Take Care with Char

ESC101: Fundamentals of Computing

Purushottam Kar

Mid-sem Theory Exam

- September 22nd, 2018 (Saturday)
- Time: 1PM – 3PM
- Room: announced shortly
- Syllabus: till whatever is covered till Sep 14th tutorial
- No Make-up Exam – do not miss this exam
- Open handwritten notes – no printouts, mobiles, iPads.

Doubt-clearing Session

- Date: September 15th, 2018 (coming Saturday)
- Time: 5PM – 7PM
- Room: CC-02
- Students not comfortable with English are welcome
- Other students also welcome to clear doubts
- Please revise and have list of doubts before coming
- Will not cover lectures again in detail – only doubts

Advanced Track

- 29 students selected for advanced track
- Sorry for delay in sending out mentor allocation
- Had a marathon 4 hours grading session last night ☺
- Will definitely send out notifications this afternoon

Char: new datatype

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Close cousin of the int and long datatypes

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Internally stored as an integer between 0 and 127

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```
#include <stdio.h>
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```
#include <stdio.h>
int main(){
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```
#include <stdio.h>
int main(){
char a = 'p';
```

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```
#include <stdio.h>
int main(){
char a = ‘p’;
scanf(“%c”, &a);
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#include <stdio.h>
int main(){
char a = ‘p’;
scanf(“%c”, &a);
printf(“My first char %c”, a);
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scanf(“%c”, &a);
printf(“My first char %c”, a);
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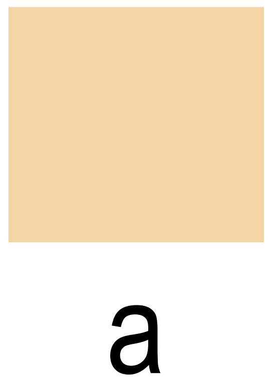

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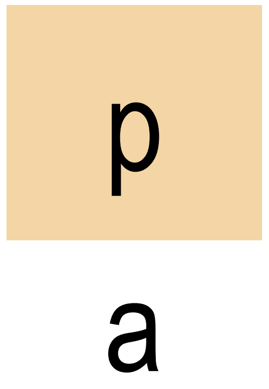

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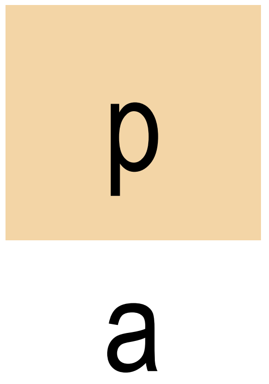

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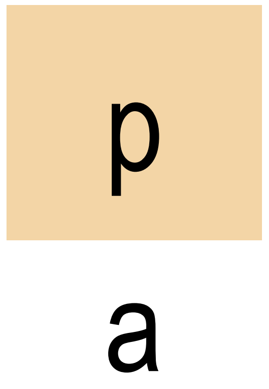

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Char constants enclosed in ‘ ’

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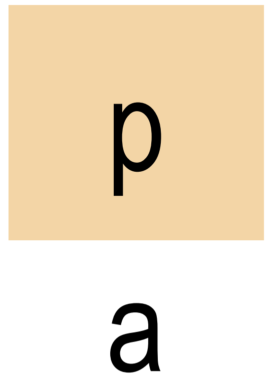

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Integer arithmetic applies to char as well +, -, /, *, %, ()

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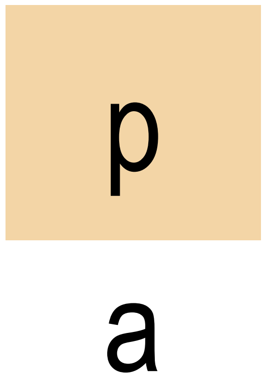

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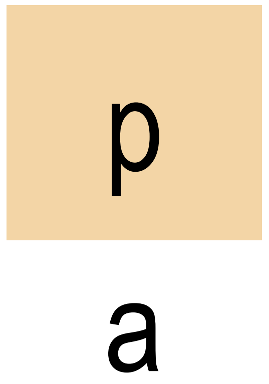

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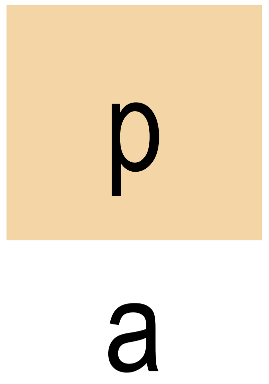

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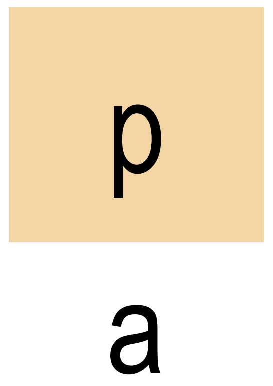

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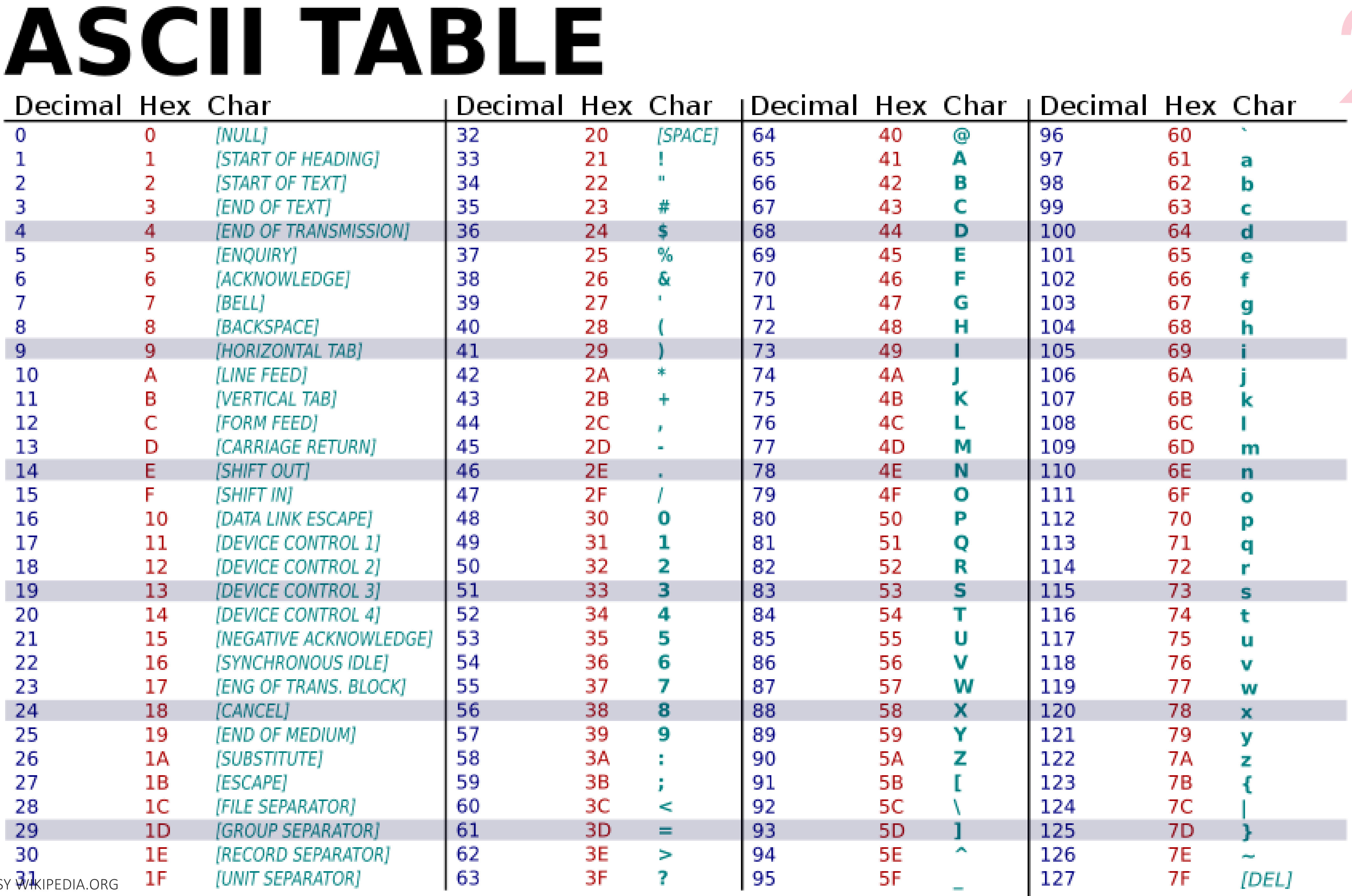
Case sensitive ‘a’, ‘A’ different

IMAGE COURTESY WIKIPEDIA.ORG



ASCII TABLE

Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	26	&	70	46	F	102	66	f
7	7	[BELL]	39	27	'	71	47	G	103	67	g
8	8	[BACKSPACE]	40	28	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	42	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	43	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	44	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	45	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
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28	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
29	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
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IMAGE COURTESY WIKIPEDIA.ORG

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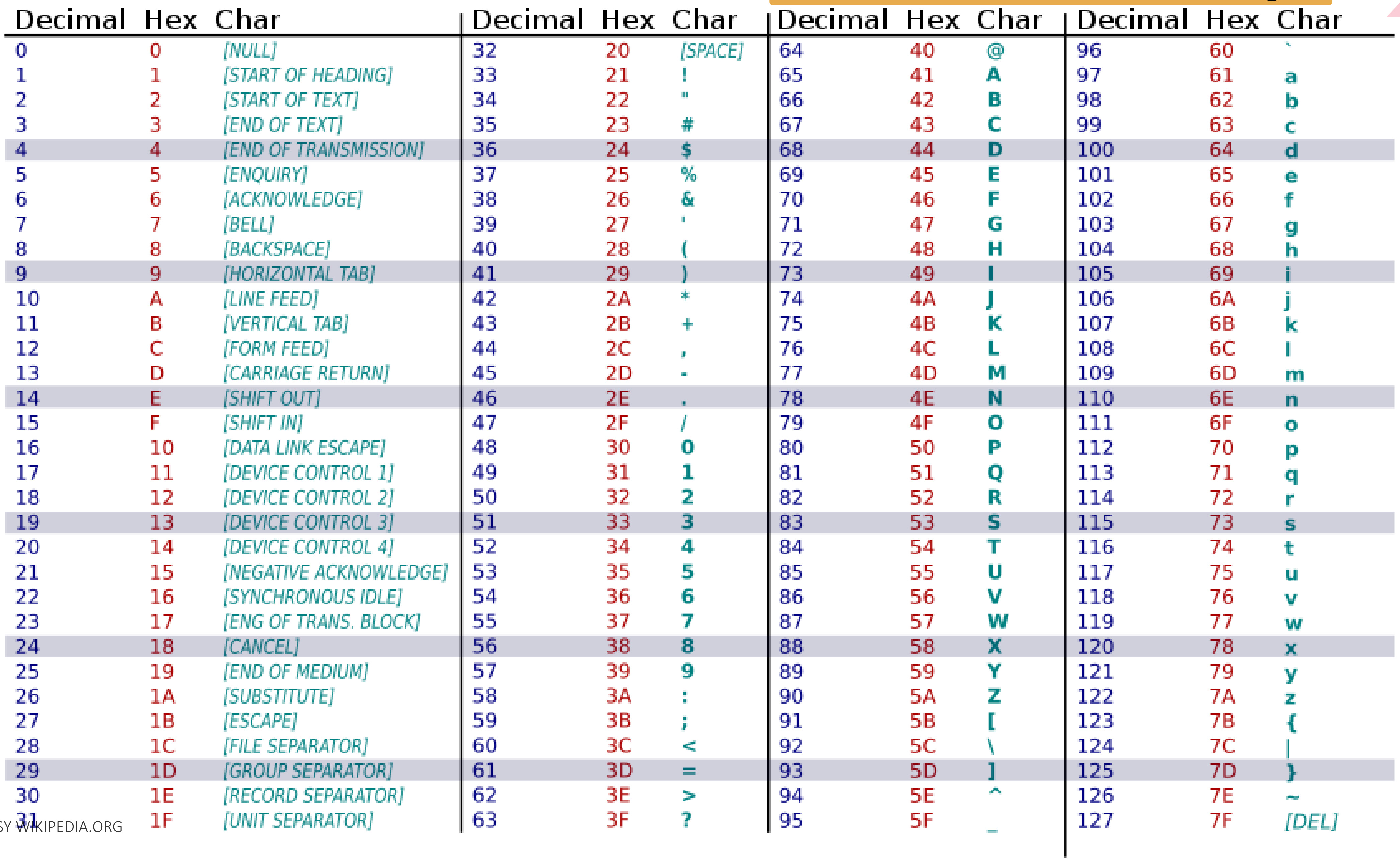

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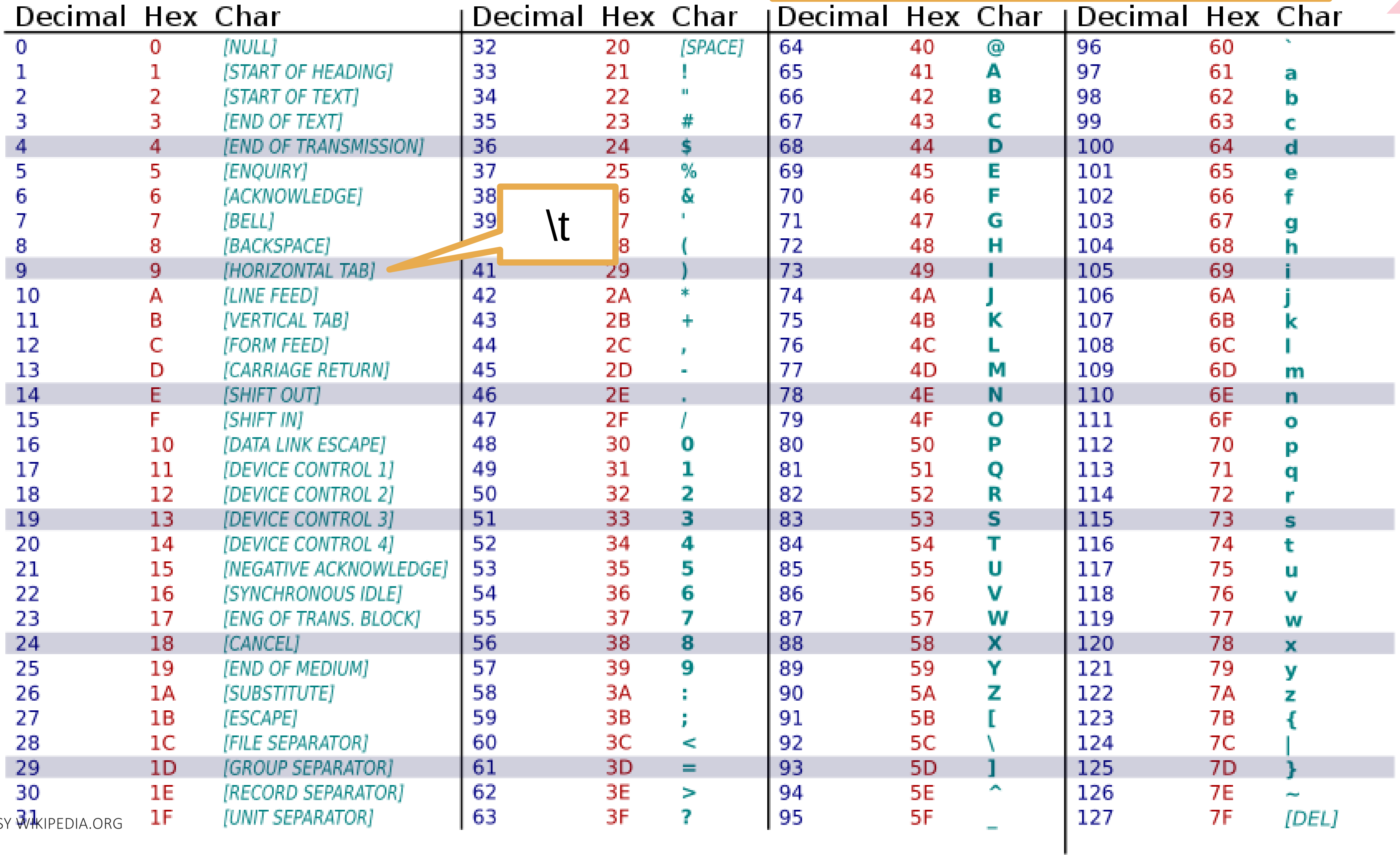

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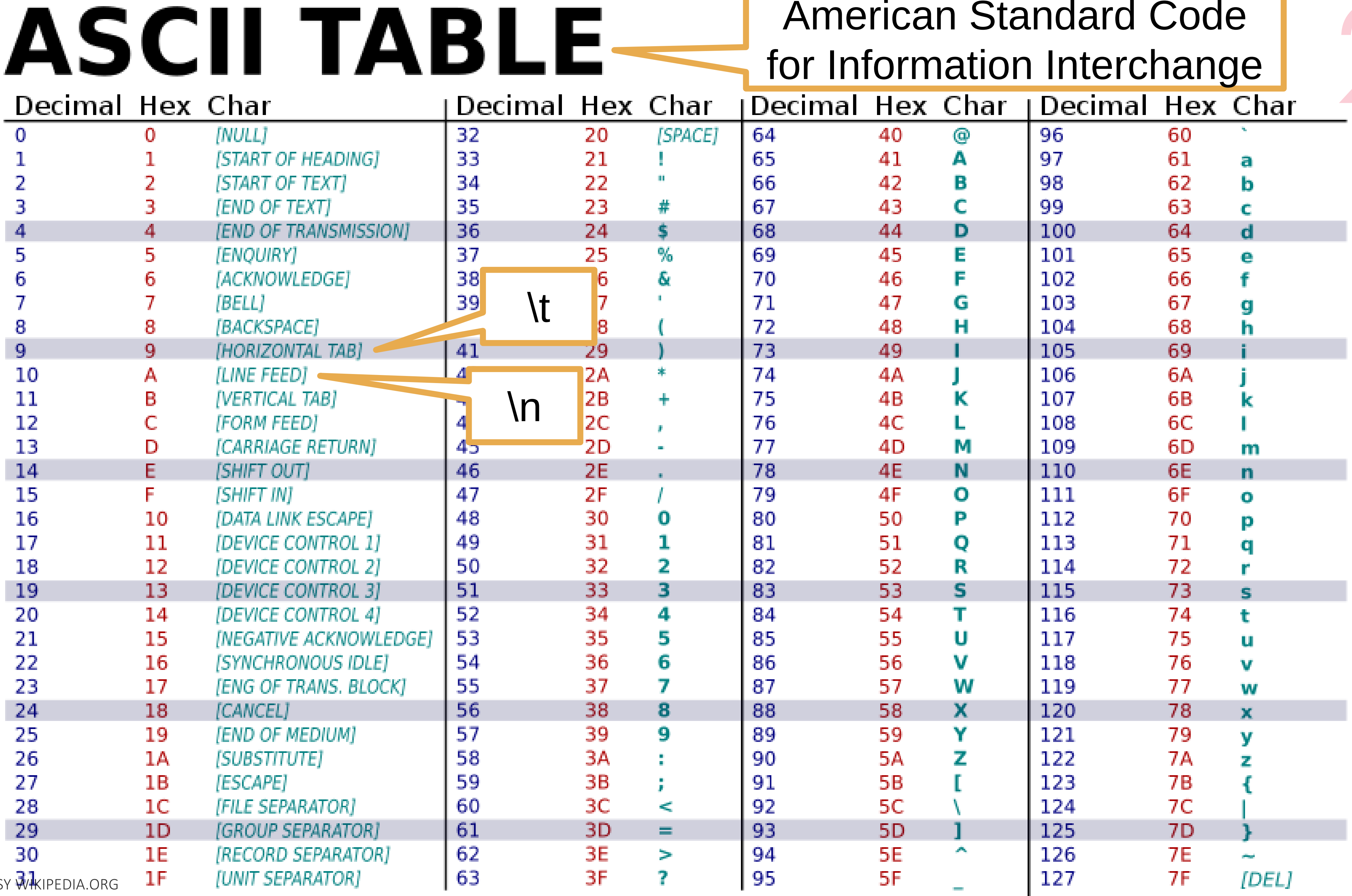

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31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

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IMAGE COURTESY WIKIPEDIA.ORG

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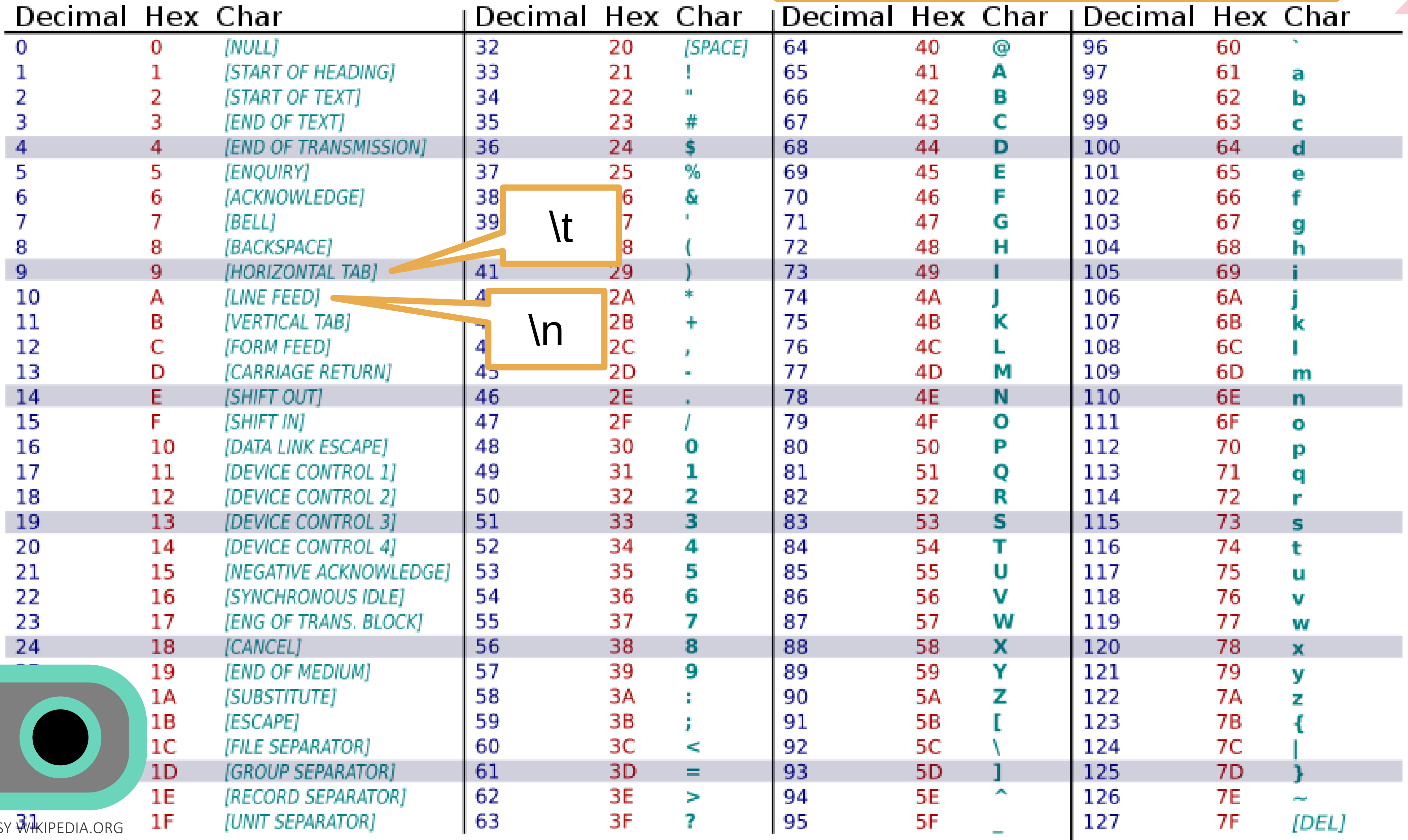

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14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[SHIFT IN]	47	2F	/	79	4F	O	111	6F	o
16	10	[DATA LINK ESCAPE]	48	30	0	80	50	P	112	70	p
17	11	[DEVICE CONTROL 1]	49	31	1	81	51	Q	113	71	q
18	12	[DEVICE CONTROL 2]	50	32	2	82	52	R	114	72	r
19	13	[DEVICE CONTROL 3]	51	33	3	83	53	S	115	73	s
20	14	[DEVICE CONTROL 4]	52	34	4	84	54	T	116	74	t
21	15	[NEGATIVE ACKNOWLEDGE]	53	35	5	85	55	U	117	75	u
22	16	[SYNCHRONOUS IDLE]	54	36	6	86	56	V	118	76	v
23	17	[ENG OF TRANS. BLOCK]	55	37	7	87	57	W	119	77	w
24	18	[CANCEL]	56	38	8	88	58	X	120	78	x
[illegible]	19	[END OF MEDIUM]	57	39	9	89	59	Y	121	79	y
[illegible]	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
[illegible]	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
[illegible]	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
[illegible]	1D	[GROUP SEPARATOR]	61	3D	=	93	5D	]	125	7D	}
[illegible]	1E	[RECORD SEPARATOR]	62	3E	>	94	5E	^	126	7E	~
31	1F	[UNIT SEPARATOR]	63	3F	?	95	5F	_	127	7F	[DEL]

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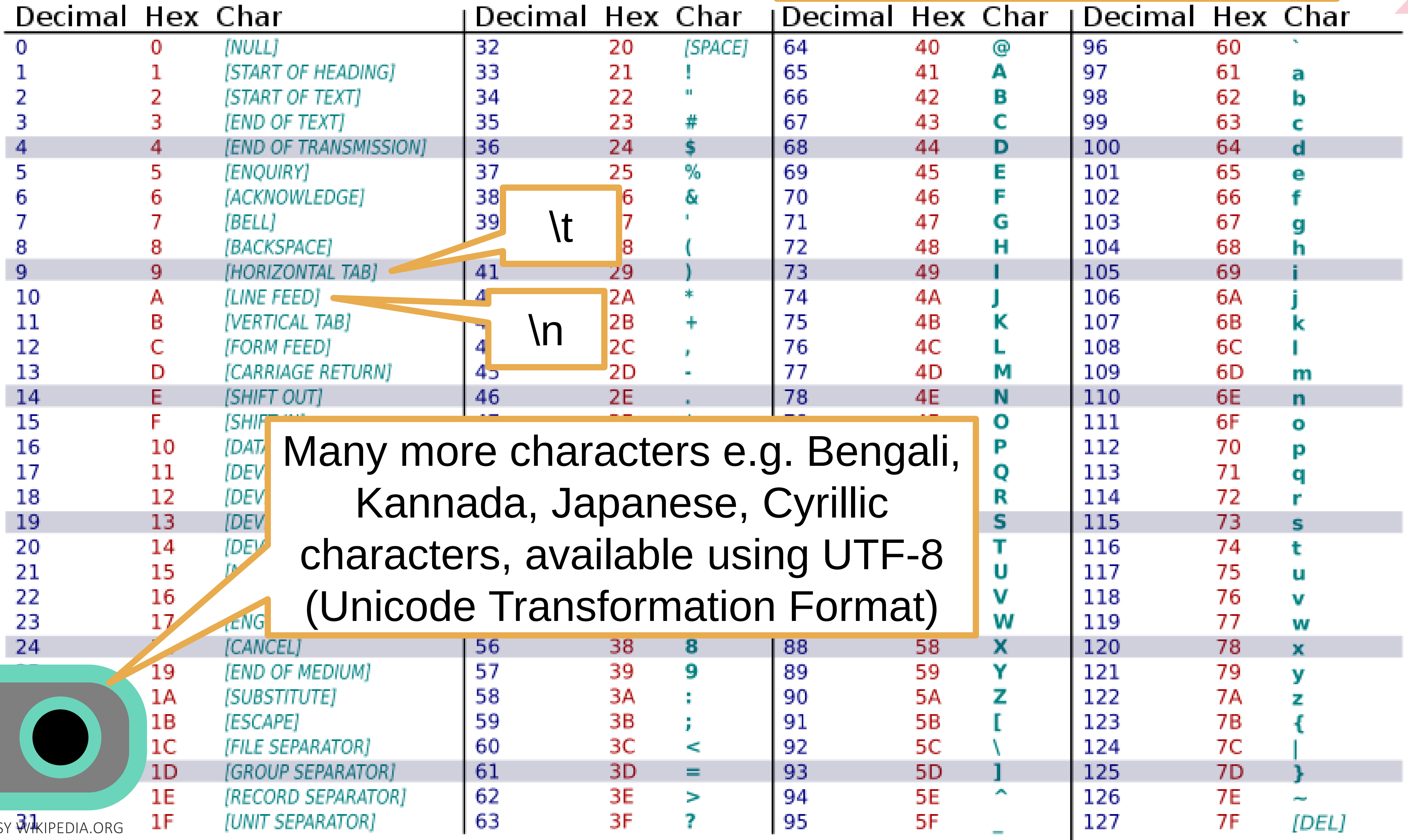
IMAGE COURTESY WIKIPEDIA.ORG

ASCII TABLE

American Standard Code for Information Interchange



Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char	Decimal	Hex	Char
0	0	[NULL]	32	20	[SPACE]	64	40	@	96	60	`
1	1	[START OF HEADING]	33	21	!	65	41	A	97	61	a
2	2	[START OF TEXT]	34	22	"	66	42	B	98	62	b
3	3	[END OF TEXT]	35	23	#	67	43	C	99	63	c
4	4	[END OF TRANSMISSION]	36	24	$	68	44	D	100	64	d
5	5	[ENQUIRY]	37	25	%	69	45	E	101	65	e
6	6	[ACKNOWLEDGE]	38	[illegible]	&	70	46	F	102	66	f
7	7	[BELL]	39	[illegible]	'	71	47	G	103	67	g
8	8	[BACKSPACE]	[illegible]	[illegible]	(	72	48	H	104	68	h
9	9	[HORIZONTAL TAB]	41	29	)	73	49	I	105	69	i
10	A	[LINE FEED]	[illegible]	2A	*	74	4A	J	106	6A	j
11	B	[VERTICAL TAB]	[illegible]	2B	+	75	4B	K	107	6B	k
12	C	[FORM FEED]	[illegible]	2C	,	76	4C	L	108	6C	l
13	D	[CARRIAGE RETURN]	[illegible]	2D	-	77	4D	M	109	6D	m
14	E	[SHIFT OUT]	46	2E	.	78	4E	N	110	6E	n
15	F	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	O	111	6F	o
16	10	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	P	112	70	p
17	11	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Q	113	71	q
18	12	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	R	114	72	r
19	13	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	S	115	73	s
20	14	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	T	116	74	t
21	15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	U	117	75	u
22	16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	V	118	76	v
23	17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	W	119	77	w
24	[illegible]	[CANCEL]	56	38	8	88	58	X	120	78	x
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[illegible]	1A	[SUBSTITUTE]	58	3A	:	90	5A	Z	122	7A	z
[illegible]	1B	[ESCAPE]	59	3B	;	91	5B	[	123	7B	{
[illegible]	1C	[FILE SEPARATOR]	60	3C	<	92	5C	\	124	7C	|
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Many more characters e.g. Bengali, Kannada, Japanese, Cyrillic characters, available using UTF-8 (Unicode Transformation Format)

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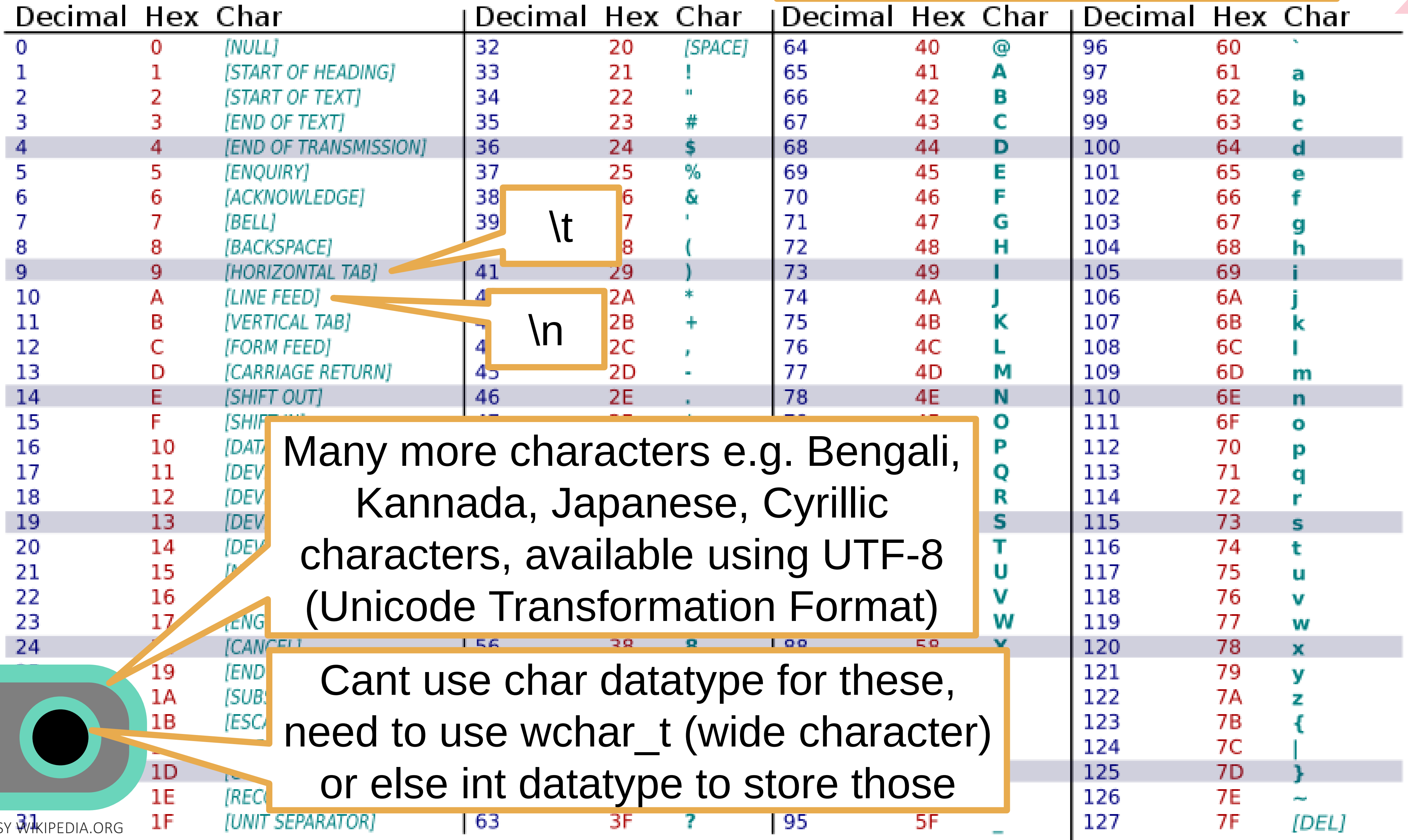

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15	F	[SHIF	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	O	111	6F	o
16	10	[DAT	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	P	112	70	p
17	11	[DEV	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Q	113	71	q
18	12	[DEV	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	R	114	72	r
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[illegible]	1A	[SUB	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	122	7A	z
[illegible]	1B	[ESC	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	123	7B	{
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	124	7C	|
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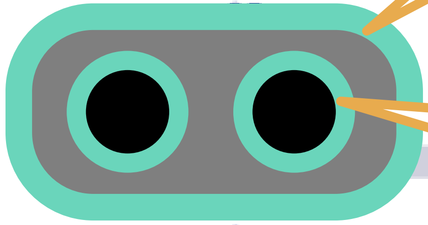

Cant use char datatype for these, need to use wchar_t (wide character) or else int datatype to store those

IMAGE COURTESY WIKIPEDIA.ORG

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When using characters in arithmetic, relational, logical expressions, integer (ASCII) value of character gets used

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Exercise: write code to flip the case i.e. A→a, d→D etc

Character Arrays

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Declaring and Using Strings

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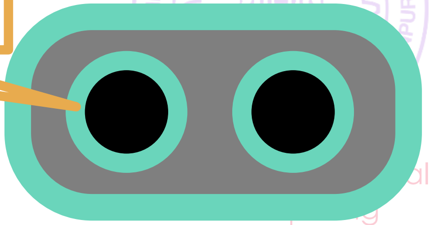
Partly initialized since only 11 characters this phrase



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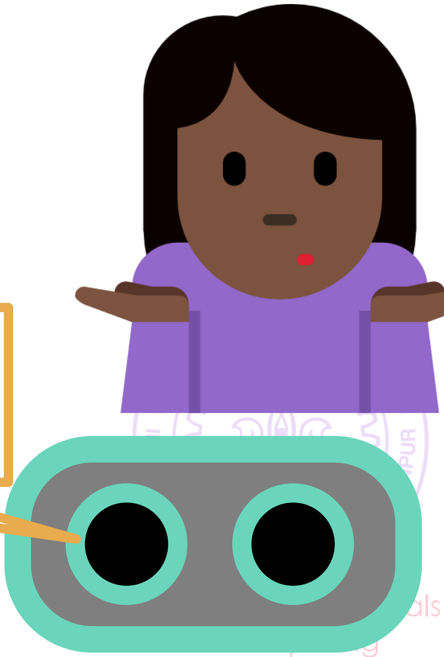

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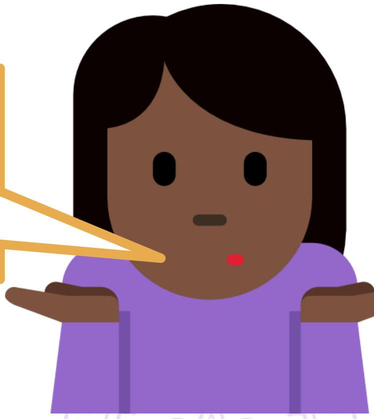

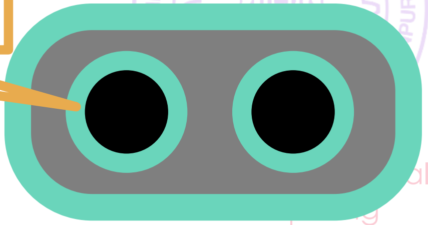

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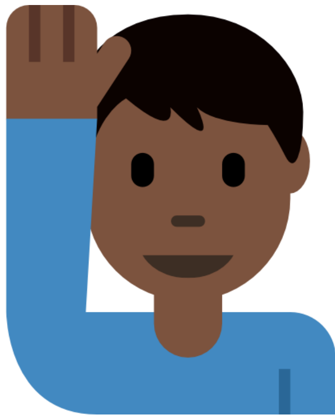

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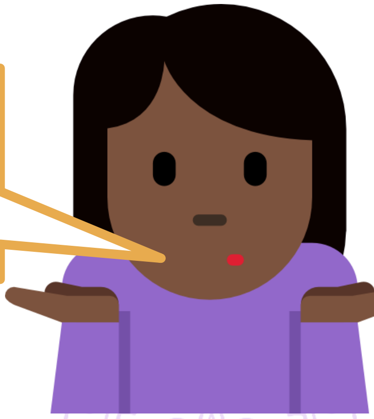

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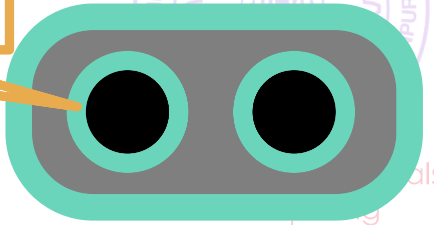

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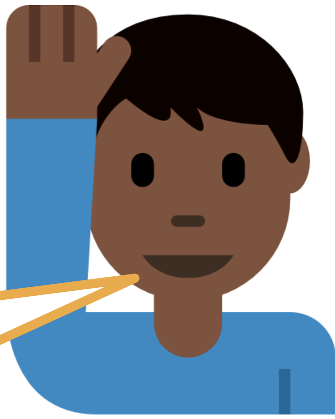

The space between the two words. Space is a character too!

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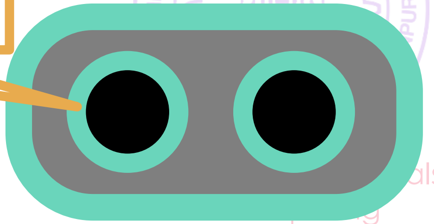

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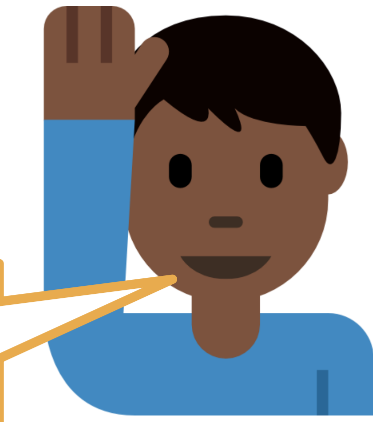

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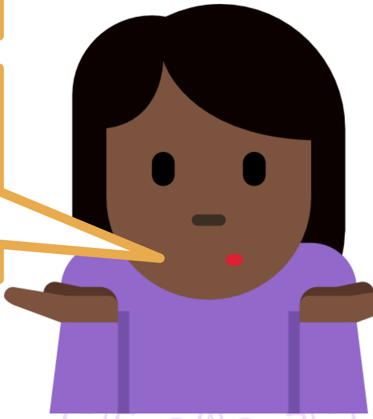

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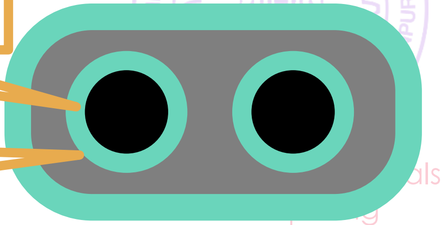

Very good!

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```
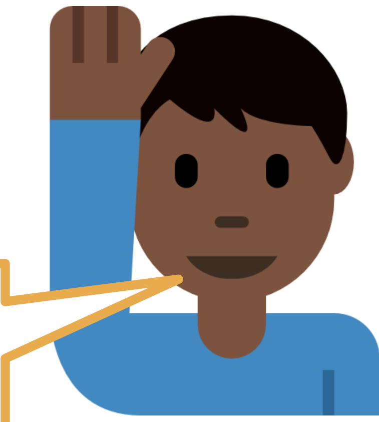
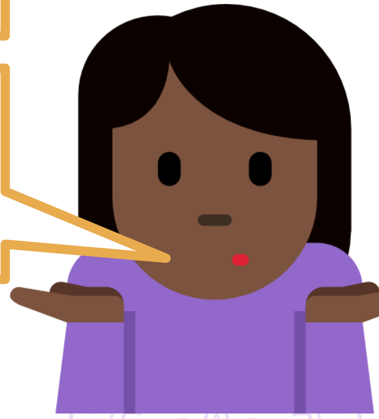
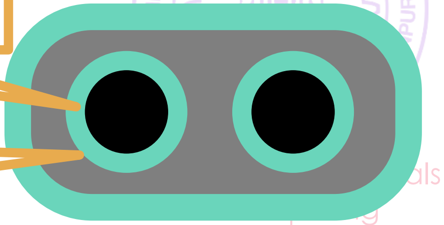

Just like int arrays, char arrays cannot be initialized this way after declaration is done




Hello has 5 characters, World has 5, what is the 11th character?



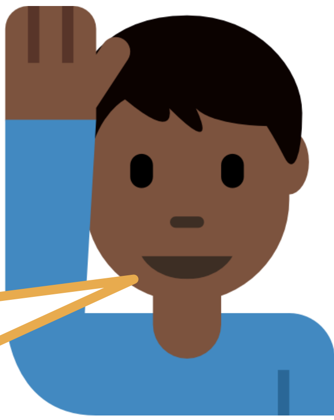
Declaring and Using Strings

Can be initialized at time of declaration

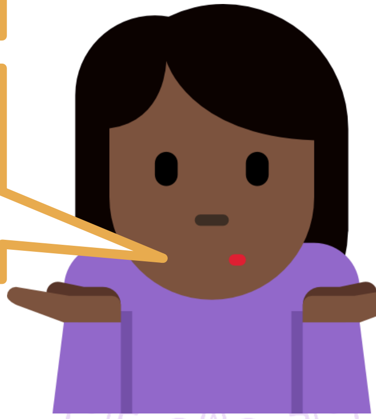
```
char str[50] = {‘H’,’e’,’l’,’l’,’o’,’ ‘,‘W’,’o’,’r’,’l’,’d’};
char str[50] = "Hello World";
```

Just like int arrays, char arrays cannot be initialized this way after declaration is done

Other ways: scanf (with %s), gets

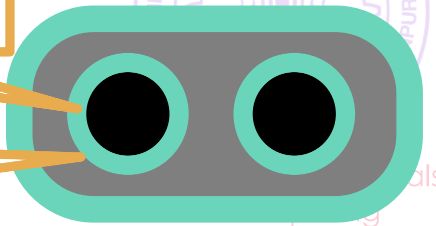


The space between the two words. Space is a character too!



Hello has 5 characters, World has 5, what is the 11th character?

Partly initialized since only 11 characters this phrase



Very good!

Declaring and Using Strings

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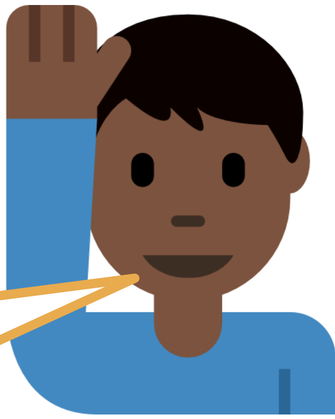
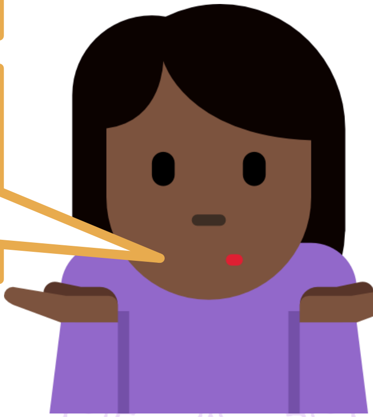
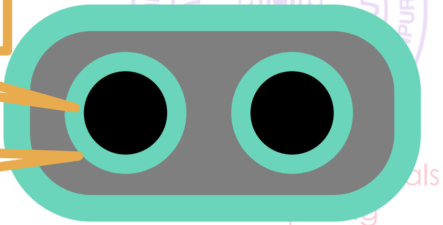
Both are very unsafe – crash!

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Hello has 5 characters, World has 5, what is the 11th character?

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Declaring and Using Strings

Can be initialized at time of declaration

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char str[50] = {'H','e','l','l','o',' ','W','o','r','l','d'};
char str[50] = "Hello World";
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To print: puts, printf (with %s)

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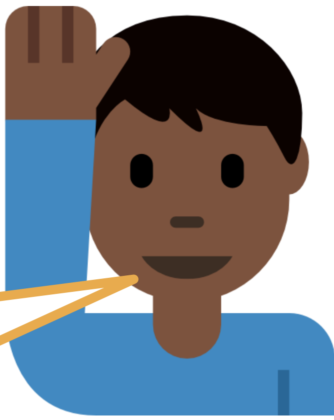

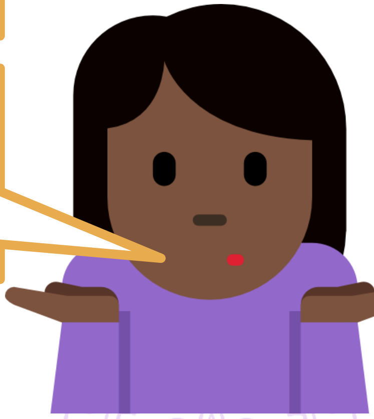

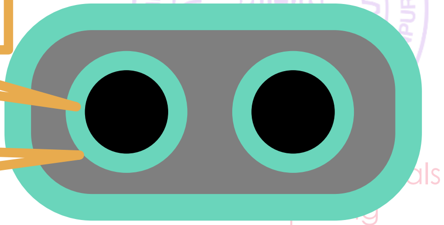

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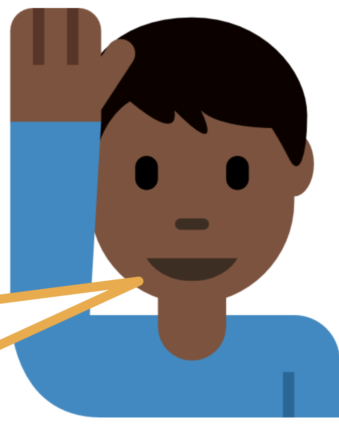
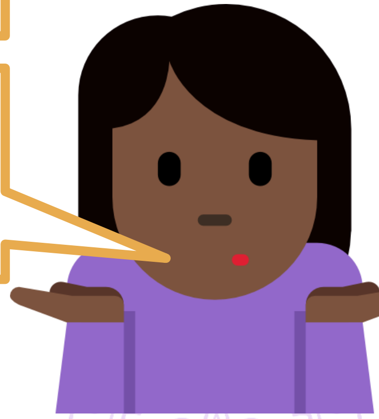
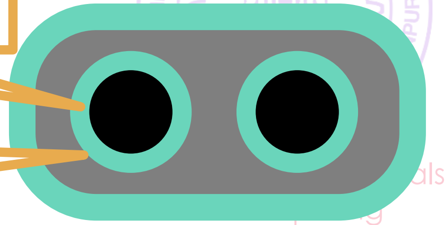
getline most powerful but have to wait for it a bit ☺

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