

3.12 Code 39 - barcode generation

Write a program in the MIPS assembly language which encodes a text using Code 39 barcode.

Code 39 description

Code 39 encodes 43 symbols. The start and stop symbol is *. It can not be used in encoded data. There are two widths of bars and spaces. The thickness ratio of wide and thin bars and spaces may vary from 2,2:1 to 3:1 (in a given barcode it is constant). Each symbol consists of five bars and four spaces. The size of the space between two characters is not defined – usually it equals the width of thin bar or space.

Code 39 consists of:

- start symbol *,
- encoded data,
- check symbol,
- stop symbol.

Check symbol

The check symbol is calculated according to the formula:

$$check_symbol_value = \left(\sum_{i=1}^{data\ count} data_value[i] \right) \bmod 43$$

Character encoding

The encoding of characters is presented in table 1. Last column contains relative widths of bars (B) and spaces (S). Digit 2 represents wide bar or space, digit 1 – thin bar or space.

Table 1. Character codes

Value	Char	B	S	B	S	B	S	B	S	B
0	0	1	1	1	2	2	1	2	1	1
1	1	2	1	1	2	1	1	1	1	2
2	2	1	1	2	2	1	1	1	1	2
3	3	2	1	2	2	1	1	1	1	1
4	4	1	1	1	2	2	1	1	1	2
5	5	2	1	1	2	2	1	1	1	1
6	6	1	1	2	2	2	1	1	1	1
7	7	1	1	1	2	1	1	2	1	2
8	8	2	1	1	2	1	1	2	1	1
9	9	1	1	2	2	1	1	2	1	1
10	A	2	1	1	1	1	2	1	1	2
11	B	1	1	2	1	1	2	1	1	2
12	C	2	1	2	1	1	2	1	1	1
13	D	1	1	1	1	2	2	1	1	2
14	E	2	1	1	1	2	2	1	1	1
15	F	1	1	2	1	2	2	1	1	1
16	G	1	1	1	1	1	2	2	1	2
17	H	2	1	1	1	1	2	2	1	1
18	I	1	1	2	1	1	2	2	1	1
19	J	1	1	1	1	2	2	2	1	1
20	K	2	1	1	1	1	1	1	2	2

21	L	1	1	2	1	1	1	1	2	2
22	M	2	1	2	1	1	1	1	2	1
23	N	1	1	1	1	2	1	1	2	2
24	O	2	1	1	1	2	1	1	2	1
25	P	1	1	2	1	2	1	1	2	1
26	Q	1	1	1	1	1	1	2	2	2
27	R	2	1	1	1	1	1	2	2	1
28	S	1	1	2	1	1	1	2	2	1
29	T	1	1	1	1	2	1	2	2	1
30	U	2	2	1	1	1	1	1	1	2
31	V	1	2	2	1	1	1	1	1	2
32	W	2	2	2	1	1	1	1	1	1
33	X	1	2	1	1	2	1	1	1	2
34	Y	2	2	1	1	2	1	1	1	1
35	Z	1	2	2	1	2	1	1	1	1
36	-	1	2	1	1	1	1	2	1	2
37	.	2	2	1	1	1	1	2	1	1
38	space	1	2	2	1	1	1	2	1	1
39	\$	1	2	1	2	1	2	1	1	1
40	/	1	2	1	2	1	1	1	2	1
41	+	1	2	1	1	1	2	1	2	1
42	%	1	1	1	2	1	2	1	2	1
	*	1	2	1	1	2	1	2	1	1

Input

- the width in pixels of narrowest bar,
- text to be encoded.

Output

- BMP file containing the barcode image:
 - Sub format: 24 bits RGB – no compression,
 - Image size: 600x50 px,
 - Colors: bars – black, background – white.
- file name: “output.bmp”

Remarks:

1. Do not store bars and spaces patterns in coding table as character strings.

References:

- [1] BMP file format – see section 4.2
- [2] “**Code 39**”, https://en.wikipedia.org/wiki/Code_39
- [3] Example images, <http://galera.ii.pw.edu.pl/~zsz/ecoar/images/barcodes>
- [4] Example program for bmp reading/writing,
http://galera.ii.pw.edu.pl/~zsz/ecoar/bmp/bmp_mips.zip