EAN13 Numbers



The EAN-13 system is used with barcodes to check that the lines have been scanned and converted into numbers correctly. Each digit in the code is multiplied alternately by 1 and then 3, etc. These results are added together to give a total. This total is subtracted from the next multiple of 10 above the sum to give the check digit that is added to the end of the product code.

Whenever the code is scanned the first twelve digits are used to generate a Check Digit. This is compared to the original check digit. If they are the same then we know that the code has been scanned correctly. If they are different then the code has not been scanned correctly

For example, the product code 123456789012

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 |  |
| 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 |  |
| 1 | 6 | 3 | 12 | 5 | 18 | 7 | 24 | 9 | 0 | 1 | 6 | =92 |

The next multiple of 10 greater than 92 is 100, so 100-92=8. 8 is therefore is the check digit.

So the full EAN-13 code would be:

1234567890128

Whenever the code is scanned all 13 digits are used and the calculation above is performed again. If the result is a multiple of 10 then the code and check digit are correct: we know that the code has been scanned correctly. If they are different then the code has not been scanned correctly

For example, the full EAN-13 code 1234567890128

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 0 | 1 | 2 | 8 |  |
| 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 | 3 | 1 |  |
| 1 | 6 | 3 | 12 | 5 | 18 | 7 | 24 | 9 | 0 | 1 | 6 | 8 | =100 |

100 is an exact multiple of 10. The code and check digit are correct

The numbers in the code actually have meaning. The first three represent the country of origin.

E.g. 539 is Ireland, the next three digits represent the manufacturer’s code and the final six are the product code.

# Questions

For these questions DO NOT write a coded solution. That comes later! Work out the answers by hand (or use alternative software methods…..)

1. What would be the check digit for each of the following codes
   1. 684932019364 1
   2. 210987654321 0
   3. 678905432193 7
2. Calculate whether the following are valid EAN-13 codes
   1. 211234567897 9
   2. 269914882664 2
   3. 365490787052 5
   4. 455546380967 8
3. Calculate the full EAN-13 code for the following:
   1. Country of origin Greece (520)
   2. Manufacturer code 289
   3. Product code 784487
4. Create your own 12 digit code, calculate the check digit. Give the original 12 digits to someone else to work out the check digit.

# Exercise

Analyse the requirements for this system and design, develop and test a program to:

* Calculate the EAN13 code from an inputted 12 digit number
* Check the validity of a 13 digit EAN13 code

## Design

A design should consist of:

* A description of the scenario
* An algorithm (pseudocode) to describe a solution
* Description of any validation necessary
* Description of any variables needed
* Proposed test plan

Thoroughly analyse the requirements of this scenario and produce a complete analysis and design.