

# How (and Why) We Speak in Unicode

---

Devon Peticolas

```
UnicodeDecodeError: 'ascii' codec can't  
decode byte 0xc3 in position 6: ordinal not  
in range(128)
```

# Morse Code

---

1863



A	.-	M	--	Y	-.--	6	-....
B	-...	N	-.	Z	--..	7	--...
C	-.-.	O	---	Ä	.-.-	8	---..
D	-..	P	.--.	Ö	---.	9	----.
E	.	Q	--.-	Ü	..--	.	.-.-.-
F	...-	R	..-	Ch	----	,	--..--
G	--.	S	...	0	-----	?	..--..
H	....	T	-	1	.-----	!	.._..
I	..	U	..-	2	..----	:	---...
J	.----	V	...-	3	...--	“	.-.-.-
K	.-.-	W	.--	4	....-	‘	.-----
L	.-..	X	-..-	5	.....	=	-...-

# Character Set

A list of characters recognized by hardware

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# Encoding

Is a system of rules that converts a character set to and from binary

---

```
MORSE_ENCODE = {
    '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': '--..',
}

def encode(s):
    encoded = []
    for letter in s:
        encoded.append(MORSE_ENCODE[letter])
    return ' '.join(encoded)
```

```
>>> encode('BURRITO')
'-... ..- .- .- .- - - -'
```

---



```
MORSE_DECODE = {  
    '-.': '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',  
}
```

```
def decode(s):  
    decoded = []  
    for code in s.split(' '):  
        decoded.append(MORSE_DECODE[code])  
    return ''.join(decoded)
```

```
>>> decode('-... ..- .-. .-. .. - ---')  
'BURRITO'
```

---





# Baudot Code

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1874



(No Model.)

11 Sheets—Sheet 6.

J. M. E. BAUDOT.

PRINTING TELEGRAPH.

No. 388,244.

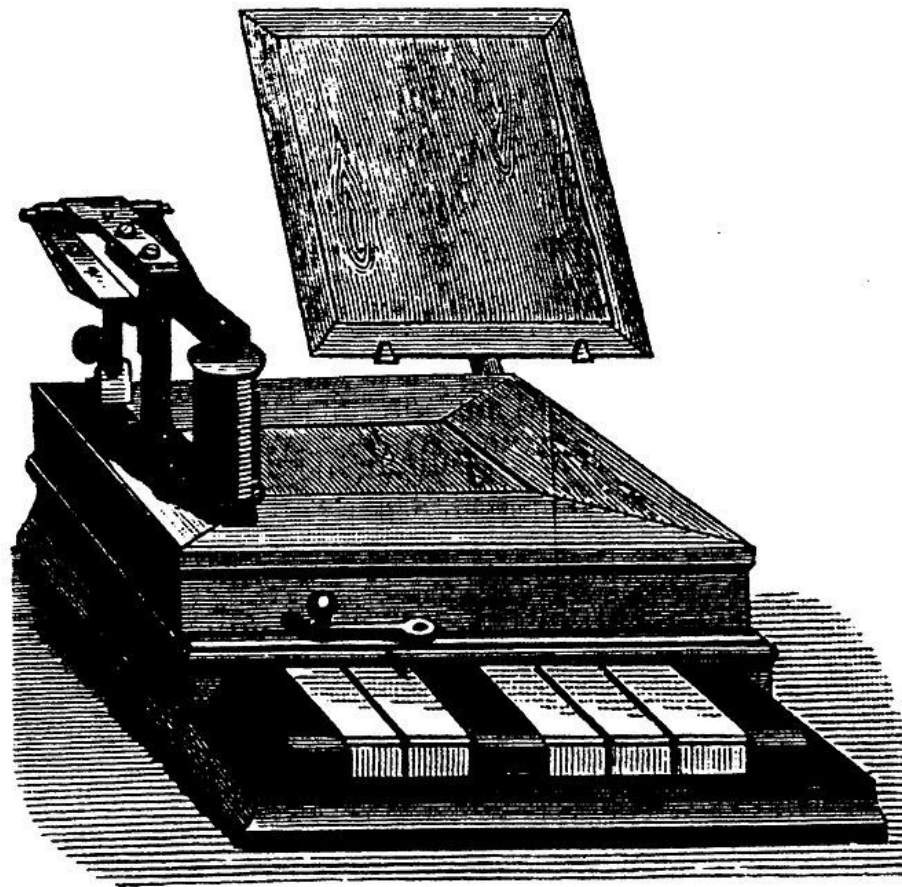
Patented Aug. 21, 1888.

Fig. 24.

	1	2	3	4	5
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	+	+	-	-	+
0	-	-	-	+	+
1	-	-	-	-	+

INVENTOR:

*Jean Maurice Emile Baudot*



# Baudôt Code

## Alphabetic Presentation

		Keyboard Layout					Transmission Order				
		V	IV	I	II	III	I	II	III	IV	V
French	English										
A 1	A 1										
B 8	B 8										
C 9	C 9										
D 0	D 0										
E 2	E 2										
É &											
F <sup>F</sup>	F <sup>7</sup>										
G 7	G 7										
H <sup>H</sup>	H <sup>1</sup>										
I <sup>I</sup>	I <sup>3</sup>										
J 6	J 6										
K (	K (										
L =	L =										
M )	M )										
N Ñ	N £										
O 5	O 5										
/ <sup>/</sup>	/ <sup>/</sup>										
P %	P +										
Q /	Q /										
R -	R -										
S ;	S <sup>7</sup>										
T !	T <sup>2</sup>										
U 4	U 4										
V ,	V ,										
W ?	W ?										
X ,	X <sup>3</sup>										
Y 3	Y 3										
Z :	Z :										
-	-										
(ERASURE)	*****										
FIGURE											
LETTER											

# Alphabet télégraphique international no. 1 (ITA-1)

		1	2	3	4	5
1	A 1					
2	B 8					
3	C 9					
4	D 0					
5	E 2					
6	F <sup>(1)</sup>					
7	G 7					
8	H +					
9	I <sup>(1)</sup>					
10	J 6					
11	K (					
12	L =					
13	M )					
14	N <sup>(1)</sup>					
15	O 5					
16	P %					
17	Q /					
18	R -					
19	S ;					
20	T <sup>(1)</sup>					
21	U 4					
22	V ,					
23	W ?					
24	X ,					
25	Y 3					
26	Z :					
27	CR					
28	LF					
29	LET					
30	FIG					
31	**					
32						

Retour du chariot <sup>(2)</sup>  
 Changement de ligne <sup>(2)</sup>  
 Blanc des lettres (espace)  
 Blanc des chiffres (space)  
 \* (Erreur)  
 Repos [Instrument at rest.]

<sup>(1)</sup> A la disposition de chaque administration pour son service interieur.

<sup>(2)</sup> Pour l'imprimeur sur pages

# ASCII

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1963



# USASCII code chart

<div> <div> b7b6b5 Bits </div> <div> <div> <div> 000001011011 </div> <div> 00010111 </div> </div> </div> </div>												
<div> <div> b4b3b2b1 </div> <div> <div> <div> Column </div> <div> Row </div> </div> </div> </div>					0	1	2	3	4	5	6	7
0	0	0	0	0	0	NUL	DLE	SP	@	P	\	p
0	0	0	1	1	1	SOH	DC1	!	A	Q	o	q
0	0	1	0	0	2	STX	DC2	"	B	R	b	r
0	0	1	1	1	3	ETX	DC3	#	C	S	c	s
0	1	0	0	0	4	EOT	DC4	\$	D	T	d	t
0	1	0	1	1	5	ENQ	NAK	%	E	U	e	u
0	1	1	0	0	6	ACK	SYN	&	F	V	f	v
0	1	1	1	1	7	BEL	ETB	'	G	W	g	w
1	0	0	0	0	8	BS	CAN	(	H	X	h	x
1	0	0	1	1	9	HT	EM	)	I	Y	i	y
1	0	1	0	0	10	LF	SUB	*	J	Z	j	z
1	0	1	1	1	11	VT	ESC	+	K	[	k	{
1	1	0	0	0	12	FF	FS	,	L	\	l	
1	1	0	1	1	13	CR	GS	-	M	]	m	}
1	1	1	0	0	14	SO	RS	.	N	^	n	~
1	1	1	1	1	15	SI	US	/	O	_	o	DEL

# The 8th Bit

---

# Latin-1

## 1252 WINDOWS LATIN 1 (ANSI)

	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
<b>0</b>		0	@	P	`	p	¡ NOT USED	í NOT USED	ÑBSF	°	À	Đ	à	đ
<b>1</b>	!	1	A	Q	a	q	í NOT USED	‘	ì	±	Á	Ñ	á	ñ
<b>2</b>	"	2	B	R	b	r	,	’	¢	²	Â	Ò	â	ò
<b>3</b>	#	3	C	S	c	s	f	“	£	³	Ã	Ó	ã	ó
<b>4</b>	\$	4	D	T	d	t	„	”	¤	´	Ä	Ô	ä	ô
<b>5</b>	%	5	E	U	e	u	...	•	¥	µ	Å	Õ	å	õ
<b>6</b>	&	6	F	V	f	v	†	-	¡	¶	Æ	Ö	æ	ö
<b>7</b>	'	7	G	W	g	w	‡	-	§	·	Ç	×	ç	÷
<b>8</b>	(	8	H	X	h	x	^	~	¨	˘	È	Ø	è	ø
<b>9</b>	)	9	I	Y	i	y	‰	™	©	¹	É	Ù	é	ù
<b>A</b>	*	:	J	Z	j	z	Š	š	ª	º	Ê	Ú	ê	ú
<b>B</b>	+	;	K	[	k	{	<	>	«	»	Ë	Û	ë	û
<b>C</b>	,	<	L	\	l	l	Œ	œ	¬	¼	Ì	Ü	ì	ü
<b>D</b>	-	=	M	]	m	}	í NOT USED	í NOT USED	ŠHY	½	Í	Ý	í	ý
<b>E</b>	.	>	N	^	n	~	í NOT USED	í NOT USED	®	¾	Î	Þ	î	þ
<b>F</b>	/	?	O	_	o		í NOT USED	ÿ	-	¿	Ï	ß	ï	ÿ

# Greek

	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
<b>0</b>	32 0	48 @	64 P	80 ,	96 p	112 I	128 'I	144 i	160 [REDACTED]	176 L	192 T	208 S	224 SHY	240 [REDACTED]
<b>1</b>	33 !	49 1	65 A	81 Q	97 a	113 q	129 I	145 i	161 [REDACTED]	177 I	193 Y	209 n	225 +	241 [REDACTED]
<b>2</b>	34 "	50 2	66 B	82 R	98 b	114 r	130 I	146 'O	162 o	178 [REDACTED]	194 T	210 F	226 t	242 v
<b>3</b>	35 #	51 3	67 C	83 S	99 c	115 s	131 I	147 I	163 v	179 	195 t	211 X	227 z	243 o
<b>4</b>	36 \$	52 4	68 D	84 T	100 d	116 t	132 I	148 I	164 A	180 +	196 -	212 P	228 k	244 x
<b>5</b>	37 %	53 5	69 E	85 U	101 e	117 u	133 I	149 'Y	165 B	181 K	197 +	213 O	229 l	245 S
<b>6</b>	38 &	54 6	70 F	86 V	102 f	118 v	134 'A	150 'Y	166 G	182 A	198 P	214 a	230 m	246 P
<b>7</b>	39 '	55 7	71 G	87 W	103 g	119 w	135 I	151 C	167 A	183 M	199 P	215 B	231 v	247 '
<b>8</b>	40 (	56 8	72 H	88 X	104 h	120 x	136 '	152 'O	168 E	184 N	200 L	216 y	232 S	248 o
<b>9</b>	41 )	57 9	73 I	89 Y	105 i	121 y	137 -	153 2	169 Z	185 H	201 F	217 J	233 o	249 "
<b>A</b>	42 *	58 :	74 J	90 Z	106 j	122 z	138 :	154 3	170 H	186 	202 L	218 r	234 p	250 w
<b>B</b>	43 +	59 ;	75 K	91 [	107 k	123 {	139 '	155 a	171 1/2	187 n	203 T	219 [REDACTED]	235 p	251 u
<b>C</b>	44 ,	60 <	76 L	92 \	108 l	124 l	140 '	156 f	172 O	188 J	204 H	220 [REDACTED]	236 s	252 u
<b>D</b>	45 -	61 =	77 M	93 ]	109 m	125 }	141 'E	157 e	173 I	189 E	205 =	221 d	237 c	253 w
<b>E</b>	46 .	62 >	78 N	94 ^	110 n	126 ~	142 -	158 n	174 O	190 O	206 H	222 e	238 t	254 [REDACTED]
<b>F</b>	47 /	63 ?	79 O	95 _	111 o	127 O	143 'H	159 i	175 >	191 r	207 S	223 [REDACTED]	239 '	255 NBSP

# Hebrew

	20	30	40	50	60	70	80	90	A0	B0	C0	D0	E0	F0
0		0	@	P	`	p	ן	י	á		␣	␣	α	≡
1	!	1	A	Q	a	q	ב	ד	í		␣	␣	β	±
2	"	2	B	R	b	r	ג	ע	ó		␣	␣	Γ	≥
3	#	3	C	S	c	s	ט	ף	ú		␣	␣	π	≤
4	\$	4	D	T	d	t	ה	פ	ñ	␣	␣	␣	Σ	∫
5	%	5	E	U	e	u	ו	ץ	Ñ	␣	␣	␣	σ	∫
6	&	6	F	V	f	v	ז	צ	␣	␣	␣	␣	μ	÷
7	'	7	G	W	g	w	ח	ק	␣	␣	␣	␣	τ	≈
8	(	8	H	X	h	x	ט	ך	␣	␣	␣	␣	Φ	°
9	)	9	I	Y	i	y	ש	␣	␣	␣	␣	␣	Θ	•
A	*	:	J	Z	j	z	ך	␣	␣	␣	␣	␣	Ω	•
B	+	;	K	[	k	{	כ	␣	½	␣	␣	␣	δ	√
C	,	<	L	\	l		ל	£	¼	␣	␣	␣	∞	n
D	-	=	M	]	m	}	ם	¥	␣	␣	␣	␣	ø	z
E	.	>	N	^	n	~	נ	␣	«	␣	␣	␣	ε	■
F	/	?	O	_	o	␣	ו	f	»	␣	␣	␣	␣	NBSP

?

	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F
0-	NULL															
1-																
2-																
3-																
4-																
5-	<i>Control characters</i>															
6-	A	B	C	D	E	F	G	H	I	V	S	L	M	:	い	う
7-	'	'	"	"	·	...	あ	え	お	☒	=	☒		☒	☒	
8-	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
9-	Q	R	S	T	U	V	W	X	Y	Z	(	)	:	;	[	]
A-	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o	p
B-	q	r	s	t	u	v	w	x	y	z	é	'd	'l	's	't	'v
C-																
D-																
E-	'	P <sub>K</sub>	M <sub>N</sub>	-	'r	'm	?	!	.	ア	ウ	エ	▷	▶	▼	⬆
F-	☒	x	.	/	,	♀	0	1	2	3	4	5	6	7	8	9



-0 -1 -2 -3 -4 -5 -6 -7 -8 -9 -A -B -C -D -E -F

0- NULL

1-

2-

3-

4-

5-

*Control characters*

6- A B C D E F G H I V S L M : い う

7- ‘ ’ “ ” · ... あ え お ☼ = ☼ || ☼ ☼

8- A B C D E F G H I J K L M N O P

9- Q R S T U V W X Y Z ( ) : ; [ ]

A- a b c d e f g h i j k l m n o p

B- q r s t u v w x y z é 'd 'l 's 't 'v

C-

D-

E- ‘ P<sub>K</sub> M<sub>N</sub> - 'r 'm ? ! . ア ウ エ ▶ ► ▼ ♂

F- ☼ x . / , ♀ 0 1 2 3 4 5 6 7 8 9



**Meanwhile,  
in Japan...**

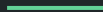
---





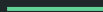
# Kanji

- Nouns
- Verbs
- Adverbs



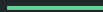
# Hiragana

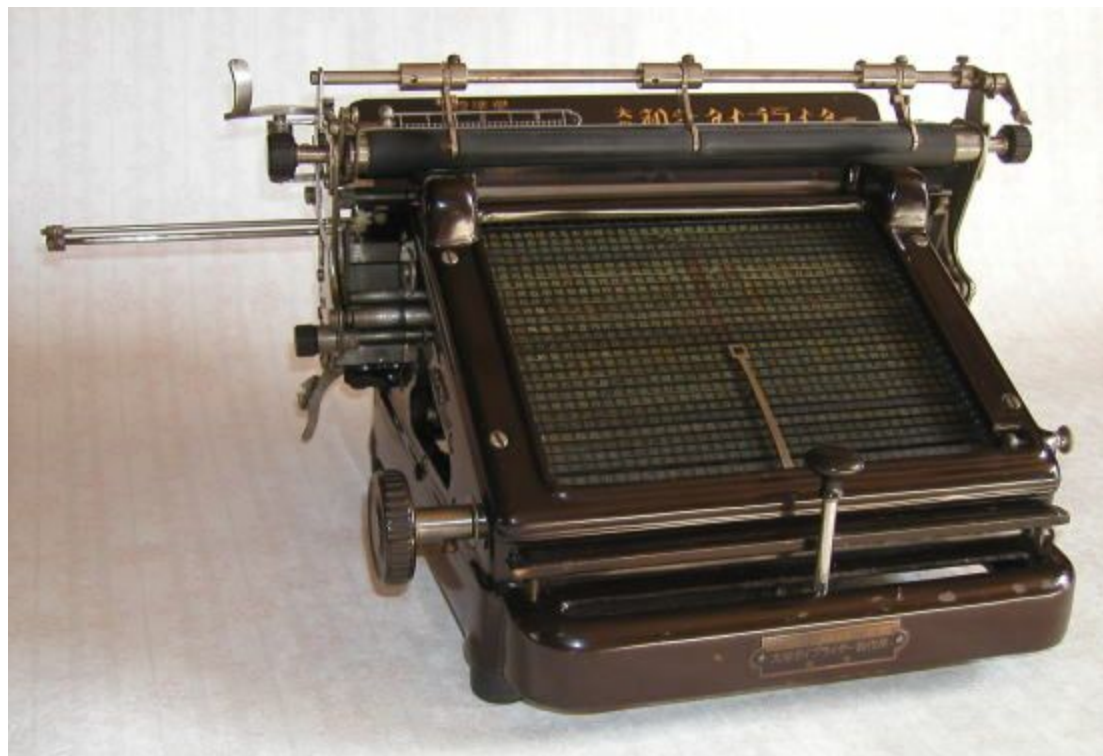
- inflectional endings
- pronunciations
- phonetic renderings of kanji



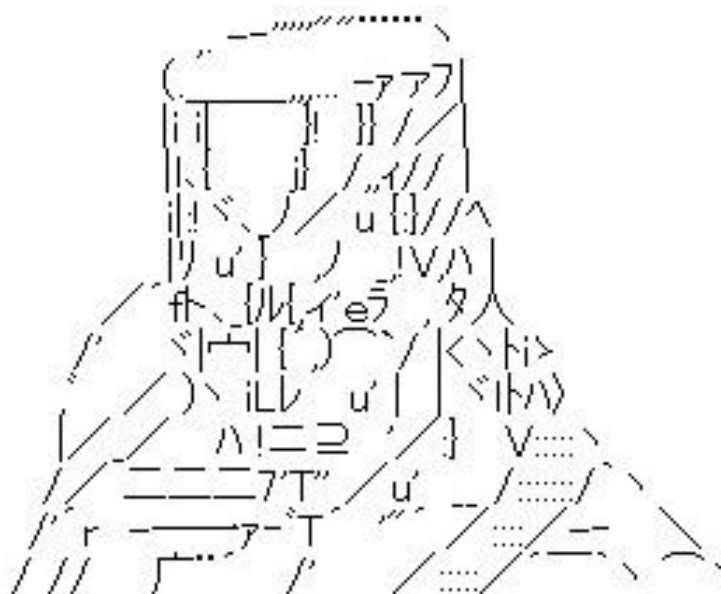
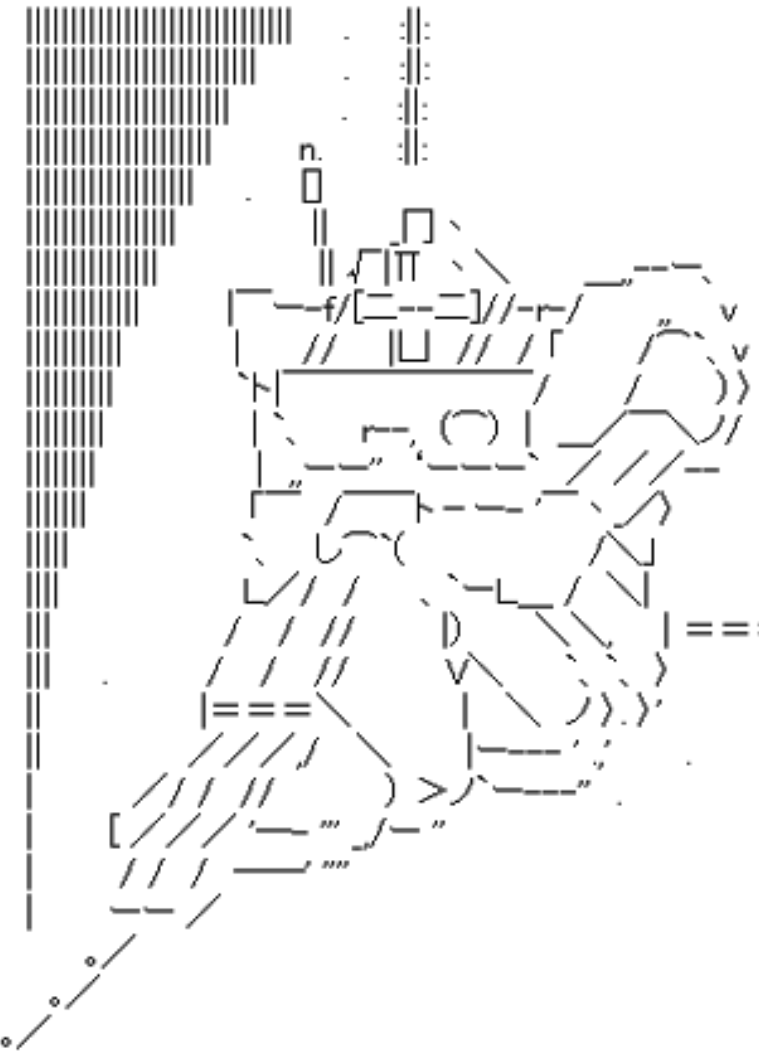
# Katakana

- foreign words
- technical terms





Row	Column	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	Bit Pat. ↓	00				01				10				11			
		00	01	10	11	00	01	10	11	00	01	10	11	00	01	10	11
0	0000			SP	0	@	P	˘	p			KS	-	タ	ミ		
1	0001			!	1	A	Q	a	q			。	ア	チ	ム		
2	0010			"	2	B	R	b	r			「	イ	ツ	メ		
3	0011			#	3	C	S	c	s			」	ウ	テ	モ		
4	0100			\$	4	D	T	d	t			,	エ	ト	ヤ		
5	0101			%	5	E	U	e	u			.	オ	ナ	ユ		
6	0110			&	6	F	V	f	v			ヲ	カ	ニ	ヨ		
7	0111			'	7	G	W	g	w			フ	キ	ヌ	ラ		
8	1000			(	8	H	X	h	x			イ	ク	ネ	リ		
9	1001			)	9	I	Y	i	y			ウ	ケ	ノ	ル		
10	1010			*	:	J	Z	j	z			エ	コ	ハ	レ		
11	1011			+	;	K	[	k	{			オ	サ	ヒ	ロ		
12	1100			,	<	L	¥	l	!			ヤ	シ	フ	ワ		
13	1101			-	=	M	]	m	}			1	ス	ヘ	ン		
14	1110			.	>	N	^	n	~			ヨ	セ	ホ	ッ		
15	1111			/	?	O	_	o	DEL			ッ	ソ	マ	。		



# Japanese Character Sets

Name	Year	Supports			
		Latin	Katakana	Hiragana	Kanji
ASCII	1963	✓			
JIS X 0201	1969	✓	✓		
JIS X 0208	1978	✓	✓	✓	✓
JIS X 0212	1990	✓	✓	✓	✓✓
JIS X 0213	2000	✓	✓	✓	✓✓✓

# Japanese Encodings

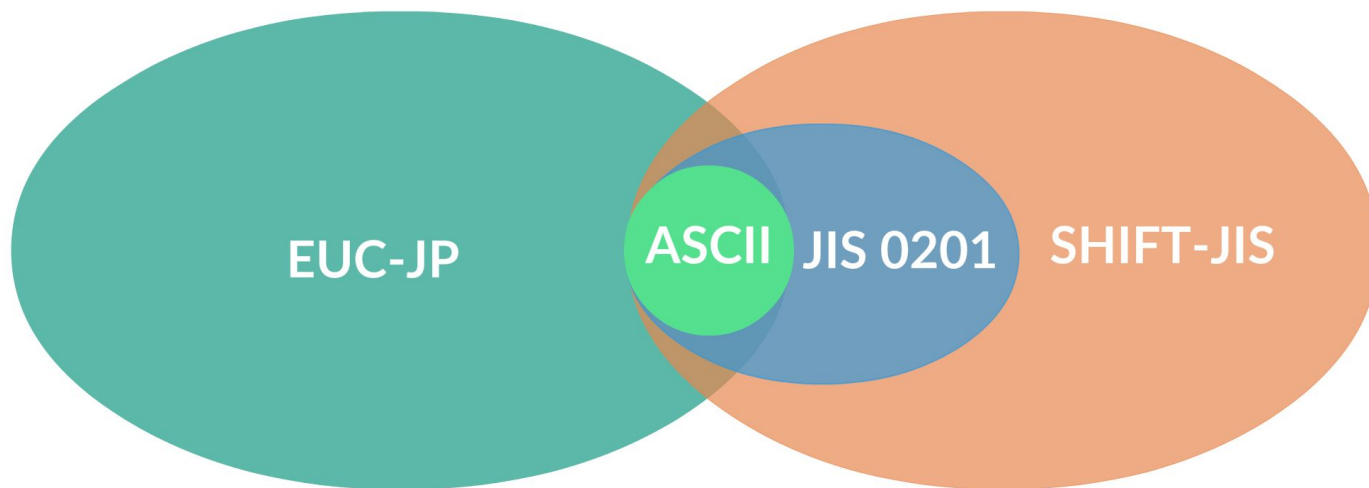




# Japanese Encodings



# Japanese Encodings



# Japanese Encodings

Name	Bytes	Supports			
		ASCII	JIS X 0201	JIS X 0208	JIS X 0213
ASCII	<1	✓			
JIS X 0201	1	✓	✓		
SHIFT-JIS	2	✓	✓	✓	
EUC-JP	2-3	✓	✓	✓	✓



# Unicode

1988



“enabling people around the world to  
use computers in any language”

# Character Set

A list of characters recognized by hardware.

**Unicode is a character set.**

---

# Encoding

Is a system of rules that converts a character set to and from binary

**UTF-8, UTF-16, and UTF-32 are encodings**

---





Name

SNOWMAN

Category

Symbol, Other

Code Point

U+2603



UTF-8    11100010   10011000   10000011

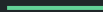
UTF-16   00100110   00000011

UTF-32   00000000   00000000   00000011   00000011

# UTF-16

(originally USC-2)

- U+0000 to U+FFFF are encoded as a single 2-byte character
- U+10000 to U+10FFFF are encoded as two 2-byte characters called “surrogate pairs”



# UTF-32

(originally USC-4)

- U+0000 to U+10FFFF are encoded as a single 4-byte character



# UTF-8

- U+0000 to U+007F are encoded as a 1 byte character
  - U+0080 to U+07FF are encoded as a 2 byte character
  - U+0800 to U+FFFF are encoded as a 3 byte character
  - U+10000 to U+10FFFF are encoded as a 4 byte character
-

# UTF-8 vs UTF-16 vs UTF-32

Glyph	Name	Code Point	UTF-8 (hex)	UTF-16 (hex)	UTF-32 (hex)
a	LATIN SMALL LETTER A	U+0061	61	00 61	00 00 00 61
â	LATIN SMALL LETTER A WITH CIRCUMFLEX	U+00E2	C3 A2	00 E2	00 00 00 E2
本	---	U+672C	E6 9C AC	67 2C	00 00 67 2C
💩	PILE OF POO	U+1F4A9	F0 9F 92 A9	D8 3D DC A9	00 01 F4 A9

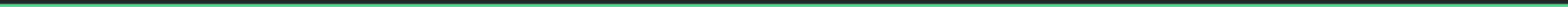
# UTF-8

Code Points	Byte 1	Byte 2	Byte 3	Byte 4
U+0000 - U+007F	0xxxxxxx			
U+0080 - U+0800	110xxxxx	10xxxxxx		
U+0800 - U+10000	1110xxxx	10xxxxxx	10xxxxxx	
U+10000 - U+10FFFF	11110xxx	10xxxxxx	10xxxxxx	10xxxxxx

# ASCII is a subset of UTF-8

Code Points	Byte 1	Byte 2	Byte 3	Byte 4
U+0000 - U+007F	0xxxxxxx			
U+0080 - U+0800	110xxxxx	10xxxxxx		
U+0800 - U+10000	1110xxxx	10xxxxxx	10xxxxxx	
U+10000 - U+10FFFF	11110xxx	10xxxxxx	10xxxxxx	10xxxxxx







```
>>> u_snowman = u'🐍'
```

```
>>> u_snowman
```

```
U'\u2603'
```

```
>>> b_snowman = u_snowman.encode('utf-8')
```

```
>>> b_snowman
```

```
'\xe2\x98\x83'
```

```
>>> b_snowman.decode('utf-8')
```

```
U'\u2603'
```



```
>>> u_snowman = '🐍'
```

```
>>> u_snowman
```

```
'🐍'
```

```
>>> b_snowman = u_snowman.encode('utf-8')
```

```
>>> b_snowman
```

```
B'\xe2\x98\x83'
```

```
>>> b_snowman.decode('utf-8')
```

```
'🐍'
```



```
>>> u_snowman = u'🐍'
```

```
>>> u_snowman
```

```
U'\u2603'
```

```
>>> b_snowman = u_snowman.encode('utf-8')
```

```
>>> b_snowman
```

```
'\xe2\x98\x83'
```

```
>>> b_snowman.decode('utf-8')
```

```
U'\u2603'
```



```
>>> u_snowman = 🐍
```

```
>>> u_snowman
```



```
>>> b_snowman = u_snowman.encode('utf-8')
```

```
>>> b_snowman
```

```
B'\xe2\x98\x83'
```

```
>>> b_snowman.decode('utf-8')
```



	Bytes	Unicode Code Points
Python 2.7	<type "str">	<type "unicode">
Python 3+	<class "bytes">	<class "str">

```
UnicodeDecodeError: 'ascii' codec can't  
decode byte 0xc3 in position 6: ordinal not  
in range(128)
```



A close-up portrait of Jay-Z. He is wearing a white long-sleeved shirt and multiple thick gold chains. He has a serious expression and is looking directly at the camera. The background is slightly out of focus, showing other people in white shirts, one of whom has an NBA logo on their sleeve.

Jay-Z

# In Python 2.7

```
>>> new_user = 'Jay-Z'
```



# In Python 2.7

```
>>> new_user = 'Jay-Z'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

# In Python 2.7

```
>>> new_user = 'Jay-Z'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

```
>>> print welcome_message.encode('utf-8')
```

```
Welcome to my  startup Jay-Z
```



A portrait of Beyoncé with voluminous, wavy brown hair, wearing a shimmering, multi-colored sequined dress and large diamond earrings. She is looking slightly to her right with a soft expression. The background is a blurred, colorful bokeh.

**Beyoncé**





Beyonc\xc3\xa9

# In Python 2.7

```
>>> new_user = 'Beyonc\xc3\xa9'
```

# In Python 2.7

```
>>> new_user = 'Beyonc\xa9'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

# In Python 2.7

```
>>> new_user = 'Beyonc\xc3\xa9'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

```
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
```

```
UnicodeDecodeError: 'ascii' codec can't decode byte 0xc3 in position 6:  
ordinal not in range(128)
```





# In Python 2.7

```
>>> new_user = 'Beyonc\xc3\xa9'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

```
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
```

```
UnicodeDecodeError: 'ascii' codec can't decode byte 0xc3 in position 6:  
ordinal not in range(128)
```

# In Python 2.7

```
>>> new_user = 'Beyonc\xc3\xa9'
```

```
>>> welcome_message = u'Welcome to my  startup' + new_user
```

```
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
```

```
UnicodeDecodeError: 'ascii' codec can't decode byte 0xc3 in position 6:  
ordinal not in range(128)
```

# In Python 3

```
>>> new_user = b'Jay-Z'
```

```
>>> welcome_message = 'Welcome to my  startup' + new_user
```

```
Traceback (most recent call last):
```

```
  File "<stdin>", line 1, in <module>
```

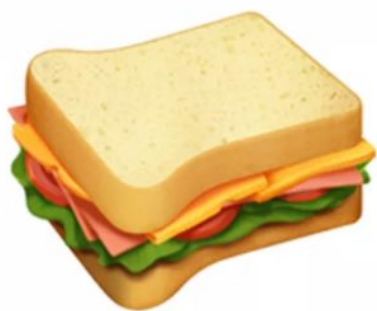
```
TypeError: Can't convert 'bytes' object to str implicitly
```

Python 3 implicitly  
converts nothing

# Best Practices

---







**BYTES**

DECODE



ENCODE

**BYTES**

Unicode  
Code  
Pointers

A portrait of Beyoncé with voluminous, curly hair, wearing a shimmering, multi-colored sequined dress and large diamond earrings. She is looking slightly to her right. The background is a soft-focus grid of colorful lights.

**Beyoncé**



ありがとうございます

Thank You