File Formats

INF 551

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File Formats

- Specify what information bits in file encode
- Example: text file
  - String of characters with particular encoding scheme, e.g., ASCII and Unicode
  - E.g., TXT, HTML, JSON, XML
- Others: xls, ppt, pdf, jpg, gif, mp3, png, etc.

Roadmap

- Character encoding 
  - ASCII
  - Unicode
- JSON
- XML

Code space & points

- Code space
  - A range of numerical values available for encoding characters
  - E.g., 0 to 10FFFF for Unicode, 0 to 7F for ASCII
- Code point
  - A value for a character in a code space
- Unicode code point
  - U+ followed by its hexadecimal value, e.g., U+0058 for capital letter ‘X’)

Encoding (of code points)

- Code unit: the smallest unit (comprising a number of bits) used to construct an encoding for a code point
  - Code unit for UTF-8: 8-bit
  - UTF-16:16-bit

- UTF (Unicode Transformation Format) encoding
  - E.g., UTF-8 and UTF-16

Variable-length encoding

- Characters encoded using codes of different length

- In Unicode, a code point may be represented using multiple code units
  - E.g., 1-4 in UTF-8, 1-2 in UTF-16

ASCII

- American Standard Code for Information Interchange

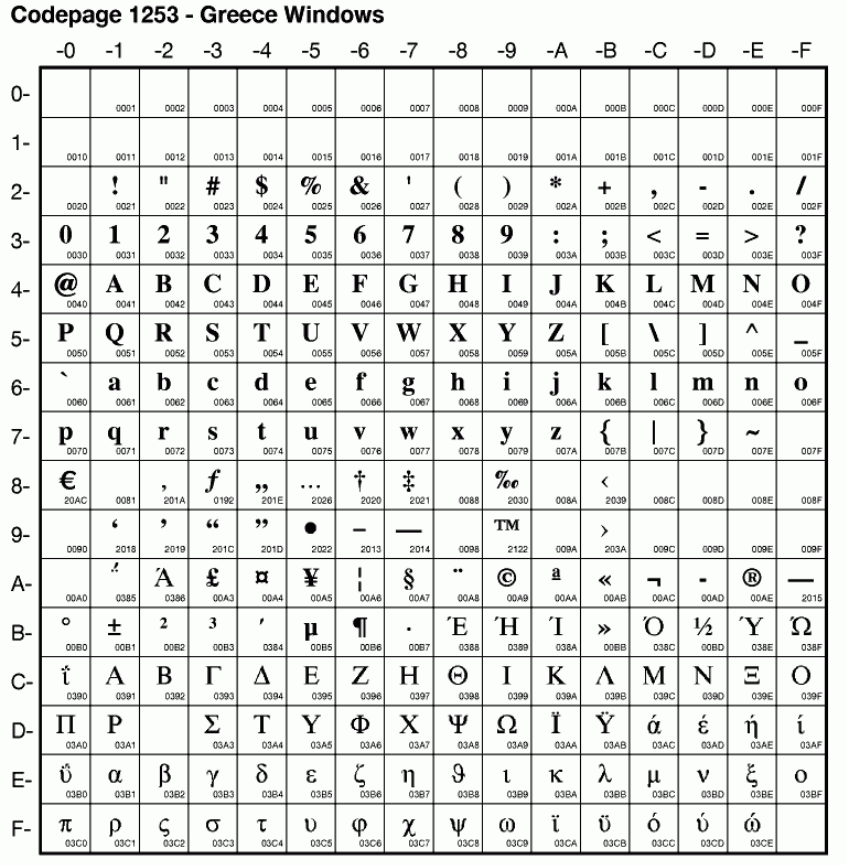
- 128 characters: 7-bit code (code points: 0~7F)
  - Digits: 0-9 (0x30 – 0x39)
  - Uppercase letters: A-Z (0x41 – 0x5A)
  - Lowercase letters: a-z (0x61 – 0x7A)
  - White space (0x20)
  - Punctuation symbols
  - Control characters (e.g., Ctrl-C: 0x03)

ASCII

Dec	Hex	Name	Char	Ctrl-char	Dec	Hex	Char	Dec	Hex	Char	Dec	Hex	Char
0	0	Null	NUL	CTRL-@	32	20	Space	64	40	@	96	60	`
1	1	Start of heading	SOH	CTRL-A	33	21	!	65	41	A	97	61	a
2	2	Start of text	STX	CTRL-B	34	22	"	66	42	B	98	62	b
3	3	End of text	ETX	CTRL-C	35	23	#	67	43	C	99	63	c
4	4	End of xmit	EOT	CTRL-D	36	24	$	68	44	D	100	64	d
5	5	Enquiry	ENQ	CTRL-E	37	25	%	69	45	E	101	65	e
6	6	Acknowledge	ACK	CTRL-F	38	26	&	70	46	F	102	66	f
7	7	Bell	BEL	CTRL-G	39	27	'	71	47	G	103	67	g
8	8	Backspace	BS	CTRL-H	40	28	(	72	48	H	104	68	h
9	9	Horizontal tab	HT	CTRL-I	41	29	)	73	49	I	105	69	i
10	0A	Line feed	LF	CTRL-J	42	2A	*	74	4A	J	106	6A	j
11	0B	Vertical tab	VT	CTRL-K	43	2B	+	75	4B	K	107	6B	k
12	0C	Form feed	FF	CTRL-L	44	2C	,	76	4C	L	108	6C	l
13	0D	Carriage feed	CR	CTRL-M	45	2D	-	77	4D	M	109	6D	m
14	0E	Shift out	SO	CTRL-N	46	2E	.	78	4E	N	110	6E	n
15	0F	Shift in	SI	CTRL-O	47	2F	/	79	4F	O	111	6F	o
16	10	Data line escape	DLE	CTRL-P	48	30	0	80	50	P	112	70	p
17	11	Device control 1	DC1	CTRL-Q	49	31	1	81	51	Q	113	71	q
18	12	Device control 2	DC2	CTRL-R	50	32	2	82	52	R	114	72	r
19	13	Device control 3	DC3	CTRL-S	51	33	3	83	53	S	115	73	s
20	14	Device control 4	DC4	CTRL-T	52	34	4	84	54	T	116	74	t
21	15	Neg acknowledge	NAK	CTRL-U	53	35	5	85	55	U	117	75	u
22	16	Synchronous idle	SYN	CTRL-V	54	36	6	86	56	V	118	76	v
23	17	End of xmit block	ETB	CTRL-W	55	37	7	87	57	W	119	77	w
24	18	Cancel	CAN	CTRL-X	56	38	8	88	58	X	120	78	x
25	19	End of medium	EM	CTRL-Y	57	39	9	89	59	Y	121	79	y
26	1A	Substitute	SUB	CTRL-Z	58	3A	:	90	5A	Z	122	7A	z
27	1B	Escape	ESC	CTRL-[	59	3B	;	91	5B	[	123	7B	{
28	1C	File separator	FS	CTRL-\	60	3C	<	92	5C	\	124	7C	|
29	1D	Group separator	GS	CTRL-]	61	3D	=	93	5D	]	125	7D	}
30	1E	Record separator	RS	CTRL-^	62	3E	>	94	5E	^	126	7E	~
31	1F	Unit separator	US	CTRL-_	63	3F	?	95	5F	_	127	7F	DEL

Windows-1253

- Windows code page for Latin + Greek characters
- Use 8 bits
  - 0x00 ~ 0xFF



Codepage 1253 - Greece Windows

	-0	-1	-2	-3	-4	-5	-6	-7	-8	-9	-A	-B	-C	-D	-E	-F
0-	0000	0001	0002	0003	0004	0005	0006	0007	0008	0009	000A	000B	000C	000D	000E	000F
1-	0010	0011	0012	0013	0014	0015	0016	0017	0018	0019	001A	001B	001C	001D	001E	001F
2-	0020	! 0021	" 0022	# 0023	$ 0024	% 0025	& 0026	' 0027	(0028	) 0029	* 002A	+ 002B	, 002C	- 002D	. 002E	/ 002F
3-	0 0030	1 0031	2 0032	3 0033	4 0034	5 0035	6 0036	7 0037	8 0038	9 0039	: 003A	; 003B	< 003C	= 003D	> 003E	? 003F
4-	@ 0040	A 0041	B 0042	C 0043	D 0044	E 0045	F 0046	G 0047	H 0048	I 0049	J 004A	K 004B	L 004C	M 004D	N 004E	O 004F
5-	P 0050	Q 0051	R 0052	S 0053	T 0054	U 0055	V 0056	W 0057	X 0058	Y 0059	Z 005A	[005B	\ 005C	] 005D	^ 005E	_ 005F
6-	` 0060	a 0061	b 0062	c 0063	d 0064	e 0065	f 0066	g 0067	h 0068	i 0069	j 006A	k 006B	l 006C	m 006D	n 006E	o 006F
7-	p 0070	q 0071	r 0072	s 0073	t 0074	u 0075	v 0076	w 0077	x 0078	y 0079	z 007A	{ 007B	| 007C	} 007D	~ 007E	007F
8-	€ 20AC	0081	‚ 201A	ƒ 0192	„ 201E	… 2026	† 2020	‡ 2021	0088	‰ 2030	008A	‹ 2039	008C	008D	008E	008F
9-	0090	‘ 2018	’ 2019	“ 201C	” 201D	• 2022	– 2013	— 2014	0098	™ 2122	009A	› 203A	009C	009D	009E	009F
A-	00A0	΅ 0385	Ά 0386	£ 00A3	¤ 00A4	¥ 00A5	¦ 00A6	§ 00A7	¨ 00A8	© 00A9	ª 00AA	« 00AB	¬ 00AC	- 00AD	® 00AE	― 2015
B-	° 00B0	± 00B1	² 00B2	³ 00B3	΄ 0384	µ 00B5	¶ 00B6	· 00B7	Έ 0388	Ή 0389	Ί 038A	» 00BB	Ό 038C	½ 00BD	Ύ 038E	Ώ 038F
C-	ΐ 0390	Α 0391	Β 0392	Γ 0393	Δ 0394	Ε 0395	Ζ 0396	Η 0397	Θ 0398	Ι 0399	Κ 039A	Λ 039B	Μ 039C	Ν 039D	Ξ 039E	Ο 039F
D-	Π 03A0	Ρ 03A1		Σ 03A3	Τ 03A4	Υ 03A5	Φ 03A6	Χ 03A7	Ψ 03A8	Ω 03A9	Ϊ 03AA	Ϋ 03AB	ά 03AC	έ 03AD	ή 03AE	ί 03AF
E-	ΰ 03B0	α 03B1	β 03B2	γ 03B3	δ 03B4	ε 03B5	ζ 03B6	η 03B7	ϑ 03B8	ι 03B9	κ 03BA	λ 03BB	μ 03BC	ν 03BD	ξ 03BE	ο 03BF
F-	π 03C0	ρ 03C1	ς 03C2	σ 03C3	τ 03C4	υ 03C5	φ 03C6	χ 03C7	ψ 03C8	ω 03C9	ϊ 03CA	ϋ 03CB	ό 03CC	ύ 03CD	ώ 03CE	

Unicode

- Unicode supports more characters than ASCII and various codepages
- Unicode separates code points from encoding
  - In contrast to ASCII, where code point = encoding

Unicode

- Code space is divided into 17 planes
- Each plane = contiguous 2^{16} code points
- Recall that code points range from 0 to 10FFFF

$\Rightarrow$Total code points = 17 * 2^{16} or 1,114,112 code points

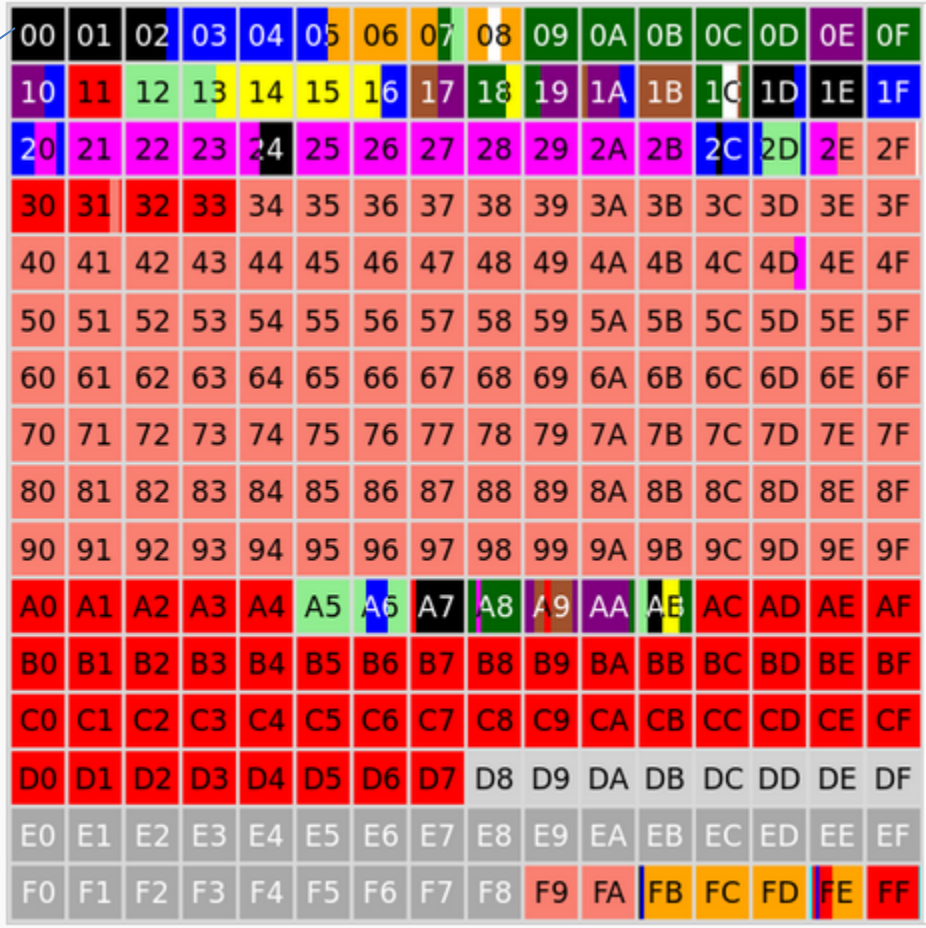
Note 2^{16} = 65,536

Planes in Unicode

V·T·E	Unicode planes and used code point ranges											[hide]
Basic		Supplementary										
Plane 0		Plane 1		Plane 2		Planes 3–13		Plane 14		Planes 15–16		
0000–FFFF		10000–1FFFF		20000–2FFFF		30000–DFFFF		E0000–EFFFF		F0000–10FFFF		
Basic Multilingual Plane		Supplementary Multilingual Plane		Supplementary Ideographic Plane		*unassigned*		Supplementary Special-purpose Plane		Supplementary Private Use Area		
BMP		SMP		SIP		—		SSP		S PUA A/B		
0000–0FFF	8000–8FFF	10000–10FFF		20000–20FFF	28000–28FFF			E0000–E0FFF		*15: PUA-A* F0000–FFFFF		
1000–1FFF	9000–9FFF	11000–11FFF		21000–21FFF	29000–29FFF							
2000–2FFF	A000–AFFF	12000–12FFF		22000–22FFF	2A000–2AFFF							
3000–3FFF	B000–BFFF	13000–13FFF	1B000–1BFFF	23000–23FFF	2B000–2BFFF					*16: PUA-B* 100000–10FFFF		
4000–4FFF	C000–CFFF	14000–14FFF		24000–24FFF	2C000–2CFFF							
5000–5FFF	D000–DFFF		1D000–1DFFF	25000–25FFF								
6000–6FFF	E000–EFFF	16000–16FFF	1E000–1EFFF	26000–26FFF								
7000–7FFF	F000–FFFF		1F000–1FFFF	27000–27FFF	2F000–2FFFF							

Plane 0: BMP (Basic Multilingual Plane)

Block 00
Represents
0000~00FF



Each block represents 256 code points

UTF-8

- Encoding scheme for Unicode code space
- Code unit = 8 bits
- Variable length
  - Code point may be represented using 1-4 code units

UTF-8 Design

- This shows the original design
  - Current: only up to U+10FFFF code points used
  - So no 5-byte/6-byte sequences

Bits of code point	First code point	Last code point	Bytes in sequence	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5	Byte 6
7	U+0000	U+007F	1	0xxxxxxx					
11	U+0080	U+07FF	2	110xxxxx	10xxxxxx				
16	U+0800	U+FFFF	3	1110xxxx	10xxxxxx	10xxxxxx			
21	U+10000	U+1FFFFF	4	11110xxx	10xxxxxx	10xxxxxx	10xxxxxx		
26	U+200000	U+3FFFFFF	5	111110xx	10xxxxxx	10xxxxxx	10xxxxxx	10xxxxxx	
31	U+4000000	U+7FFFFFFF	6	1111110x	10xxxxxx	10xxxxxx	10xxxxxx	10xxxxxx	10xxxxxx

UTF-8 Features

- Backward compatibility
  - One byte for ASCII, leading bit of byte is zero
- Clear distinction btw single- vs. multi-byte characters
  - Single-byte/multi-byte: start with 0/1 respectively
- Multiple length
  - a leading byte starts with 2 or more 1's, followed by a 0, e.g., '110', '1110', etc.
  - One or more continuation bytes all start with '10'

UTF-8 Features

- Clear indication of code sequence length
  - By # of 1's in leading byte (for multi-byte)
- Self-synchronization
  - Can find start of characters by backing up at most 3 bytes (5 in original design)

Example

- Encode ‘€’ using UTF-8
- Code point = U+20AC
- Need 3 bytes in UTF-8

Character		Binary code point	Binary UTF-8	Hexadecimal UTF-8
$	U+0024	0100100	00100100	24
¢	U+00A2	00010100010	11000010 10100010	C2 A2
€	U+20AC	0010000010101100	11100010 10000010 10101100	E2 82 AC
𐍈	U+10348	00001000000110100 1000	11110000 10010000 10001101 10001000	F0 90 8D 88

UTF-16

- Code unit = 16 bits
- Variable-length encoding
  - Code point = one/two code units
- Not compatible with ASCII

UTF-16

- Plane 0: encoded using one code unit: 16 bit
- Rest: two code units

V·T·E	Unicode planes and used code point ranges											[hide]
Basic		Supplementary										
Plane 0		Plane 1		Plane 2		Planes 3–13		Plane 14		Planes 15–16		
0000–FFFF		10000–1FFFF		20000–2FFFF		30000–DFFFF		E0000–EFFFF		F0000–10FFFF		
Basic Multilingual Plane		Supplementary Multilingual Plane		Supplementary Ideographic Plane		*unassigned*		Supplementary Special-purpose Plane		Supplementary Private Use Area		
BMP		SMP		SIP		—		SSP		S PUA A/B		
0000–0FFF	8000–8FFF	10000–10FFF		20000–20FFF	28000–28FFF			E0000–E0FFF		*15: PUA-A* F0000–FFFFF		
1000–1FFF	9000–9FFF	11000–11FFF		21000–21FFF	29000–29FFF							
2000–2FFF	A000–AFFF	12000–12FFF		22000–22FFF	2A000–2AFFF							
3000–3FFF	B000–BFFF	13000–13FFF	1B000–1BFFF	23000–23FFF	2B000–2BFFF					*16: PUA-B* 100000–10FFFF		
4000–4FFF	C000–CFFF	14000–14FFF		24000–24FFF	2C000–2CFFF							
5000–5FFF	D000–DFFF		1D000–1DFFF	25000–25FFF								
6000–6FFF	E000–EFFF	16000–16FFF	1E000–1EFFF	26000–26FFF								
7000–7FFF	F000–FFFF		1F000–1FFFF	27000–27FFF	2F000–2FFFF							

UTF-16 Encoding

- U+0000 to U+D7FF and U+E000 to U+FFFF
  - One code unit, i.e., 2 bytes
- U+D800 to U+DFFF
  - Reserved
- U+10000 to U+10FFFF
  - Two code units, i.e., 4 bytes

Encoding planes 1 to 16

- Code points: 10000 to 10FFFF

1. Subtract 10000 from code point
   => 0..FFFFF (20 bits)

2. Add 1st 10 bits to D800 => 1st code unit

3. Add 2nd 10 bits to DC00 => 2nd code unit

Examples

- Encoding code points in BMP is easy

Character		Binary code point	Binary UTF-16	UTF-16 hex code units	UTF-16BE hex bytes	UTF-16LE hex bytes
$	U+0024	0000 0000 0010 0100	0000 0000 0010 0100	0024	00 24	24 00
€	U+20AC	0010 0000 1010 1100	0010 0000 1010 1100	20AC	20 AC	AC 20
𐐷	U+10437	0001 0000 0100 0011 0111	1101 1000 0000 0001 1101 1100 0011 0111	D801 DC37	D8 01 DC 37	01 D8 37 DC
𤭢	U+24B62	0010 0100 1011 0110 0010	1101 1000 0101 0010 1101 1111 0110 0010	D852 DF62	D8 52 DF 62	52 D8 62 DF

Subtract 0001 from 0010 => 0001

Decoding UTF-16 (big endian)

- Divide file into 2-byte words

- If the word starts with 1101 10xx
  - Must be the first code unit of a 2-unit encoding
- Else if the word starts with 1101 11xx
  - Must be the second code unit of a 2-unit encoding
- Else
  - Must be a 1-unit encoding

Big-Endian (BE) and Little-Endian (LE)

- Two ways of storing a multi-byte word (code unit)
  - Not a problem in UTF-8

- UTF-16BE
  - BE: big endian where most significant bytes stored first
  - So no change to the order of bytes
  - So ABCD stored as “AB CD”

- UTF-16LE
  - Reverse the order
  - ABCD stored as “CD AB”

Byte Order Mark (BOM)

- Unicode recommends to add BOM to the beginning of a text
  - Tell which order the text follows
  - BOM: U+FEFF

- “FE FF” => big endian
- “FF FE” => small endian

Gulliver’s Travels

Besides, our Histories of six thousand Moons make no mention of any other Regions, than the two great Empires of Lilliput and Blefuscu. Which two mighty Powers have, as I was going to tell you, been engaged in a most obstinate War for six and thirty Moons past.

It began upon the following Occasion. It is allowed on all Hands, that the primitive way of breaking Eggs, before we eat them, was upon the larger End: But his present Majesty's Grand-father, while he was a Boy, going to eat an Egg, and breaking it according to the ancient Practice, happened to cut one of his Fingers. Whereupon the Emperor his Father published an Edict, commanding all his Subjects, upon great Penaltys, to break the smaller End of their Eggs.

The People so highly resented this Law, that our Histories tell us there have been six Rebellions raised on that account; wherein one Emperor lost his Life, and another his Crown. These civil Commotions were constantly fomented by the Monarchs of Blefuscu; and when they were quelled, the Exiles always fled for Refuge to that Empire. It is computed, that eleven thousand Persons have, at several times, suffered Death, rather than submit to break their Eggs at the smaller End.

Many hundred large Volumes have been published upon this Controversy: But the books of the Big-Endians have been long forbidden, and the whole Party rendered incapable by Law of holding Employments. During the Course of these Troubles, the Emperors of Blefuscu did frequently expostulate by their Ambassadors, accusing us of making a Schism in Religion, by offending against a fundamental Doctrine of our great Prophet Lustrog, in the fifty-fourth Chapter of the Brundrecal (which is their Alcoran.) This, however, is thought to be a meer Strain upon the Text: For the Words are these: That all true Believers shall break their Eggs at the convenient End: and which is the convenient End, seems, in my humble Opinion, to be left to every Man's Conscience, or at least in the power of the Chief Magistrate to determine.

Now the Big-Endian Exiles have found so much Credit in the Emperor of Blefuscu's Court, and so much private Assistance and Encouragement from their Party here at home, that a bloody War has been carried on between the two Empires for six and thirty Moons with various Success; during which time we have lost forty Capital Ships, and a much greater number of smaller Vessels, together with thirty thousand of our best Seamen and Soldiers; and the Damage received by the Enemy is reckon'd to be somewhat greater than Ours. However, they have now equipped a numerous Fleet, and are just preparing to make a Descent upon us; and his Imperial Majesty, placing great Confidence in your Valour and Strength, has commanded me to lay this Account of his affairs before you.

"Example" in different encodings

ASCII: 45 78 61 6d 70 6c 65

UTF-16BE: FE FF 00 45 00 78 00 61 00 6d 00 70 00 6c 00 65

UTF-16LE: FF FE 45 00 78 00 61 00 6d 00 70 00 6c 00 65 00

What about end of line?

- LF (Line feed, '\n', 0x0A, 10 decimal)
- CR (Carriage return, '\r', 0x0D, 13 in decimal)

- Different systems represent it differently
  - Window: \r\n
  - Unix based: \n
  - Old Mac: \r

A type writer

Unicode

Unicode standard defines a number of characters that conforming applications should recognize as line terminators:

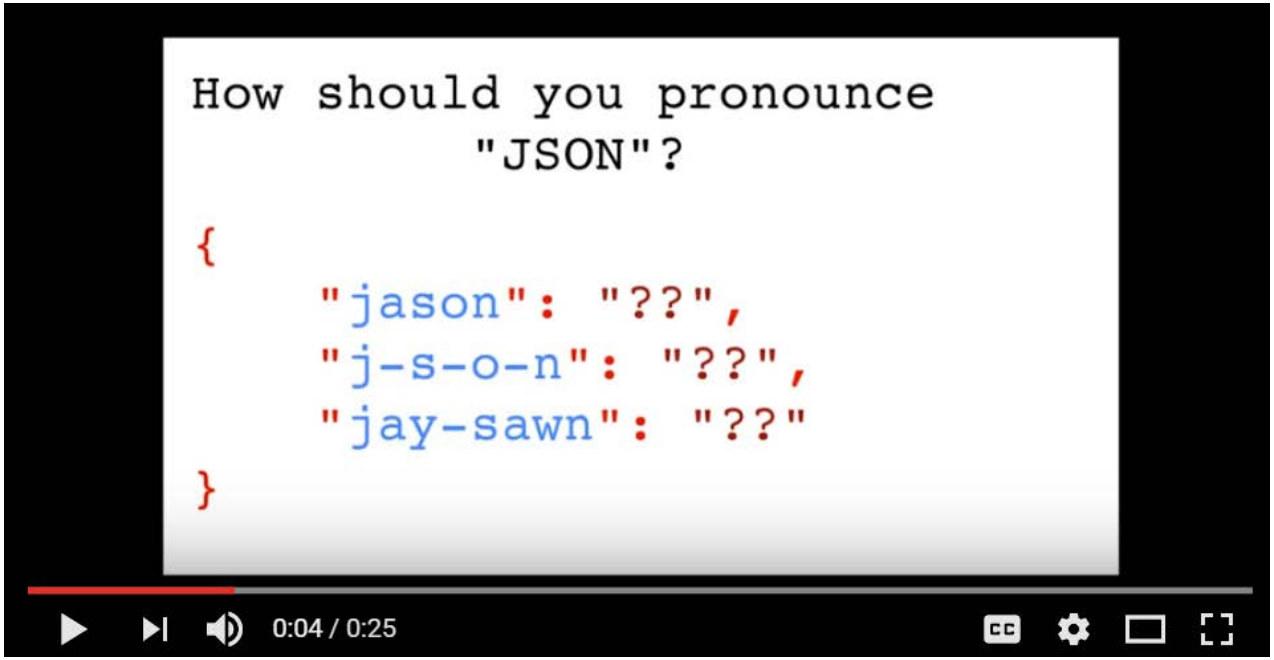
- LF: Line Feed, U+000A
- VT: Vertical Tab, U+000B
- FF: Form Feed, U+000C
- CR: Carriage Return, U+000D
- CR+LF: CR (U+000D) followed by LF (U+000A)
- NEL: Next Line, U+0085
- LS: Line Separator, U+2028
- PS: Paragraph Separator, U+2029

Roadmap

- Character encoding
  - ASCII
  - Unicode
- JSON 
- XML

How to pronounce JSON??

- Douglas Crockford: pronouncing "JSON"
  - https://www.youtube.com/watch?v=zhVdWQWKRqM



JSON (Javascript Object Notation)

- Light-weight data exchange format
  - Much simpler than XML
  - Language-independent
  - Inspired by syntax of JavaScript object literals

- Some differences from JavaScript objects, e.g.,
  - String in JSON must be double-quoted
  - Ok to single-quote in JavaScript (& Python)

Syntax of JSON

- value =
  string|number|object|array|true|false|null

- object = {} | { members }
  - members = pair | pair, members
  - pair = string : value

- array = [] | [elements]
  - elements = value | value, elements

Valid JSON or not?

- []
- {}
- {[]}
- [{}]
- {"name": john}
- {name: "john"}
- {"name": 25}
- "name"
- 25
- {25}
- [25]

JSON is case-sensitive

- Valid or not?
  - True
  - true
  - TRUE
  - Null
  - false

Example JSON

```
{
  "firstName": "John",
  "lastName": "Smith",
  "isAlive": true,
  "age": 25,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021-3100"
  },
  "phoneNumbers": [
    {
      "type": "home",
      "number": "212 555-1234"
    },
    {
      "type": "office",
      "number": "646 555-4567"
    }
  ],
  "children": [],
  "spouse": null
}
```

Value is an object

Value is an array

Check syntax of JSON

- JSON validator
  - http://jsonlint.com/

Python primer

- String: 'abc' or "abc"
- List: x = ['abc', 25]
  - x[0] =?
  - x.append(True) // True is boolean
  - x.append(None) // None is NoneType = null
- Tuple: y = ('abc', 25)
  - y[0] =?
  - What about y.append(True)?

Python primer

- Dictionary: z = {'name': 'john', 25: 'age'}
  - Note key in Python can also be integer or tuple
  - z['name'] = ?
  - z[25]=?
  - What about z['age'] or z['25']?

- z['gender'] = 'male'
  - z = {25: 'age', 'name': 'john', 'gender': 'male'}

Working with JSON in Python

- import json
  - Loading json library module
- json.dumps()
  - JSON encoder
  - Python object => JSON document
- json.loads()
  - JSON decoder
  - JSON document => Python object

Python object => JSON document

- Python list => JSON array
  - json.dumps([1, 2]) => '[1, 2]'
  - json.dumps([3, 'abc', True, None]) => '[3, "abc", true, null]'
- Python tuple => JSON array
  - json.dumps((1, 'abc')) => '[1, "abc"]'

Python object => JSON document

- Python dictionary => JSON object
  - json.dumps({'name': 'john', 25: 'age'}) => '{"25": "age", "name": "john"}'

- Notes
  - None => null
  - True => true
  - 'abc' => "abc"

Python object => JSON document

- json.dumps(['foo', {'bar': ('baz', None, 1.0, 2)}])
  - '["foo", {"bar": ["baz", null, 1.0, 2]}]'

- json.dumps({(1,2): 5})
  - Error (key is a tuple, Ok in Python)
  - dumps() doesn't take tuple as key (but see below)
- json.dumps({(2): 5}) => '{"2": 5}'

JSON document => Python object

- JSON object => Python dictionary
  - json.loads('{"name": "john", "age": 5}') => {u'age': 5, u'name': u'john'}
  - Note: 'u' means "unicode"

- JSON array => Python list
  - json.loads('[25, "abc"]') => [25, u'abc']

JSON document => Python object

- json.loads('"abc"') => u'abc'
- json.loads('25.2') => 25.2
- json.loads('true') => True
- json.loads('null') => None

- json.loads('{"name": "john", "age": 25, "phone": [123, 456]}')

  => {u'phone': [123, 456], u'age': 25, u'name': u'john'}

Conversion summary

JSON	Python
Object	Dictionary
Array	List
Array	Tuple (from Python)
null	None
true	True
false	False

Python dictionary => JSON object

- Keys in Python can be number, string, or tuple.
- Number is also converted to string.
- But tuple (with two or more components) is not acceptable by dumps()/dump().

Working with files

- f = open('lax.json')
- lax= json.load(f)

- out_file = open('output.json', 'w')
- json.dump(lax, out_file)

LAX passenger traffic data

- Download data at:
  - https://data.lacity.org/A-Prosperous-City/Los-Angeles-International-Airport-Passenger-Traffi/g3qu-7q2u

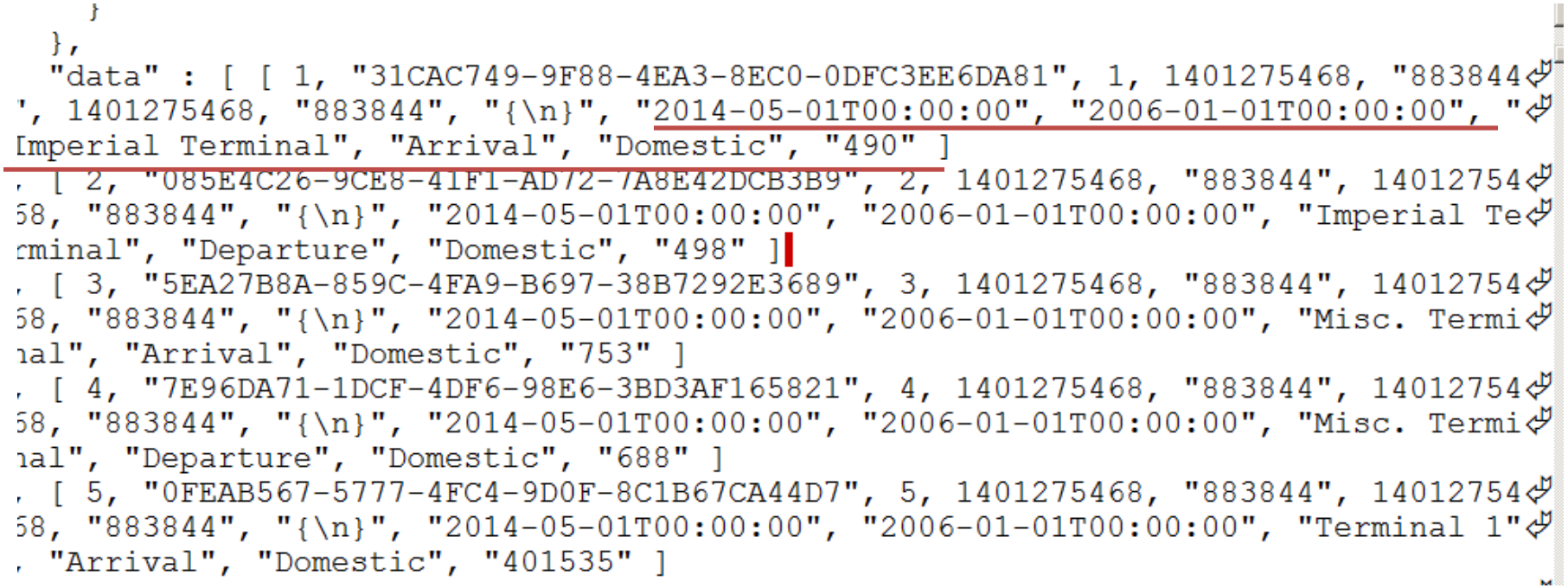
- A copy is available on Blackboard too
  - In the Resources folder

Data spreadsheet

	ReportPeriod	Terminal	Arrival_Departure	Domestic_International	Passenger_Count
4650	07/01/2016 12:00:00 AM	Terminal 3	Arrival	Domestic	402,452
4651	07/01/2016 12:00:00 AM	Terminal 3	Departure	Domestic	390,418
4652	07/01/2016 12:00:00 AM	Terminal 3	Departure	International	4,365
4653	07/01/2016 12:00:00 AM	Terminal 4	Arrival	Domestic	422,257
4654	07/01/2016 12:00:00 AM	Terminal 4	Arrival	International	35,800
4655	07/01/2016 12:00:00 AM	Terminal 4	Departure	Domestic	384,861
4656	07/01/2016 12:00:00 AM	Terminal 4	Departure	International	64,590
4657	07/01/2016 12:00:00 AM	Terminal 5	Arrival	Domestic	456,188
4658	07/01/2016 12:00:00 AM	Terminal 5	Arrival	International	78,781
4659	07/01/2016 12:00:00 AM	Terminal 5	Departure	Domestic	478,348
4660	07/01/2016 12:00:00 AM	Terminal 5	Departure	International	71,021
4661	07/01/2016 12:00:00 AM	Terminal 6	Arrival	Domestic	374,394

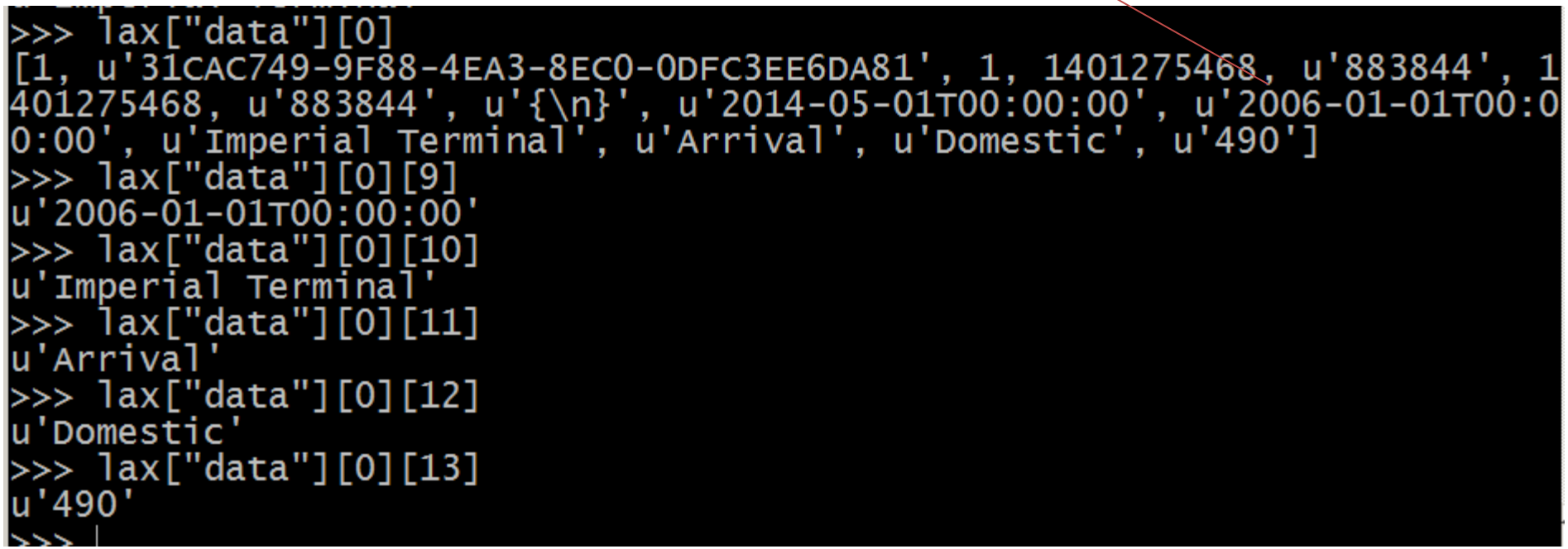
JSON file (lax.json)

- Ignore "meta" info (in the beginning of file)
- Records are in the value of "data"



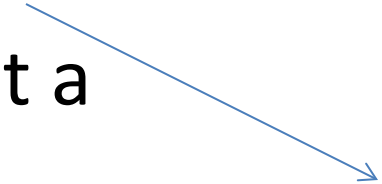
Querying it in Python

ReportPeriod



Unicode in Python

- >>> a = u'\u20AC' # note need u before '
- >>> print a
- €



u indicates it is a Unicode string

- >>> e = u'€'
- >>> e
- u'\u20ac'

Unicode in Python

- >>> b = '€'
- >>> b
- '\xe2\x82\xac'
  - Normal 8-bit string representation of €
  - This corresponds to its UTF-8 encoding

Resources

- UTF-8
  - https://en.wikipedia.org/wiki/UTF-8
- UTF-16
  - https://en.wikipedia.org/wiki/UTF-16
- JSON
  - https://en.wikipedia.org/wiki/JSON
  - Syntax: http://www.json.org/

Resources

- JSON encoder and decoder
  - https://docs.python.org/2/library/json.html