

DECUS

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DECUS NO.	FOCAL8-174
TITLE	SYNDIV 5
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SOURCE LANGUAGE	FOCAL

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ABSTRACT

The user is requested to type in the coefficients of two polynomials. The first is divided by the second, and the coefficients of the quotient and remainder are printed. On input or output the " $X \uparrow n$ " associated with the coefficient is supplied by the program. The degrees of both the dividend and the divisor may be from 1 to 9 with the extended functions still in core. A translation into a dialect of APL is included.

See the listing for a sample run of the program and instructions for operation. The colons and signs which appear on the listing are supplied by FOCAL, undesirable, and should be eliminated by patches on systems where this is possible. The elimination of the colons and equal signs greatly improves the legibility of this program's hard copy.

Parts 10 and 11 are fairly self-explanatory service routines for accepting and printing polynomials, formatting each term as $ccc.cc *X \uparrow n$, $n > 1$, or $ccc.cc *X$, or $ccc.cc$ for the constant term.

The dividend and divisor are stored as arrays where $D1(I)$ is the coefficient of $X \uparrow I$ in the dividend, and $D2(K)$ is the coefficient of $X \uparrow K$ in the divisor. The division algorithm is ordinary "synthetic division," extended for use with divisors of degree higher than 1. $P(I \uparrow K+J)$ is a simulated double-subscripted matrix, used to hold partial products (products of terms in the quotient by the negative of terms in the divisor other than the first). Later these products are added to corresponding terms in the dividend to form coefficients of the quotient or of the remainder. Terms in the quotient are divided by the leading coefficient of the divisor before being entered in the quotient vector $Q()$. During step 8.35 the entries in $P()$ that are left are added to form the remainder polynomial, which is stored in $Q()$ after the quotient has been typed out. Terms in the remainder are not divided by $D2(N2)$, the leading coefficient in the divisor, and do not generate new entries in $P()$.

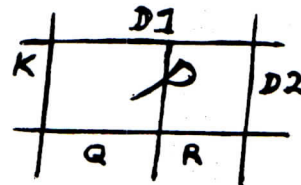
Syndiv 5 (APL)

Legend

ϕ -origin indexing. In polynomial vectors, subscript of coeff. = power of x.

- D1 dividend polynomial vector.
- D2 divisor polynomial vector.
- P matrix of partial answers, intermediate results.
- Q quotient vector. (polynomial)
- R remainder vector. (polynomial)
- K reciprocal leading coefficient of divisor.
- I, J, I2, J2 counters.

- ϕ : $\nu D1, \nu D2, D1, D2 \leftarrow \square$
- 1: $P \leftarrow (\nu D1, (\nu D2)-1) \phi$
- 2: $Q \leftarrow (\nu D1 - \nu D2) \phi$
- 3: $R \leftarrow (\nu D1 - (\nu Q)-1) \phi$
- 4: $K \leftarrow 1 \div D2 [\nu D2]$
- 5: $D2 \leftarrow -D2$
- 6: $I \leftarrow \nu D1$
- 7: $J \leftarrow \nu Q$
- 8: $Q[J] \leftarrow (+/P[;I] + D1[I]) \times K$
- 9: $I2 \leftarrow I-1$
- ϕ : $J2 \leftarrow 1$
- 11: $P[I2;J2] \leftarrow Q[J] \times D2[\nu D2-J2]$
- 12: $I2 \leftarrow I2-1$
- 13: $J2 \leftarrow J2+1$
- 14: $J2 \neq \nu D2 \rightarrow 11$
- 15: $I \leftarrow I-1$
- 16: $J \leftarrow J-1$
- 17: $J \geq \phi \rightarrow 8$
- 18: $J \leftarrow \nu R$
- 19: $R[J] \leftarrow +/P[;I] + D1[I]$
- 20: $I \leftarrow I-1$
- 21: $J \leftarrow J-1$
- 22: $J \geq \phi \rightarrow 19$
- 23: $\square \leftarrow Q, R$
- 24: \rightarrow



$$\frac{4x^3 - 2x^2 + K - 7}{2x^2 + 2x + 4}$$

	4	-2	+1	-7	
$\frac{1}{2}$		-4	+6		-2
			-8	+12	-4
	2	-3	-1	+5	

quotient = 2X-3
remainder = 1X+5

C-FOCAL, U04

```

08.05 A "DIVIDEND'S DEGREE"N1,"DIVISOR'S"N2,!!"THE POLYNOMIAL"!
08.10 F I=-N1,;A D1(-I);S E=-I;D 11
08.15 T !,"DIVIDED BY THE POLYNOMIAL"!
08.20 F I=-N2,;A D2(-I);S E=-I;D 11
08.25 T !"EQUALS"!;S X=N2;F I=-N1,-N2;F J=-I;D 9;D 10
08.30 T !,"PLUS THE REMAINDER"!
08.35 S X=;F I=-N2+1,;S J=-I;D 9.1;D 10

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```

09.10 F Q(J)=D1(J);F K=1,N2;S Q(J)=Q(J)+P(10*K+J)
09.15 S Q(J)=Q(J)/D2(N2)
09.20 F L=1,N2;FF K=N2-L;S P(10*L+J-L)=-Q(J)*D2(K)

```

```

10.30 I (Q(J))10.4;T "+
10.40 T %3.3,Q(J);S E=J-X;D 11

```

```

11.10 I (E-1)11.9,11.7;T "*X+",%1,E;R
11.20 R
11.70 T "*X
11.90 R

```

```

* ↑ T
*C STARTING COMMANDS ARE ERASE , DOPART 8
*
*
*E
*D 8
DIVIDEND'S DEGREE:2 DIVISOR'S:1

```

```

THE POLYNOMIAL
:4*X ↑ = 2: -4*X: +1
DIVIDED BY THE POLYNOMIAL
:2*X: -1
EQUALS
+= 2.00*X=-1.00
PLUS THE REMAINDER
+- 0.00*

```

```

*E
*D 8
DIVIDEND'S DEGREE: ↑ C?01.00 @ 08.05
*E
*D 8;T !!!
DIVIDEND'S DEGREE:7 DIVISOR'S:3

```

```

THE POLYNOMIAL
:1*X ↑ = 7: +2*X ↑ = 6: -3*X ↑ = 5: +4*X ↑ =4: -3*X ↑ = 3: +2*X ↑ = 2: -1*X: +49
DIVIDED BY THE POLYNOMIAL
:7*X ↑ = 3: +4*X ↑ =2: -2*X: +6
EQUALS
+= 0.14*X ↑ = 4+= 0.21*X ↑ = 3=-0.51*X ↑ = 2+= 0.80*X=-1.20
PLUS THE REMAINDER
+= 11.4*X ↑ = 2=-8.18*X+= 56.2

```

*E
*D 8;T !!!!!
DIVIDEND'S DEGREE:1 DIVISOR'S:2

THE POLYNOMIAL

:1 *X: +1

DIVIDED BY THE POLYNOMIAL

:2*X ↑ = 2: +3*X: -1

EQUALS

+ = 0.50

PLUS THE REMAINDER

+ = 1.00*X = -0.50

*E
*D 8;T !!!!! \\
DIVIDEND'S DEGREE:4 DIVISOR'S:2

THE POLYNOMIAL

:1*X ↑ = 4: +0*X ↑ = 3: +0*X ↑ = 2: +0*X: +1

DIVIDED BY THE POLYNOMIAL

:1*X ↑ = 2: +1.4142*X: +1

EQUALS

+ = 1.00*X ↑ = 2 = -1.42*X ↑ = 1.00

PLUS THE REMAINDER

+ = 0.00*X = 0.00

*E A
*
*