Marking recurrent decimals

Overview

[Wikipedia] A decimal representation of a real number is called a repeating decimal (or recurring decimal) if at some point it becomes periodic: there is some finite sequence of digits that is repeated indefinitely.

For example, the decimal representation of 1/3 = 0.3333333... (spoken as “0.3 repeating”, or “0.3 recurring”) becomes periodic just after the decimal point, repeating the single-digit sequence “3” infinitely.

A somewhat more complicated example is 3227/555 = 5.8144144144..., where the decimal representation becomes periodic at the second digit after the decimal point, repeating the sequence of digits “144” infinitely.

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Representing repeating decimals

See en.wikipedia.org for a detailed explanation of the issue.

One convention to indicate a repeating decimal is to put a horizontal line (known as a vinculum) above the repeated numerals:

$$\frac{1}{7} = 0.\overline{142857}$$ Repeated digits with vinculum (1)

Another convention is to place dots above the outermost numerals of the repeating digits:

$$\frac{1}{7} = 0.\dot{1}42857\dot{}$$ Repeated digit range marked with dots (2)

Where these methods are impossible, the extension may be represented by an ellipsis, although this may introduce uncertainty as to exactly which digits should be repeated.

$$\frac{1}{7} = 0.142857\ldots$$ Repeat indicated by ellipsis. (3)

Another notation, used for example in Europe and China, encloses the repeating digits in brackets.

Character format Overline

This is the simplest method for creating the appearance according to (1): 1/7 = $0.\overline{142857}$ (set line spacing to variable).

Using the equation editor

The equation editor provides a number of diacritical marks, which can be placed on a construct, such as variable or a number. However it can not be applied to a single digit in a number:

Wrong representation (also the 0. is marked with overbar):

$$\frac{1}{7} = \overline{0.142857}$$

To place a diacritical mark on a single digit, this digit must be a distinct construct, such as a string:

$$\frac{1}{7} = 0.\overline{142857}$$

To enter this formula, you enter the `0.` as numeral and the `142857` as string, select the string and apply the overbar:

- `1 / 7 Enter` → $\frac{1}{7} = ?$
- `0 . "` → $\frac{1}{7} = 0.""$ start the string

- `142857 Enter` → $\frac{1}{7} = 0.142857$ enter the string
- `CTRL+g -` → $\frac{1}{7} = 0.\overline{142857}$ mark the string

For a period use instead of `CTRL+g -` just the period: $\frac{1}{7} = 0.142\dot{8}57$. It will be placed above the centre of the selected object (the digits behind the decimal period).

Multiple dots required

To create the presentation of equation (2) you need to break down the number 0.142857 into distinct elements to be able to apply the dots (␣ denotes a blank selecting elements):

- `1 / 7 Enter` → $\frac{1}{7} = ?$
- `0 . "` → $\frac{1}{7} = 0.''''$ enter first element (0.1) and start the string (second element).
- `1 Enter` → $\frac{1}{7} = 0.1$ second element.
- ␣ `* 4285` → $\frac{1}{7} = 0.14285$ blank extends selection to `0.1`, `*` inserts invisible multiply operator to enter the third element.
- `" 7 Enter` → $\frac{1}{7} = 0.\underline{1}\underline{42857}$ 4th element again is a string. The underlines identify the elements, which can be accessed seperately with cursor and space bar (selection).
- Apply dot to selected elements by typing a period:

  → $\frac{1}{7} = 0.\dot{1}42857\dot{}$

Avoiding strings

Since multiplication normally is presented as adjacent symbols with no operator in between (for example $c = ab$), this mechanism can be used to create the presentation more easily than with strings (␣ denotes a blank selecting elements):

- `0 . ␣ *` $0.?$ first element, prepare second
- `1 ␣ ␣ ESC m r p` 0.1 second element, remove ()
- `. (period)` $0.\dot{1}$ place the dot on selection
- ␣ `* 4285` $0.\dot{1}4285$ place the dot on selection
- ␣ `* 7` $0.\dot{1}4285(7)$ fourth element

- ␣ ␣ ESC m r p . $0.\dot{1}42857\dot{}$ remove (), place dot

Shifting character location

A selected string can be moved as a graphic with the ALT+arrow buttons:

- Type the number 1.333 and after the last digit a period and a blank **1.333.**
- Select the period: **1.333.**
- Move the period over the last digit with **ALT+arrow** or for larger amounts of dislocation **ALT+SHIFT+arrow**: **1.333̇**
- You may wish to use the centred dot · (**CTRL+q, a**) as a starter, since this is a larger dot: **1.333•**

Final presentation

1.333̇ the space before this text is the width of the dot. Hence you should leave out the explicit space normally entered after a number or word.

The artificial space after the dotted digit can not be eliminated. Hence this method does not work for cases where the dotted digit is within the number: 0.i̇ 42857̇ and other.

Using a character format

Although it is not possible to define a character format for the shifts within FrameMaker, a MIF method helps here:

Set up the following MIF file (which works in any FM version above 5):

```
<MIFFile 5.50>
<FontCatalog
 <Font
  <FTag `recurring-dot'>
  <FPosition FNormal>
  <FDX  -50%>
  <FDY  -80.0%>
  <FLocked Yes>
 > # end of Font
> # end of FontCatalog
```

Import (by copy!) this `mif` file into your document. You will see the character format `recurring-dot` in the catalogue. It can be applied to the period to create the shift: 1.33̇

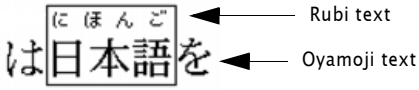
To avoid that also the ¶ symbol is shifted, place a blank before it, if the numeric value is the last item in a paragraph.

You may need to fiddle around with the values for `FDX` and `FDY` depending on the font of the digits.

The centred dot can be created with **CTRL+q, a**.

Using Rubi

Rubi (also spelled ruby) characters are small, annotative glosses that can be placed above or to the right or above of a Chinese character when writing logographic languages such as Chinese or Japanese to show the pronunciation.
[en.wikipedia.org]



Handling rubi text was introduced in FrameMaker with the first fully functional Japanese version (5.5) in 1997.

Use rubi function to apply reccurring dots

The default formatting of rubi text is 50% font size, which is very small for the dots to be applied. Hence set the value to 100% in the options dialogue. You get this dialogue with **ESC, o, r** . For the following examples this value is used.

	Result
Write down the complete number	1/7 = 0.142857
Select the digit(s) onto which you want to place the indicating dot and enter **ESC, s, r** to create the rubi construct.	cursor ➔ 1/7 = 0.142857
Enter a period, followed by **Enter**. Use a larger line spacing or variable line spacing. With fixed line spacing the rubi construct overlays the previous line (or table cell).	1/7 = 0.142857
As soon as you place the cursor in front of the 'rubied' digit, the rubi-frame appears. With the arrow keys you can move the cursor first after the digit, and next in front of the rubi character above. With **Shift+➔** you select the rubi character, which now can be manipulated (character format, font size, move ...)	1/7 = 0.142857 1/7 = 0.142857
However, the size modification of the rubi character enlarges the rubi-box and the dot appears far away from the digit and selection of the whole number becomes difficult. In the example the size of the rubi character is set to 24pt. You may move it down with **Alt+↓**.	1/7 = 0.142857
A better method to get a larger dot is to use a special character, for example, the centered dot from the standard text font · (**CTRL+q, a**) or even • (Ÿ of font WingDings). You may wish to move these symbols down with **Alt+↓**.	1/7 = 0.142857 1/7 = 0.142857