Computing in the Modern World

BCS-CMW-7: Data Representation

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October 25, 2011

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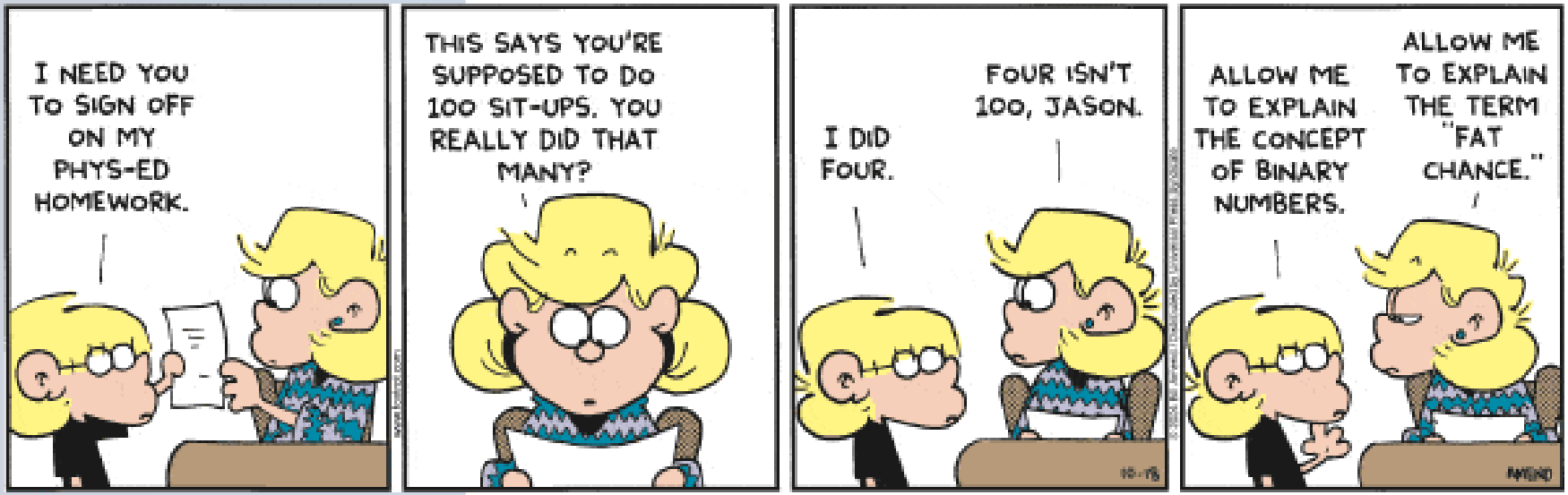
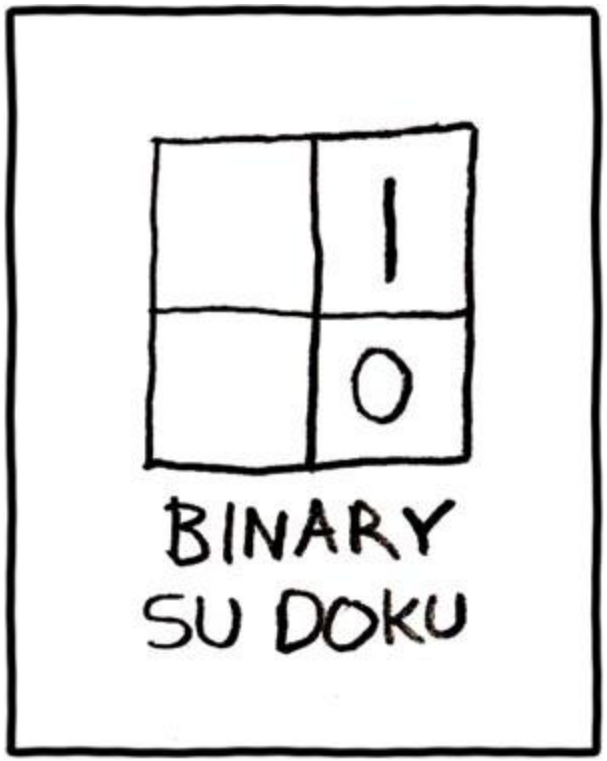

I NEED YOU TO SIGN OFF ON MY PHYS-ED HOMEWORK.
THIS SAYS YOU'RE SUPPOSED TO DO 100 SIT-UPS. YOU REALLY DID THAT MANY?
I DID FOUR.
FOUR ISN'T 100, JASON.
ALLOW ME TO EXPLAIN THE CONCEPT OF BINARY NUMBERS.
ALLOW ME TO EXPLAIN THE TERM "FAT CHANCE."

There are 10 kinds of people in the world: those who understand binary and those who don’t.



Pre-exercises

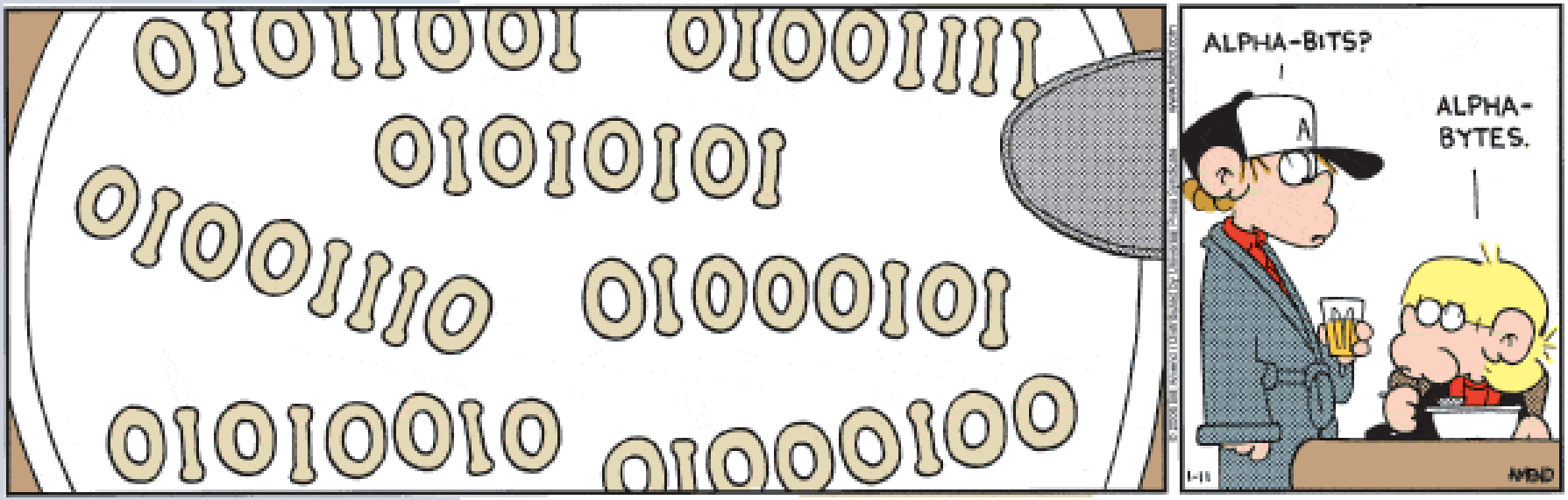
- **Magic trick (parity bits) : tack board with colored cards**
- **Representing numbers : Binary digit counting cards (1, 2, 4, 8, 16, 32)**
- **Decimal, Binary, Hexadecimal**

Decimal	Binary	Hexadecimal
1	0000 0001	1
2	0000 0010	2
3	0000 0011	3
4	0000 0100	4
5	0000 0101	5
6	0000 0110	6
7	0000 0111	7
8	0000 1000	8
9	0000 1001	9
10	0000 1010	A
11	0000 1011	B
12	0000 1100	C
13	0000 1101	D
14	0000 1110	E
15	0000 1111	F
16	0001 0000	10

Representing letters : Letter card & some words

Dec	Hx	Oct	Char	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr	Dec	Hx	Oct	Html	Chr
0	0	000	NUL (null)	32	20	040	&#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


ALPHA-BITS?
ALPHA-BYTES.

BCS-CMW-7. Students will demonstrate an understanding of how pictures, sounds, and video are represented in a computer.

Essential Questions:

- How is the binary system used to represent images?
- What is a pixel?
- How is a pixel used to represent images?
- How can the two-state nature of transistors be used to represent information?
- How are decimal numbers converted to binary numbers and vice versa?
- What is the 8-bit ASCII code?

a. Describe how a picture is digitized and represented in a computer.

Examples

- http://www.printactivities.com/HiddenPictures/004_SunAndTree.html (paint by number picture per student)
- What's the secret code for talking to spacecraft? - http://spaceplace.nasa.gov/binary-code/redirected/ (build poster)
- RGB Hexadecimal / Decimal Converter - http://www.psyclops.com/tools/rgb/

b. Describe how a sound/song is digitized and represented in a computer.

- An **audio file format** is a container format for storing audio data on a computer system. They can be divided in three basic groups:
  - **uncompressed audio file formats**,
  - **lossless compression audio formats** and
  - **lossy compression audio file formats**.

uncompressed audio file formats

- The most used and known uncompressed audio file format is PCM
- usually stored as a .wav on Windows or as .aiff on MAC.
- flexible file formats designed to store more or less any combination of sampling rates or bitrates.
- CD-quality sound files in uncompressed PCM format are large in size - around 10 MB per minute.

lossless compression audio formats

- require more processing for the same time recorded,
- more efficient in terms of disk space used,
- FLAC (Free Lossless Audio Codec) - audio format similar to MP3,
- audio information is compressed file without any loss in its audio quality (similar to how Zip works)

lossy compression audio file formats

- most used audio format today
- best known is MP3 (MPEG-1 Audio Layer 3)
- patented digital audio encoding format
- common audio format for consumer audio storage, de facto standard of digital audio compression for the transfer and playback of music on digital audio players.

Video and multimedia files

- contain digitally capturing, recording, processing, storing, transmitting, and reconstructing a sequence of **still images** representing scenes in motion and of course captured or recorded audio.

- basically **data container** formats, that are used for audio-with-video playback.

video file formats

- **AVI** (Audio Video Interleave) developed by Microsoft. Audio or video content can be compressed with a wide variety of video or audio and video codecs
- **MPG** (MPEG), developed by Moving Picture Experts Group. ISO standard used by many multimedia devices (DVD players, Blu-RAY, portable players, computers).

video file formats

- **MP4**, MPEG-4 multimedia file format, contains encoded video and advanced audio coding (AAC)-encoded audio content.
- **MOV**, a Apple QuickTime multimedia container format that can store one or more tracks of data such as video, audio, text, and effects.

QUESTIONS???

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