IALP 2011 – Bar codes

P. Stallinga

MIEET 1º ano

A bar code is a set of lines coding a product number. The most famous bar code is UPC (Universal Product Code), used for most products in shops (in supermarkets, for food in general sometimes shorter versions are found). A version of this is EAN-13 (European Article Number with 13 digits) which is encountered in European shops and which we will discuss here.

Basic working

The product number has 12 codified digits, divided in two groups of 6. This is preceded by one (uncoded) digit. (This one plus the first or first two coded digits represent the country of origin, for example, “560” is Portugal, “00” is United States).

Each digit is coded by two black and two white bars of width 1 to 4 units, with a total width of 7 units. Before the code, at the end of the code, and in the middle a synchronization pattern is placed consisting of two single-width black bars spaced by single-width white bars. They can be recognized by them being a little bit longer than the others. The codes for these are (“0” is white, “1” is black)

Synchronization code	Pattern
Start	0101
Middle	01010
Stop	1010

An example is given here with the individual patterns highlighted yellow and green:

A digit can be coded in three different ways, depending on its position in the number. Digits on the right side (last six digits) are always coded normally and always start with a black line and end with a white line. Digits on the left side (first 6 digits) can be either coded the inverse of the normal pattern (1 becomes 0 and vice versa), or its reverse order (first bit becomes last bit, etc.). Looking at the table below will clarify what is meant with this.

Digit	Normal Code	Inverse code	Reverse code
0	1110010	0001101	0100111
1	1100110	0011001	0110011
2	1101100	0010011	0011011
3	1000010	0111101	0100001
4	1011100	0100011	0011101
5	1001110	0110001	0111001
6	1010000	0101111	0000101
7	1000100	0111011	0010001
8	1001000	0110111	0001001
9	1110100	0001011	0010111

The six left digits are either coded inverse (I) or reverse (R) depending on their position in the number and the value of the zeroth non-coded digit. The first (coded) digit is always coded inverse. The others are coded according to the following table:

Non-coded digit	Coding of coded digits
0	IIIIII-NNNNNN
1	IIRIRR-NNNNNN
2	IIRRIR-NNNNNN
3	IIRRRI-NNNNNN
4	IRIIRR-NNNNNN
5	IRRIIR-NNNNNN
6	IRRRII-NNNNNN
7	IRIRIR-NNNNNN
8	IRIRRI-NNNNNN
9	IRRIRI-NNNNNN

Note that, since the pattern of coding types of the first 6 digits is unique, in this way it is possible to recover the zeroth non-coded digit! (This shows the history of the EAN-13 code, as a derivative of the UPC-12 code – which is equal to the the EAN-13 with the

zeroth digit equal to 0 -, compatibility prohibited the zeroth digit to be coded directly). An example is given below with the non-coded digit equal to “5”.

Meaning of the number

The first digits codify the country of origin. This includes the zeroth non-coded digit plus one or two more digits. The rest of the first six digits are reserved for the producer. The first five digits are the choice of the producer. The last digit is a checksum code.

The table below shows the country codes (where the institute that issued a code resides, **not necessarily the country where the product was made!**)

00-13	USA & Canada
20-29	In-Store Functions
30-37	France
40-44	Germany
45,49	Japan
46	Russian Federation
471	Taiwan
474	Estonia
475	Latvia
477	Lithuania

479	Sri Lanka
480	Philippines
482	Ukraine
484	Moldova
485	Armenia
486	Georgia
487	Kazakhstan
489	Hong Kong
50	United Kingdom
520	Greece

528	Lebanon
529	Cyprus
531	Macedonia
535	Malta
539	Ireland
54	Belgium & Luxembourg
560	**Portugal**
569	Iceland
57	Denmark

590	Poland
594	Romania
599	Hungary
600,601	South Africa
609	Mauritius
611	Morocco
613	Algeria
619	Tunisia
622	Egypt
625	Jordan
626	Iran
64	Finland
690-692	China
70	Norway
729	Israel
73	Sweden
740	Guatemala
741	El Salvador
742	Honduras
743	Nicaragua

744	Costa Rica
746	Dominican Republic
750	Mexico
759	Venezuela
76	Switzerland
770	Colombia
773	Uruguay
775	Peru
777	Bolivia
779	Argentina
780	Chile
784	Paraguay
785	Peru
786	Ecuador
789	Brazil
80-83	Italy
84	Spain
850	Cuba
858	Slovakia
859	Czech Republic

860	Yugoslavia
869	Turkey
87	Netherlands
880	South Korea
885	Thailand
888	Singapore
890	India
893	Vietnam
899	Indonesia
90,91	Austria
93	Australia
94	New Zealand
955	Malaysia
977	ISSN
978	ISBN
979	ISMN
980	Refund receipts
981,982	Common Currency Coupons
99	Coupons

ISSN: International Standard Serial Number for Periodicals
ISBN: International Standard Book Numbering
ISMN: International Standard Music Number

Checksum

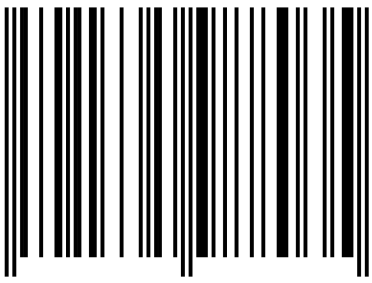
The checksum number is a way to check if something went wrong in the reading of the number. The sum of all digits, including the checksum, needs to be a multiple of 10. For this calculation, every even digit (counting from the right) has to be multiplied by 3 before adding tot he sum. As an example, the above bar code is 5 603577 027125 and

$$5 + 3x6 + 0+ 3x3 + 5 + 3x7 + 7 + 3x0 + 2 + 3x7 + 1 + 3x2 + 5 = 100$$

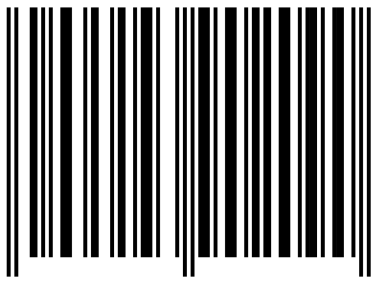
and the checksum is correct because 100 is a multiple of 10.

Exercises

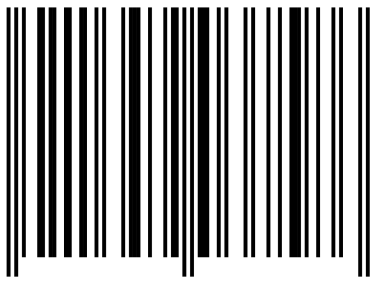
1) What is the code for the bar codes below (including the zeroth digit!)



Code:
Country:
Checksum:



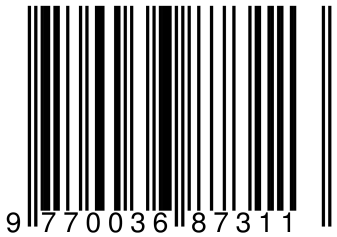
Code:
Country:
Checksum:



Code:
Country:
Checksum:

2) Draw the barcode for 5602007192198

3) What is the checksum of the bar code below:

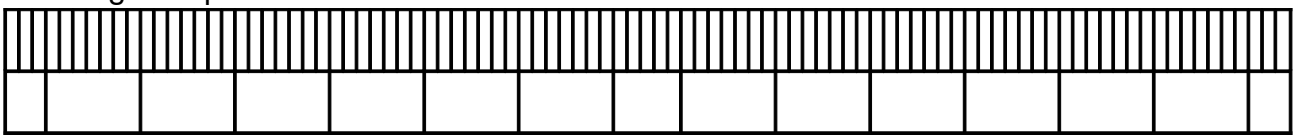


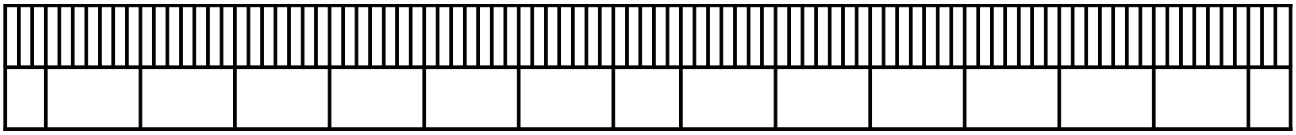
Checksum:

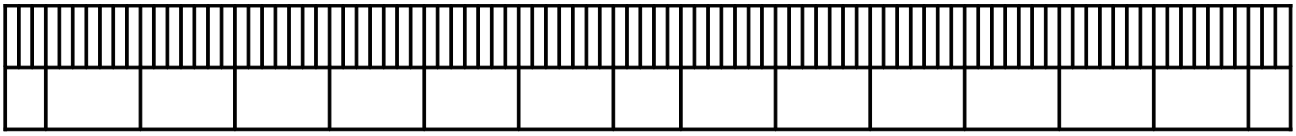
4) The price is not coded into the EAN. Why not?

5) The Da Vince code? In every code there is the number 666. Find out where.

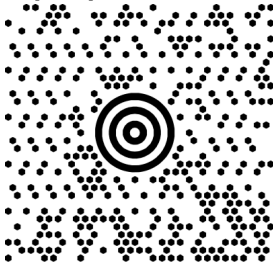
This might help:







Other, advanced (2D) codes



© 2011, Peter Stallinga, Universidade do Algarve

Based on: Linux GIMP (ImageMagick) Ubuntu

http://www.barcodeisland.com/ean13.phtml