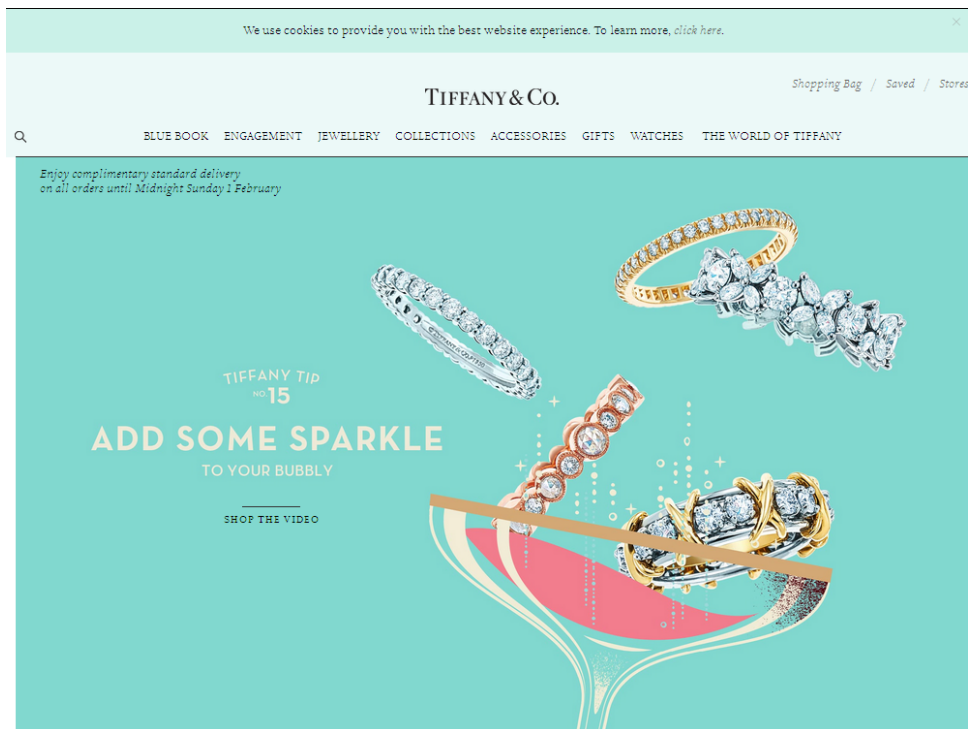
1. <http://signi-bay.com/>
2. <https://signi-bay.com/>

"HTTPS"
S = Secure

Periods
are used

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Site
One



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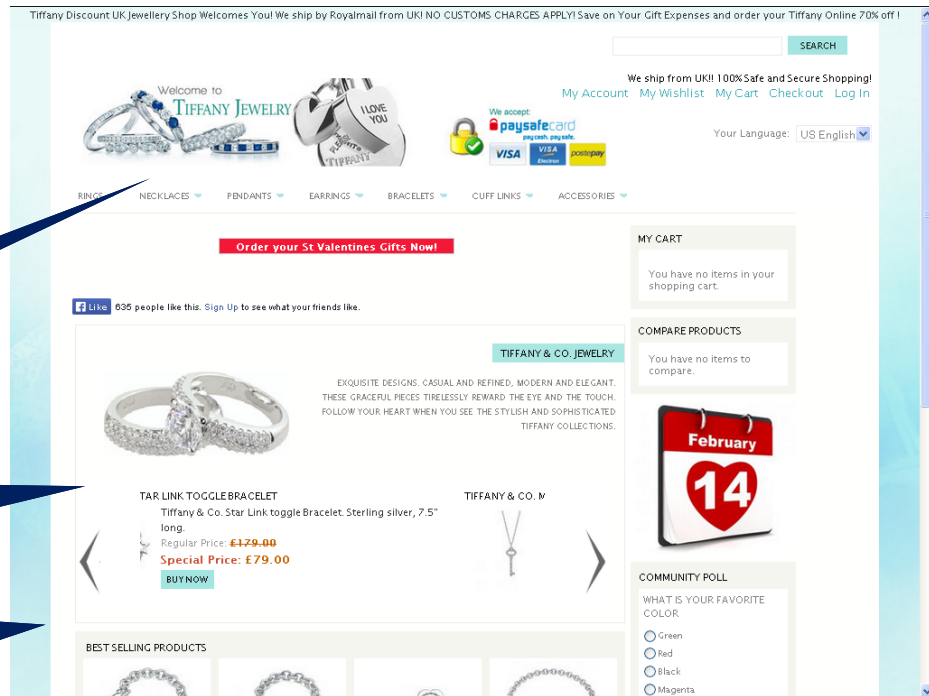
Site Two

FAKE!

Company Name

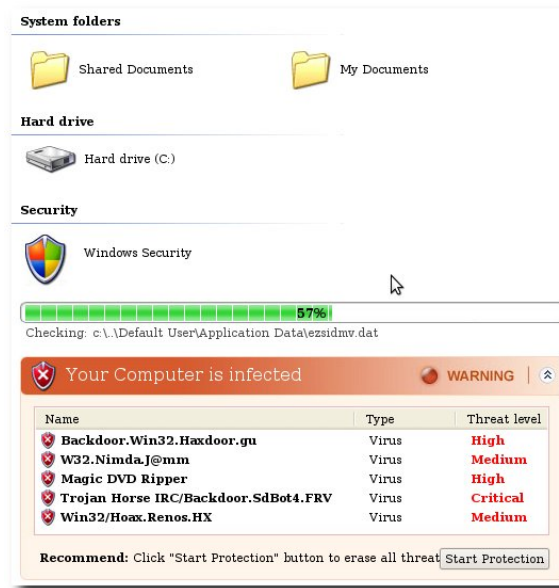
Not Well Designed

Prices to low



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Fake Virus Software – Example One



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Fake Virus Software – Example Two

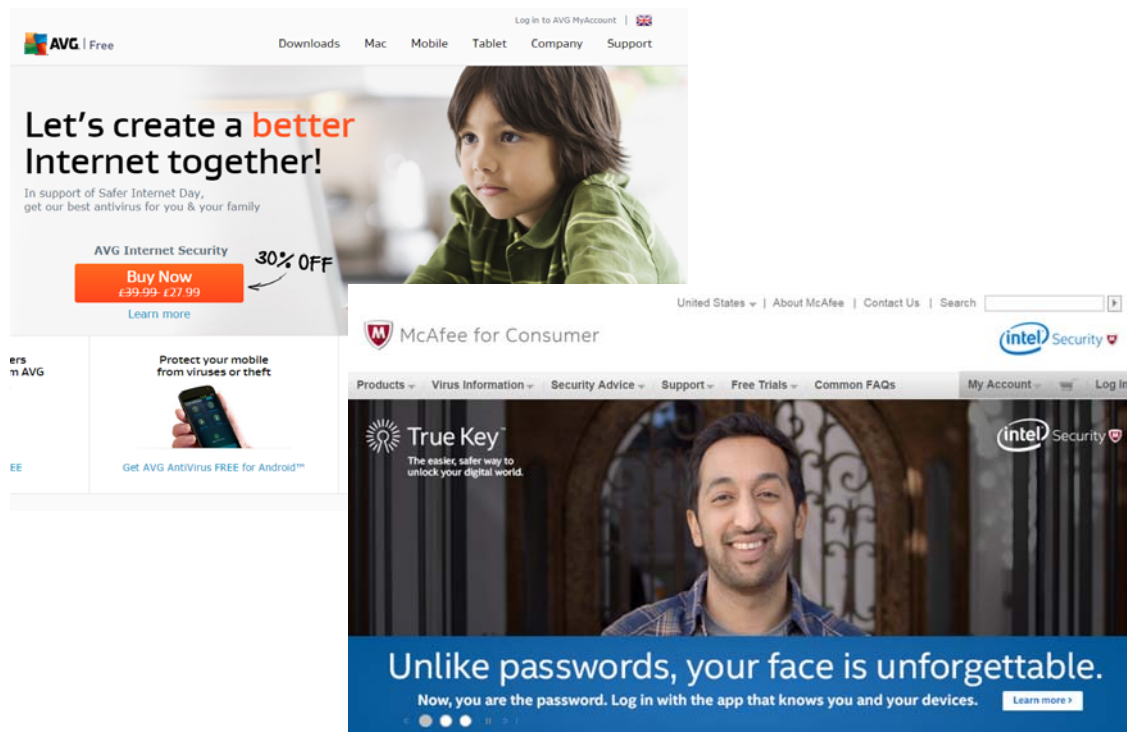


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Prevention Tips

- ☒ Don't put yourself and your identity in jeopardy.
- ☒ Do not reveal to much/protect your privacy.
- ☒ Never send money to people you haven't met.
- ☒ Keep all communication on the dating website.
- ☒ Be courteous when "keep this is a secret" is motioned

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Mobile Phone Scams

- ☒ Receiving a text from an unknown number saying you have won and that you need to claim money/prize.
- ☒ Costs to text back are an extortionate amount.



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Prevention Tips



- ☒ Do NOT reply to text messages that offer you money.
- ☒ Do NOT reply to text messages encouraging you to enter a competition.
- ☒ You may have to call a premium rate number - Do NOT phone them back.

Your entry last month has WON! Go to <http://bestbuy.com.sofre.biz/bb/> and enter code 8228 to claim your free \$1000 Best Buy Gift Card now.

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Prevention Methods



- ☒ Secure websites and an internet safety software.
- ☒ Responding to unusual emails can put you on a 'Suckers List' – Do NOT reply.
- ☒ Banks never ask for personal bank details via email. Do NOT reply.
- ☒ Be aware of your surroundings – never reuse a password.
- ☒ steve@email.com – his password is Steve123.
- ☒ How about 5t3vE123?

Capital letter and numbers to spell 'Steve' This is stronger.

Capital letter and numbers included.

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Viruses and Anti-Virus



- ☒ **Via email, websites & portable devices.**
- ☒ **Vital that you have some form of Anti-Virus protection.**
- ☒ **Strongly recommended that you use additional protection.**
- ☒ **Payware and freeware software out there, bought in most technology shops.**



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10 Golden Rules

1. There's no guaranteed get-rich-quick schemes - sound too good to be true?
2. Never send money or give out your details when you do not know/trust the person or company you are giving them to.
3. Destroy personal information, shred documents, credit cards etc.
4. Log directly onto a website rather than clicking on the link provided.
5. Never reply to spam emails, even when you're trying to stop them.
6. Always remember: scammers are cunning and clever. They know how to manipulate you to produce the response they want.
7. Legitimate banks and companies will not ask for your details via email or phone.
8. Just because a company has a well design website doesn't mean it legitimate.
9. Be suspicious. If you are unsure about anything, seek advice from family or Police.
10. Never get embarrassed by reporting a scam – If you spot a scam or have been scammed contact ActionFraud on 0300 123 2040 or visit their website at

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Lecture No (11)

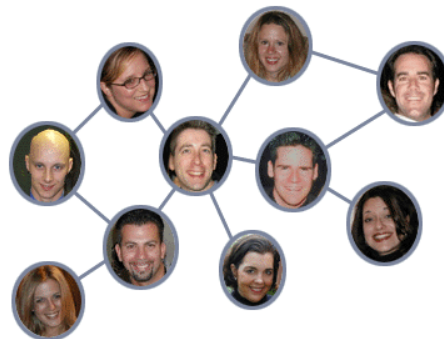
The Risks of Social Networking

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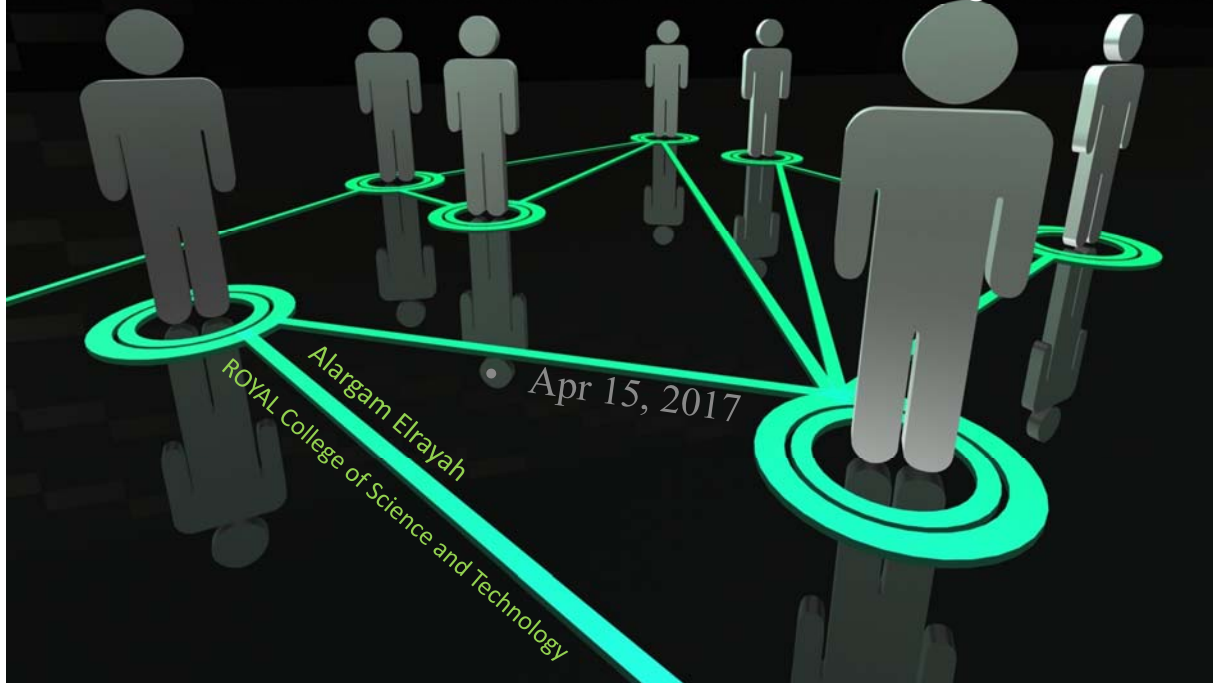
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Fan, Friend or Foe?

The Risks of Social Networking



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How Do We Communicate Today?

- I can write you a letter by snail mail.
- I can write you a letter by email, without any regard for capitalization and punctuation.
- I can send you a message via Xbox Live or on my Wii.
- I can call you.
 - From my office phone or mobile device.
 - From my computer running Skype.
- We can instant message (AOL, Yahoo!, Google)
- I can txt u, LOL.
- We can video conference.
- I can be your Facebook friend.
- I can access your Myspace page.
- I can follow you on Twitter.
- I can actually visit you in person?!



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“MySpace is a place for friends.”

“MySpace is Your Space.”

“MySpace keeps you connected.”

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The screenshot shows the Facebook homepage. At the top left is the Facebook logo. To the right are links for "Keep me logged in" and "Forgot your password?". Below these are input fields for "Email" and "Password", with a "Login" button. The main content area features the headline "Facebook helps you connect and share with the people in your life." and a world map with user avatars connected by lines. To the right is a "Sign Up" section with the text "It's free and anyone can join". The sign-up form includes fields for "First Name", "Last Name", "Your Email", and "New Password". It also has dropdown menus for "I am:" (with "Select Sex" as an option), "Birthday:" (with "Month", "Day", and "Year" dropdowns), and a "Sign Up" button. Below the form is a link: "Create a Page for a celebrity, band or business." At the bottom of the page, there are language options (including "(France)", "Deutsch", "Italiano", "العربية", "हिन्दी", "日本語", "한국어") and a footer with links: "About Advertising Developers Careers Terms Find Friends Privacy Mobile Help Center Blog Badges".



“Giving people the power to share and make the world more open and connected.”

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The screenshot shows the Twitter homepage. At the top left is the Twitter logo. To the right is a search bar with the placeholder text "Search for a keyword or phrase..." and a "Search" button. Below the search bar is the text "Discover what's happening right now, anywhere in the world". To the right of the search bar is a "Sign in" button. Below the search bar is a "TRENDING TOPIC" section with various topics like "PINOY HOUSEMATES", "GEEK PRIDE", "PAUL GRAY", "LOST FINALE", and "OIL SPILL". The main content area is divided into three sections: "See who's here" (a grid of user avatars), "Top Tweets" (a list of tweets with user avatars and text), and "New to Twitter?" (a promotional box with a "Let me in" button). The footer contains copyright information "© 2010 Twitter" and links for "About Us", "Contact", "Blog", "Status", "Goodies", "API", "Business", "Help", "Jobs", "Terms", "Privacy", and "Language: English".



“Twitter is a service for friends, family, and co-workers to communicate and stay connected through the exchange of quick frequent answers to one simple question: **What are you doing?**”

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LinkedIn Home What is LinkedIn? Join Today Sign In

Over 65 million professionals use LinkedIn to exchange information, ideas and opportunities

- Stay informed about your contacts and industry
- Find the people & knowledge you need to achieve your goals
- Control your professional identity online

Join LinkedIn Today

First Name:

Last Name:

Email:

Password:
6 or more characters

Join Now *

Already on LinkedIn? Sign in.

Search for someone by name: First Name Last Name

LinkedIn member directory: a b c d e f g h i j k l m n o p q r s t u v w x y z more | Browse members by country

* By clicking Join Now, you are indicating that you have read, understood, and agree to LinkedIn's User Agreement and Privacy Policy.

Customer Service | About | Blog | Careers | Advertising | Recruiting Solutions | Tools | Developers | Language
 LinkedIn Updates | LinkedIn Answers | LinkedIn Jobs | Jobs Directory | Company Directory | Service Provider Directory
 LinkedIn Corporation © 2010 | User Agreement | Privacy Policy | Copyright Policy



“Your professional network of trusted contacts gives you an advantage in your career, and is one of your most valuable assets. LinkedIn exists to help you make better use of your professional network and help the people you trust in return.”

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delicious
social bookmarking

It's Free! **Join Now** **Sign In**

The tastiest bookmarks on the web.
Save your own or see what's fresh now!

[Learn More](#)

Search the biggest collection of bookmarks in the universe... Search Delicious

Fresh Bookmarks Hotlist Explore Tags

The freshest bookmarks that are flying like hotcakes on Delicious and beyond.

[See more recent bookmarks](#) → New bookmarks saved in the last minute **2 1 0**

What Happens to a YouTube Video After 1,000 Uploads? **SAVE** **11**
via mashable.com

art < youtube < video < compression < repeat

▶ 13 Related Tweets



“Delicious is a Social Bookmarking service, which means you can save all your bookmarks online, share them with other people, and see what other people are bookmarking.”

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Why Use Social Media?

- It's where the students are
- Provides a sense of community
- Seen as a forum to postulate views
- Fun way to stay connected with old friends or make new friends
- Forum for communication (individual/group/mass) and collaboration
- Allows for self-expression and self-representation
- "Democratizing innovation"
- "Crowdsourcing"



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What Are The *Security* Risks?

- **Malware distribution**
- **Cyber-bullying** (“trolling,” emotional abuse)

November 20, 2008

First cyber-bullying trial hears how Megan Meier, 13, killed herself after online taunts



- **“Shelf-life” of information** (lives forever in cyberspace)

[How Tweet It Is!: Library Acquires Entire Twitter Archive](#)

April 14th, 2010 by [Matt Raymond](#)

- **Privacy concerns**
 - Information about you that *you* post
 - Information about you that *others* post
 - Information about you the *social networking sites* collect and share with others

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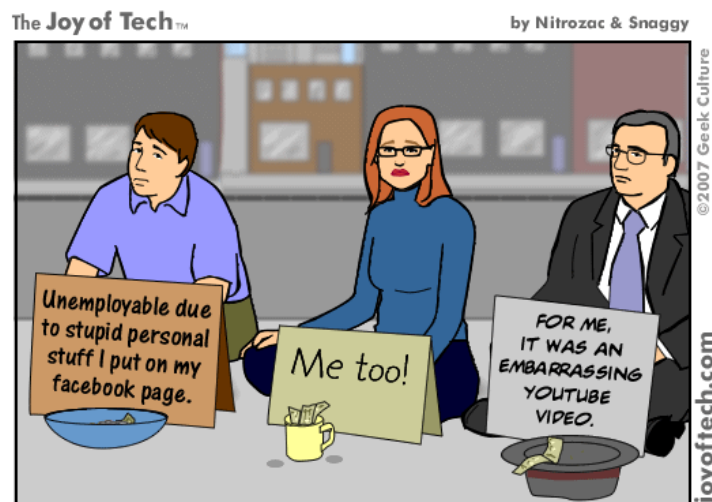
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What Are The *Security* Risks?

- Can result in social engineering, identity theft, financial fraud, infected computers, stalking, child abuse, sexual predation, defamation, lawsuits, mad boyfriend/girlfriend/spouse/parent, unwanted legacy, embarrassment, ...



Signs of the social networking times.

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Take my stuff, please!

twitter

May 6, 2010 ... I am going **on vacation** the end of July and first week of August (Maine). Today the ACL guest editor was confirmed. This is going to be fun.
twitter.com/acontinuouslean/status/13511554783 - Cached

twitter.com/ShaniDavis2010/statuses/11954707145 - Cached

Twitter / Christian Louboutin: Hey guys ,I'm **on vacation** ...

Hey guys ,I'm **on vacation** next week , I'll reply to all your questions when I return!Take care :)
twitter.com/LouboutinWorld/status/11098562936 - Cached

Twitter / Don Braid: **On vacation** in Banff. Am I ...

May 6, 2010 ... **On vacation** in Banff. Am I dreaming? #ableg #abpc #banff #ablib #wap.
twitter.com/DonBraid/status/13526777881 - Cached

Twitter / Hunter Pecunia: Loving being **on vacation** a ...

Mar 15, 2010 ... Loving being **on vacation** at the beautiful white, chilly, beach in Florida. At least my hotel has a hot tub! Haha!!
twitter.com/hunterpecunia/status/10546398591 - Cached

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Law of Unintended Consequences



keyinfluencer True confession but I'm in one of those towns where I scratch my head and say "I would die if I had to live here!"



See www.cisconfatty.com

(Motto: "How to Lose a New Job with 1 Tweet")
"Cisco just offered me a job! Now I have to weigh the utility of a fatty paycheck against the daily commute to San Jose and hating the work."

IRS Finding Tax Dodgers via Facebook, MySpace
Tax agents are heading to social websites to track down evaders.

Vodafone suspends employee after obscene tweet

Message on Vodafone's official Twitter account prompted hundreds of followers to contact the mobile phone company

Miss New Jersey blackmailed over Facebook photos

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Malware Distribution



- Similar to other threats that can lead to downloading/installing malware
 - Malicious ads
 - Clickjacking (aka “likejacking”)
 - Wall posts, inbox or chat messages with malicious links from “Friends” (hijacked user account)
 - “My wallet was stolen and I’m stuck in Rome. Send me cash now.”
 - Spam email pretending to be from Facebook admins

Facebook Clickjacking Worm Persists

Spread via status messages, there's no mention of the 'likejacking' attack on Facebook's security page.

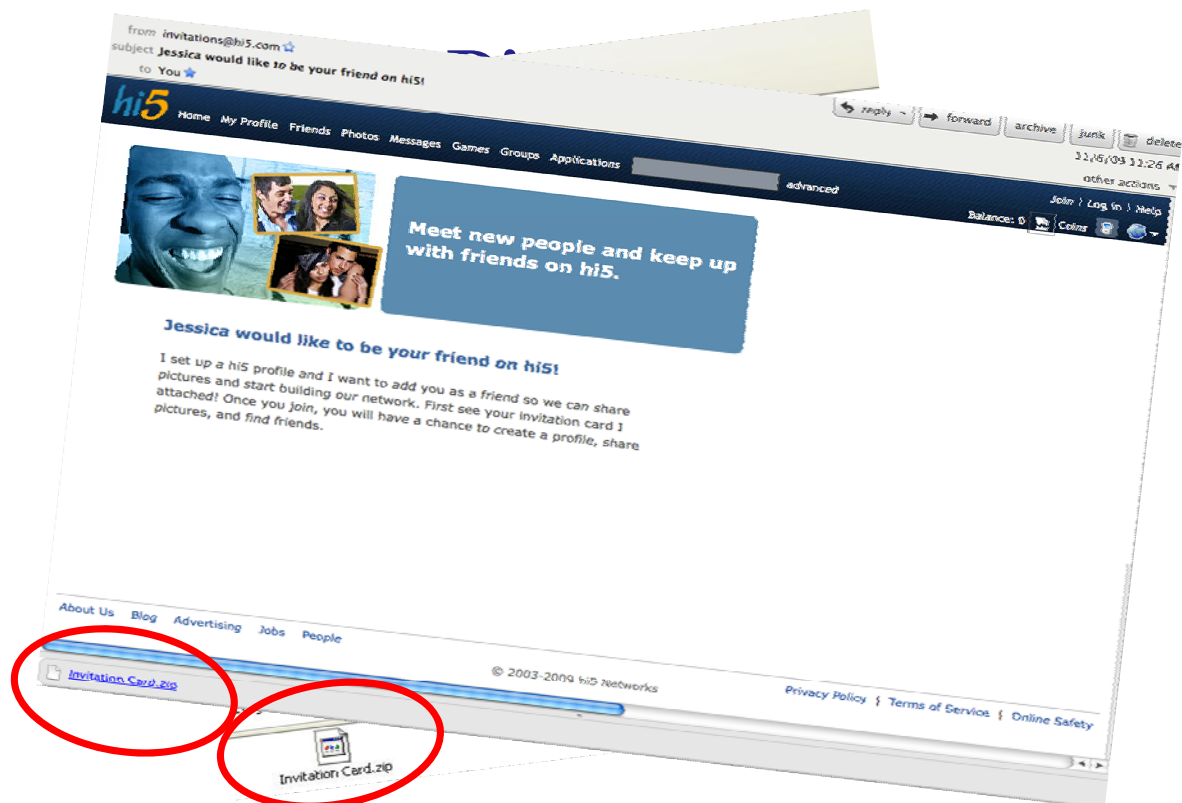
By Mathew J. Schwartz, [InformationWeek](#)
June 3, 2010

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Malware Distribution



- [Koobface](#) is granddaddy of malware targeting Facebook; continues to evolve and infect today
- Suspicious friend or follow request, or link



- Bogus FB groups/Pages/profiles to entice you
- Suspicious/malicious application
mashable.com/2010/05/29/facebook-hilarious-video/

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That Important “P” Word

privacy, : \ 'prī-və-sē, n. “The claim of individuals, groups or institutions to determine for themselves when, how and to what extent information about them is communicated to others.”



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Who's peeking?

- Friends\family
- Friends of friends\family
- Parents
- Employers and co-workers
 - Dec 2009 study commissioned by Microsoft said 79% of recruiters & hiring mgrs researched applicants online
 - CareerBuilder.com study – 45% of employers use social networks to screen job candidates
- Customers
- Universities
- Marketing companies\vendors
- Criminals\hackers
- Government agencies (IRS, SRS!)
- EVERYONE ELSE



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Privacy Policy Protection? LOL

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Hey Peter

Hot singles are waiting for you!!

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Facebook and Other Social Media Networks Found Sending Data to Advertisers

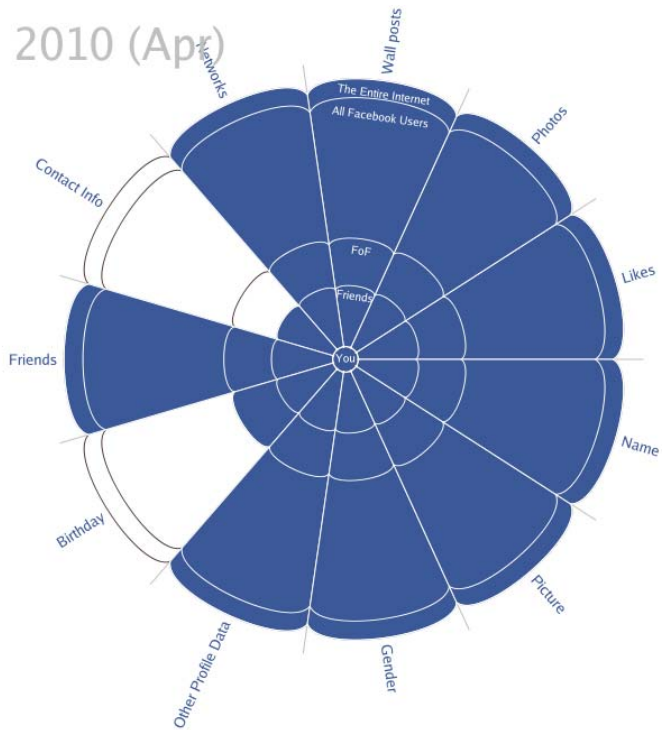
21. MAY, 2010 4 COMMENTS AUTHOR: TIM ROENICKE

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The Evolution of Facebook “Privacy”

(blue = default availability of your personal data)



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Chart by Matt McKeon: <http://mattmckeon.com/facebook-privacy/>

<http://www.RCSTSD.com>

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A Friend of Mine Is A Friend of Yours

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Oh no! URL Shorteners

- bit.ly, TinyUrl, ReadThisURL, NotLong
- Hides the true destination URL – no way to tell where you're going until you click!

<http://www.hacker.com/badsite?%20infect-your-pc.html>
is now
<http://bit.ly/aal9KV>

DANGER! ENTER AT YOUR OWN RISK! BEWARE!

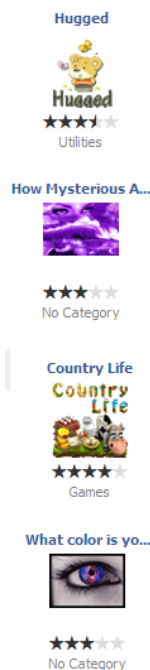
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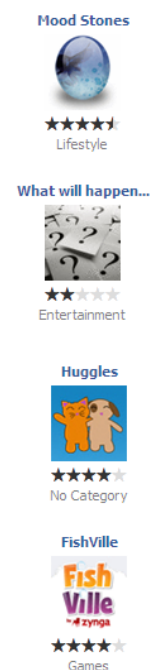
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3rd Party Applications



- Games, quizzes, cutesie stuff
- Untested by Facebook – anyone can write one
- No Terms and Conditions – you either allow or you don't
- Installation gives the developers rights to look at your profile and overrides your privacy settings!



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Legal Issues

- Copyright violations
- COPPA (Children's Online Privacy Protection Act) covers sites directed to children under age 13 or general audience sites that know they're dealing with kids younger than 13.
- Cyberbullying\stalking laws (recent)
- More to come....

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Legal Issues

Ten Privacy Groups File FTC Complaint
Against Facebook for Recent Privacy Changes
December 17th, 2009

Home > [Online Media Daily](#) > [Wednesday, Jun 2, 2010](#)

Facebook Sued For Sharing Users' Names With Advertisers

by [Wendy Davis](#), Yesterday, 12:17 AM



**Senator Schumer Asks FTC To
REGULATE Facebook, Social
Networks**

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Social Networking at Work

- Does your University have a policy? Is incidental personal use allowed? At what point does it exceed “incidental”? Discuss it with your supervisor
- Faculty and staff posting work-related information without authorization, or posting work-related information on personal pages
- K-State units should use Facebook Pages or groups rather than setting up a user profile; latter violates FB policy
- Should also be conscious of branding, making it clear whether the page is an official institutional page
- See Social Media Guidelines from K-State’s Media Relations www.k-state.edu/media/socialmedia/
- Possible data loss (inadvertent or malicious)
- Damage to reputation (personal or institutional)
- Regulatory compliance issues (e.g., FERPA, HIPAA)
- Personal rights issues (free speech, academic freedom)

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Ethical Issues

Should you friend someone who works for you?

Should you accept your bosses’ friend request?

Should faculty accept a student’s friend request?

How much should you research job applicants?



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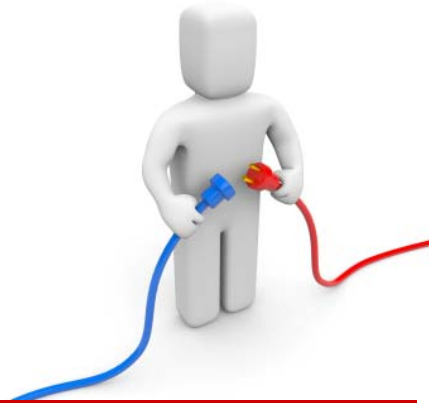
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Tips for Safer Social Networking

1. Use a strong, unique password (don't use the same password on multiple sites; don't use eID password on social networking sites)
2. Provide as little personal information as possible – avoid revealing birth date, address, etc.
3. Understand and customize the privacy settings in all of your social networking accounts
4. Don't allow 3rd party applications to access your information (if possible)
5. Be careful about what you post
 - a. Photos of self or others
 - b. Opinions on controversial topics
 - c. Don't rip classmates, professors, coworkers, employers, etc. – it WILL come back to haunt you
6. Don't post anything related to your employer (unless you're authorized)
7. Supervise your kids' use of social networking sites



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Tips for Safer Social Networking

8. Be suspicious of friend/follow requests, ads, 3rd party applications, chat messages, etc.
9. Minimize exploration – don't carelessly click on lots of ads, videos, games, etc.
10. Use built-in and add-on features in web browsers to warn you of malicious sites
 - a. Anti-phishing filters in IE and Firefox
 - b. Web of Trust
 - c. NoScript
 - d. Adblock Plus
 - e. Preview features of bit.ly, TinyURL
11. Trend Micro Web Reputations Services is your friend
12. Google yourself and scrutinize results
13. **Think before you click!!**



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How To Quit Your Addiction

- How to permanently delete your facebook account
FB group (Key is to NOT use your FB account in any way for 14 days after submitting the request)
- How to deactivate your Twitter account (they claim it takes “up to 30 days to clear from our internal systems.”)
- How to delete your MySpace profile



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Conclusion

- In my opinion, the value far outweighs the risk. I'd even say the dangers are exaggerated.
- Use social networking effectively and positively to establish new relationships, strengthen existing ones, innovate, learn, collaborate, and have fun.
- But beware of the risks so you can do your best to steer clear of them
- And **think before you click!!**

