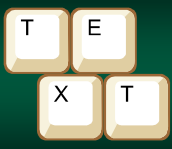# Evolution of ASCII

From ASCII to Unicode

1

Evolution of ASCII

- The ASCII Character Set has gone through a few minor revisions this it was first created
- But, the 1967 standard is still used today

2

Evolution of ASCII

- Back in the 1960's – there were no computer monitors
- Nor did you enter programs using a keyboard
- Instead…
  - programs were inputted using punched cards or tape
  - all output was printed

3

Evolution of ASCII

- The initial 1963 version didn't include lowercase letters
- As shocking as it sounds, there was a time where lowercase letters were considered obsolete
- All-caps was called "modern"

4

Original 1963 ASCII Proposal

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	NUL	SOM	EOA	EOM	EOT	WRU	RU	BEL	FE0	HT	LF	VT	FF	CR	SO	SI
1	DC0	DC1	DC2	DC3	DC4	ERR	SYN	LEM	S0	S1	S2	S3	S4	S5	S6	S7
2	␣p	!	"	#	$	%	&	'	(	)	*	+	,	–	.	/
3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	↑	←
6																
7													ACK		ESC	DEL

5

1967 Revision Added Lowercase

Changed

New

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

6

1

Control Characters

- Many of the control characters were designed for transferring data (SOH, STX, FS, GS, etc…)
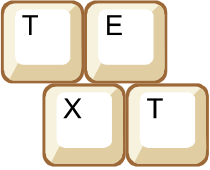- Other control characters we designed for printing

7

Evolution of ASCII

- Also note that very useful characters like "→" were ultimately removed from the 1963 design
- And a new character, Backspace (BS), was added
- Why?

8

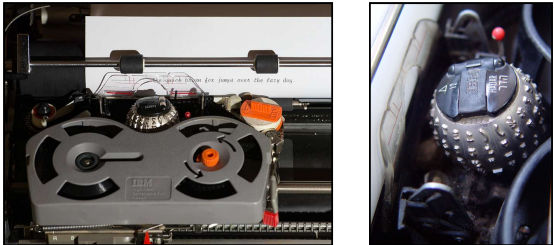## Backspace Control Character

- Printers, at the time, were basically classic typewriters
- The backspace character (BS) was used to print 2+ symbols on top of each other
- This would essentially create a new character on the paper

9

IBM Ball-Printers

10

Power of the Backspace

:	BS	–	➡	÷
=	BS	/	➡	≠
n	BS	~	➡	ñ
a	BS	_	➡	a

11

Recreating the Removed Arrows

| ^ | BS | \| | ➡ | ↑ |
| < | BS | – | ➡ | ← |

12

2

DEL Control Character

- You might have noticed an odd control character located at 7F
- This is the "Deleted" control character and was used with punched cards and tape

13

ASCII Chart

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

14
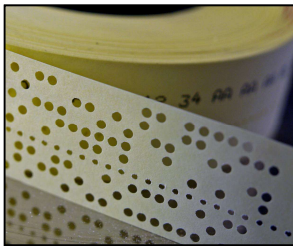
Punched Tape

15

Bill Gates – Original Altair BASIC

Intel 8080 machine code

16
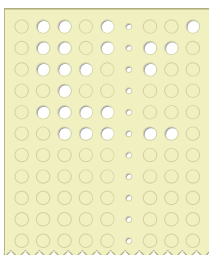
Example Punched Tape: `int x;`

Student punched the wrong hole! They meant ;

Do they have to punch an entire new tape?

17

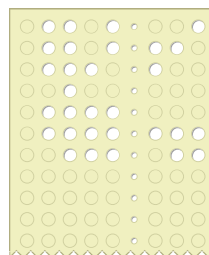## Example Punched Tape: `int x;`

Just punch all remaining holes. It becomes DEL and is ignored by the card or tape reader.

18