Using a TI-84's List Feature: Synthetic Division

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Abstract

Synthetic division is easily accomplished with a spreadsheet, but it gets complicated. In contrast, a TI-84's list feature with its dynamic dimension feature is ideal. We provide the code and an easy test case.

Introduction

A student created a program to do synthetic division all on his own in one of my classes. I marveled at his seeing that it was an easy application and one that is completely ignored by textbooks (and teachers like myself). Challenged, I tried to use a spreadsheet and soon realized the ungainly character of having to set an arbitrary limit on the degree of the polynomials considered. I next recalled that the student's program also had an unnaturalness to it; one had to put in zero coefficients for polynomial dividends of smaller degrees than the programs limit. This was a little disconcerting as I had subsequently flippantly challenged students with making a synthetic division program as an extra credit assignment. It wasn't that easy to do it right! Was there a natural way to dynamically allow various degreed polynomials?

The answer is "yes". A TI-84 allows for users to enter in lists of coefficients of an arbitrary number. It has a function that gives the *dimension* of the entered list. There are always exactly three *rows* in synthetic division [1], so one needs a total of three lists of the same dimension. Code is given in the next section.

The code

In Figure 1, the first line of code is to prompt the user to enter a list using curly braces. For example, the dividing the polynomial $x^4 + x^3 + x^2 + x + 1$ by $(x - 1)$, the user would enter $\{1, 1, 1, 1, 1\}$ and, in response to the second prompt 1. This is nice test case because, as the division algorithm indicates, the value of this polynomial at one should just be number of terms – the terms all evaluate to 1. We should get 5: see Figure 2.

```
001  Disp "CFTS {1,2,...}"
002  Prompt L1
003  dim(L1)→D
004  Disp "R OF (X-R)"
005  Prompt R
006  D→dim(L2)
007  D→dim(L3)
008  Ø→L2(1)
009  L1(1)+L2(1)→L3(1)
010  For(K,1,D-1)
011  K+1→J
012  L3(K)*R→L2(J)
013  L1(J)+L2(J)→L3(J)
014  End
015  Disp L3
```

Figure 1: Code for TI-84 calculator program for doing synthetic division.

It is perhaps an easy matter, to form the dividend and remainder term in a more recognizable format: $x^4 + x^3 + x^2 + x + 5/(x - 1)$. That's a good extra credit challenge.

```
prgmSYNDIV
CFTS {1,2,...}
L1=?{1,1,1,1,1}
R OF (X-R)
R=?1
                    {1 2 3 4 5}
                            Done
```

Figure 2: Test case shows correctness of program.

References

[1] Blitzer, R. (2014). Algebra and Trigonometry, 3rd ed., New York: Prentice Hall.