EPHICACY

Handling Special Characters

Author : Aravindan Karunakaran

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Agenda

- Digital vs Physical Data
- Number systems
- What, why, how? – Handling Special characters
- Double-Byte Character sets (DBCS)

Digital vs Physical Data

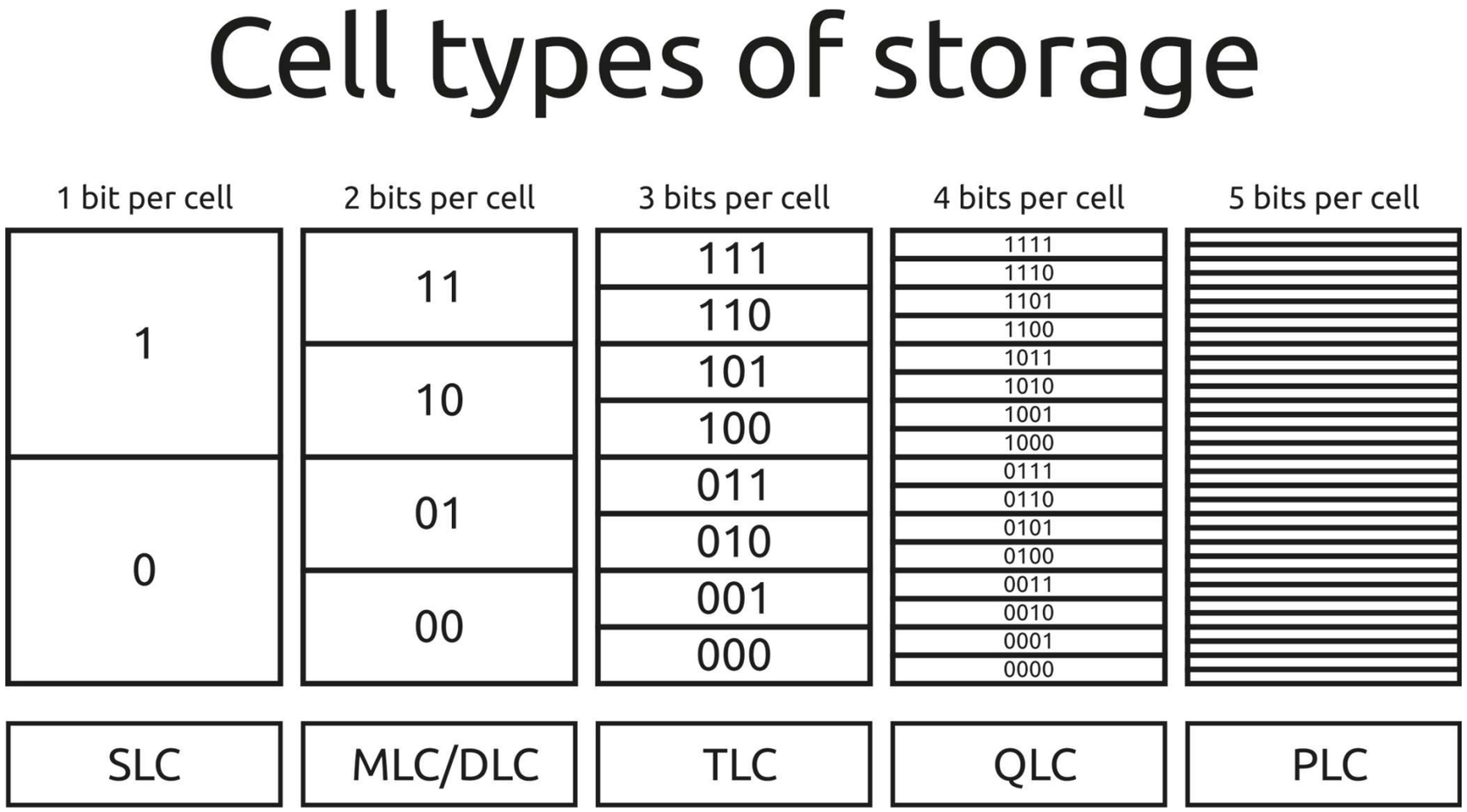
Physical

Digital

Number systems

Decimal System	Binary System	Octal System	Hexadecimal System
0	00000000	000	0
1	00000001	001	1
2	00000010	002	2
3	00000011	003	3
4	00000100	004	4
5	00000101	005	5
6	00000110	006	6
7	00000111	007	7
8	00001000	010	8
9	00001001	011	9
10	00001010	012	A
11	00001011	013	B
12	00001100	014	C
13	00001101	015	D
14	00001110	016	E
15	00001111	017	F

Memory cell types



What?

Basic Computer Keyboard – Special characters

Example of Special characters outside ASCII standard

“ ” ‘ ’ µ © ™ ®

ASCII standards

Control characters/ Non-printable characters

Acceptable ASCII characters

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

Extended ASCII table

Character encoding

Windows-1252

- UTF-8 (Unicode)
- CP437
- Windows-1252
- Big5 (Chinese)
- CP866 (Russian)
- EUC-JP (Japanese)
- EUC-KR (Korean)
- GB 18030 (Chinese)
- ISO-8859-1 (Latin1/Western European)
- ISO-8859-2 (Latin2/Eastern European)
- ISO-8859-3 (Latin3/South European)
- ISO-8859-4 (Latin4/North European)
- ISO-8859-5 (Latin/Cyrillic)
- ISO-8859-6 (Latin/Arabic)
- ISO-8859-7 (Latin/Greek)
- ISO-8859-8 (Latin/Hebrew)
- ISO-8859-10 (Latin6/Nordic)
- ISO-8859-13 (Latin7/Baltic Rim)
- ISO-8859-14 (Latin8/Celtic)
- ISO-8859-15 (Latin9/Western European)

Character encoding

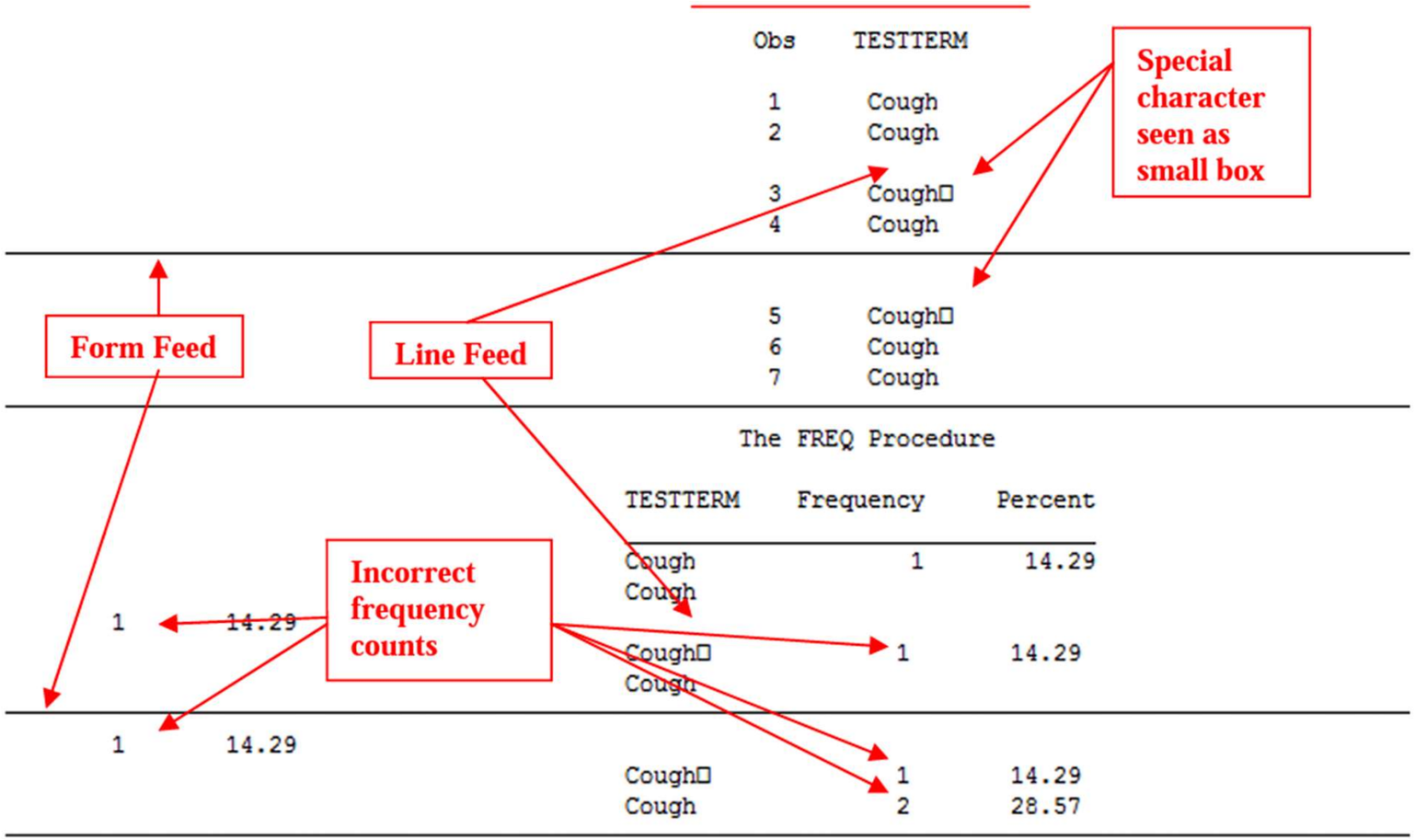
ISO-8859-1 (Latin1/Western European)

128	80	€	153	99	™	179	B3	³	205	CD	Í	231	E7	ç
129	81		154	9A	š	180	B4	´	206	CE	Î	232	E8	è
130	82	‚	155	9B	›	181	B5	µ	207	CF	Ï	233	E9	é
131	83	ƒ	156	9C	œ	182	B6	¶	208	D0	Đ	234	EA	ê
132	84	„	157	9D		183	B7	·	209	D1	Ñ	235	EB	ë
133	85	…	158	9E	ž	184	B8	¸	210	D2	Ò	236	EC	ì
134	86	†	159	9F	Ÿ	185	B9	¹	211	D3	Ó	237	ED	í
135	87	‡	160	A0		186	BA	º	212	D4	Ô	238	EE	î
136	88	ˆ	161	A1	¡	187	BB	»	213	D5	Õ	239	EF	ï
137	89	‰	162	A2	¢	188	BC	¼	214	D6	Ö	240	F0	ð
138	8A	Š	163	A3	£	189	BD	½	215	D7	×	241	F1	ñ
139	8B	‹	164	A4	¤	190	BE	¾	216	D8	Ø	242	F2	ò
140	8C	Œ	165	A5	¥	191	BF	¿	217	D9	Ù	243	F3	ó
141	8D		166	A6	¦	192	C0	À	218	DA	Ú	244	F4	ô
142	8E	Ž	167	A7	§	193	C1	Á	219	DB	Û	245	F5	õ
143	8F		168	A8	¨	194	C2	Â	220	DC	Ü	246	F6	ö
144	90		169	A9	©	195	C3	Ã	221	DD	Ý	247	F7	÷
145	91	‘	170	AA	ª	196	C4	Ä	222	DE	Þ	248	F8	ø
146	92	’	171	AB	«	197	C5	Å	223	DF	ß	249	F9	ù
147	93	“	172	AC	¬	198	C6	Æ	224	E0	à	250	FA	ú
148	94	”	173	AD		199	C7	Ç	225	E1	á	251	FB	û
149	95	•	174	AE	®	200	C8	È	226	E2	â	252	FC	ü
150	96	–	175	AF	¯	201	C9	É	227	E3	ã	253	FD	ý
151	97	—	176	B0	°	202	CA	Ê	228	E4	ä	254	FE	þ
152	98	˜	177	B1	±	203	CB	Ë	229	E5	å	255	FF	ÿ
			178	B2	²	204	CC	Ì	230	E6	æ			

Why?

- Issue in line/page alignment, data spill over.
- Wrong statistics or count in output.
- Issue while executing programs.
- Issue while converting datasets to XPT files.
- P21 issue.

Example – why?


Obs TESTTERM
1 Cough
2 Cough
3 Cough□
4 Cough
5 Cough□
6 Cough
7 Cough
Special character seen as small box
Form Feed
Line Feed
Incorrect frequency counts
The FREQ Procedure
TESTTERM Frequency Percent
Cough 1 14.29
Cough
1 14.29
Cough□ 1 14.29
Cough
1 14.29
Cough□ 1 14.29
Cough 2 28.57

How?

1. Deleting/Compressing all Non-printable characters (from 0 – 31 and 127).

2. Finding and replacing the Extended ASCII characters (from 128 – 256) with appropriate ASCII characters (from 32 – 126).
   a) Scan and Print special characters in a file (special_char.txt) during first extraction.
   b) Mention the replacement character in the file and use it to replace the special characters in consecutive extractions.

E.g. µg -> ug

Example – How?

- Compressing a specific Non-printable character.

```
labunit=compress(labunit,'09'x); *remove the horizontal-tab;
```

- Compressing most of the Non-printable character (some Non-printable characters can not be compressed with the following method E.g. ‘A0’).

```
varname=compress(varname,,'kw');
```

- Replacing Extended ASCII character µ with u

```
labunit=tranwrd(labunit,'B5'x,'u'); *replace µ with u;
```

Compressing all Non-printable and Extended ASCII characters

```
data &ds (drop=i npschars);
   set &ds;
   array charvars _character_;
   length npschars $161; *161 is the total number of characters from 0 to 31, 127 to 255;

   do i=0 to 31, 127 to 255;
      if i=0 then npschars=byte(i);
      else npschars=trim(npschars)||byte(i);
   end;

   do over charvars;
       charvars=compress(charvars, npschars);
   end;
run;
```

Finding and Replacing all Extended ASCII Characters

```
data _td_&ds(drop=i);
   set &ds(keep=_character_);
   array charvars{*} _character_;
   length npschars $96; *96 is the total number of characters from 32 to 126;
   retain npschars;

   if _n_=1 then do;
      do i=32 to 126;
         if i=32 then npschars=byte(i);
         else npschars=trim(npschars)||byte(i);
      end;
   end;

   do i=1 to dim(charvars);
      char_vars(i)=compress(charvars(i),npschars);
   end;
run;
```

Finding and Replacing Extended ASCII Characters - Continued

```
ods exclude all;
ods output nlevels=_td_nlevels;
proc freq data=_td_&ds. nlevels;
   tables _character_ / noprint;
run;
ods exclude none;

%let varlist=; * list of variables with special characters;
proc sql noprint;
   select TableVar into :varlist separated by " "
   from _td_nlevels
   where nnonmisslevels ne 0;
quit;
```

Double-Byte Character sets (DBCS)

- Because East Asian languages have thousands of characters, double (two) bytes of information are needed to represent most characters.
- Proc contents can be used to determine the Encoding of the dataset.
- To work with datasets created in DBCS/MBCS encoding there are different versions of SAS editor available with different encoding options.
- UTF-8 is an DBCS/MBCS encoding that contains the Latin-script languages, Greek, Cyrillic, Arabic, and Hebrew. It also includes East Asian languages such as Japanese, Chinese, and Korean.

THANK YOU!

aravindan.karunakaran@ephicacy.com

References

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