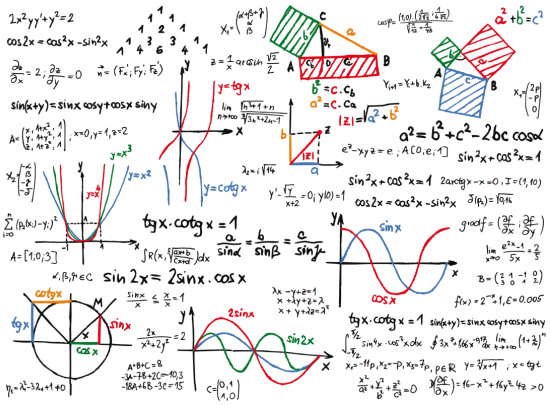
B2 - Mathematics

B-MAT-200

107transfer

Polytechnical Polynomials



2.0

107transfer

binary name:	107transfer
repository name:	107transfer_*$ACADEMIC_YEAR*
repository rights:	ramassage-tek
language:	C, C++, python3, perl, ruby, php or bash
compilation:	when necessary, via Makefile, including re, clean and fclean rules

- Your repository must contain the totality of your source files, but no useless files (binary, temp files, obj files,...).
- All the bonus files (including a potential specific Makefile) should be in a directory named *bonus*.
- Error messages have to be written on the error output, and the program should then exit with the 84 error code (0 if there is no error).

A laboratory performs tests on new electronic components to be integrated into its last generation chipset. Those components are entirely characterized by their transfer function, which determines frequency response; this function processes the input frequency and computes an output frequency (caracterizing the way the component amplifies or reduces the input frequency). The transfer functions of these components are rational functions, *i.e.* fractions such as both the numerator and the denominator are polynomials:

$$f(x) = \frac{a_n x^n + ... + a_2 x^2 + a_1 x + a_0}{b_m x^m + ... + b_2 x^2 + b_1 x + b_0}$$

You have to develop a program to optimize the transfer function computations.

You have to manage several components in cascade. In such a case, the transfer function of the set of components is the product of the transfer funtions of each component.

A transfer function is defined by two strings (one for the numerator, one for the denominator), composed by the polynomial coefficients split by the '*' sign.

For instance, "1*4*2*6*0*8" stands for $8x^5 + 6x^3 + 2x^2 + 4x + 1$.

Your program has to print the frequency responses of the component for a every values in a range from 0 to 1, with a step of 0.001.

You should use a fast algorithm, slow programs will be considered non functional...
Beware of precision when using floating-point numbers!

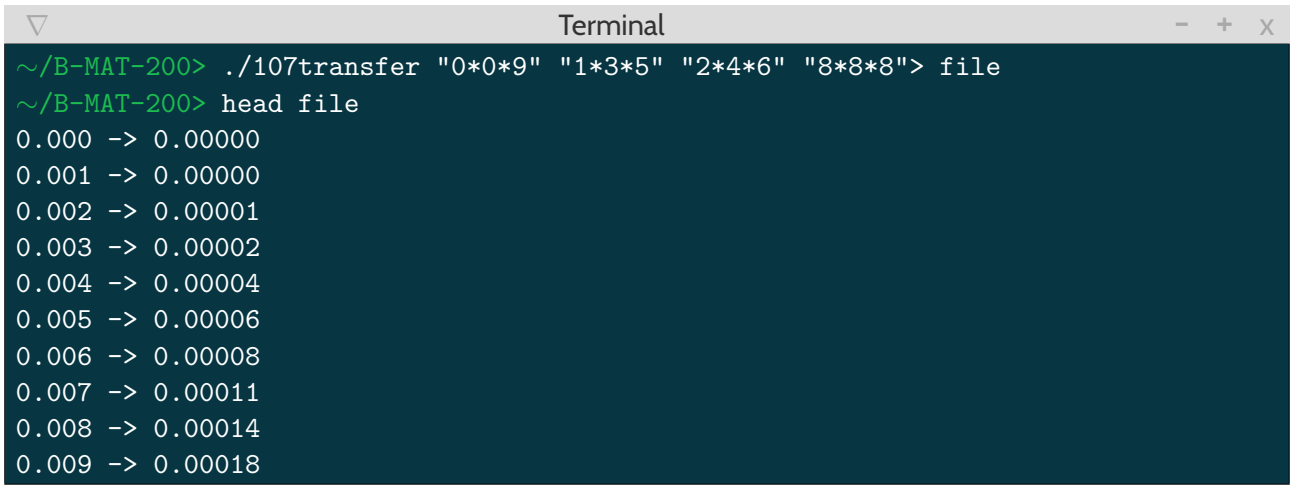
USAGE

```
Terminal
~/B-MAT-200> ./107transfer -h
USAGE
    ./107transfer [num den]*

DESCRIPTION
    num     polynomial numerator defined by its coefficients
    den     polynomial denominator defined by its coefficients
```

EXAMPLES

```
Terminal
~/B-MAT-200> ./107transfer "0*1*2*3*4" "1" > file
~/B-MAT-200> head -n 12 file
0.000 -> 0.00000
0.001 -> 0.00100
0.002 -> 0.00201
0.003 -> 0.00302
0.004 -> 0.00403
0.005 -> 0.00505
0.006 -> 0.00607
0.007 -> 0.00710
0.008 -> 0.00813
0.009 -> 0.00916
0.010 -> 0.01020
0.011 -> 0.01125
~/B-MAT-200> tail file
0.991 -> 9.73282
0.992 -> 9.76223
0.993 -> 9.79171
0.994 -> 9.82126
0.995 -> 9.85087
0.996 -> 9.88056
0.997 -> 9.91031
0.998 -> 9.94014
0.999 -> 9.97003
1.000 -> 10.00000
```


Terminal
~/B-MAT-200> ./107transfer "0*0*9" "1*3*5" "2*4*6" "8*8*8"> file
~/B-MAT-200> head file
0.000 -> 0.00000
0.001 -> 0.00000
0.002 -> 0.00001
0.003 -> 0.00002
0.004 -> 0.00004
0.005 -> 0.00006
0.006 -> 0.00008
0.007 -> 0.00011
0.008 -> 0.00014
0.009 -> 0.00018