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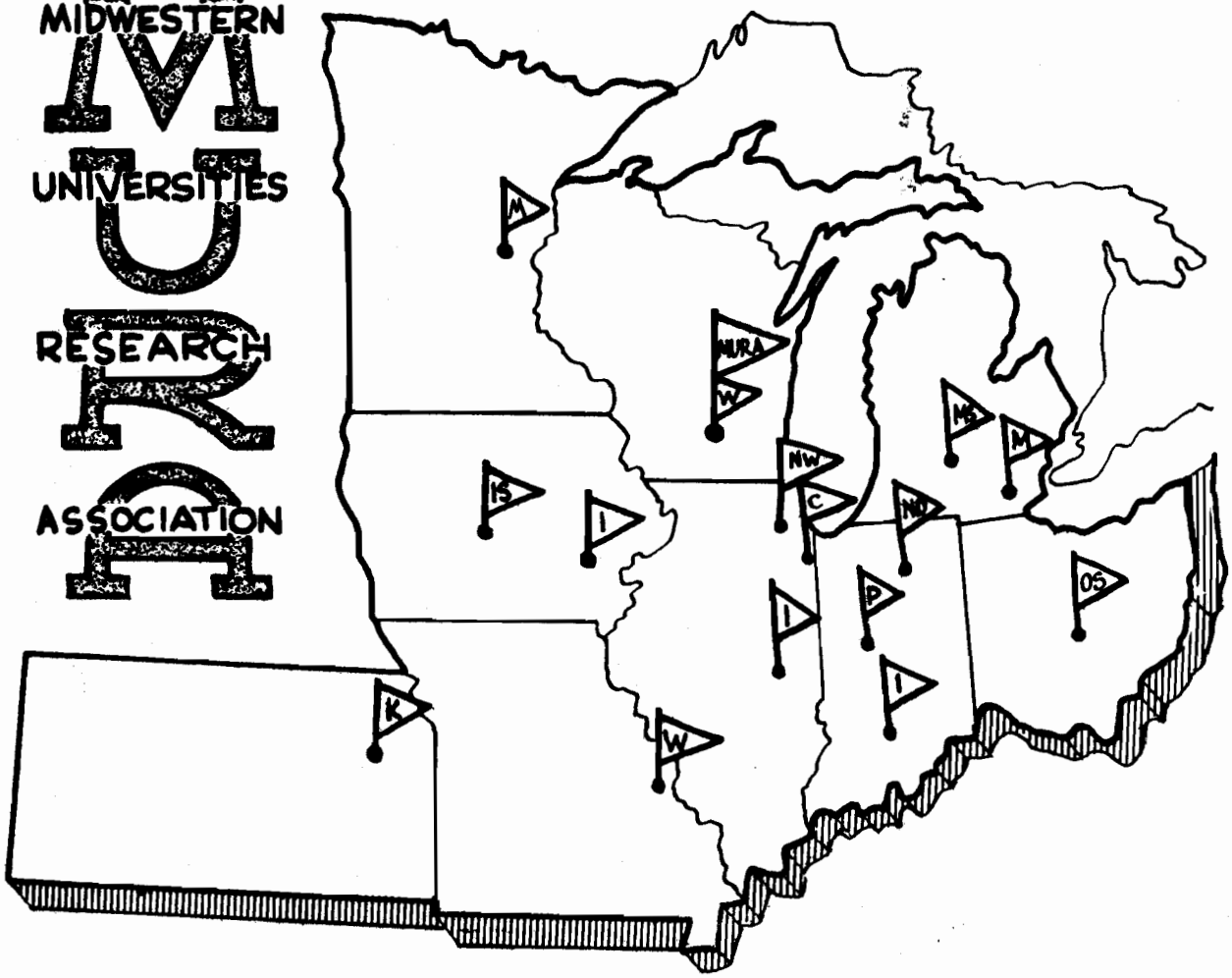

REPORT ROOTS OF A POLYNOMIAL
(Program 259)
September, 1959

NUMBER 505
Computer Program
Internal

ROOTS OF A POLYNOMIAL
(Program 259)

M. R. Storm

This computer program extracts the n real or complex roots of a polynomial whose coefficients may be either real or complex. The listed author is responsible only for that portion which has to do with the method of input-output and certain other connecting links. Most of the program includes the SHARE subroutine, CL AEQ1, prepared by the Lockheed Aircraft Corporation of California. For pertinent details about the programming techniques, restrictions, methods, and the like concerning it, one is referred to SHARE distribution number 116 which can be found in the MURA computer files under Vol. 8, pp. 1931-1937, August, 1956.

To use the program, of course, certain input parameters are necessary and these should be specified by the user on agendum forms which are available. The remarks column on these forms intend to explain fully the various symbols used and, therefore, will not be repeated here.

For a given polynomial

$$F(x) = a_n x^n + a_{n-1} x^{n-1} + \ldots + a_1 x + a_o ,$$

the coefficients must be listed consecutively starting with a_n and proceeding through a_o. If the coefficients are complex, then the imaginary part must be entered on the agendum immediately following its corresponding real part. Even if the imaginary part is identically zero, it cannot be omitted if at least one other coefficient has a non-zero imaginary part. When the coefficients are all real, no imaginary parts should be entered.

The user has the option of giving first estimates to all the roots or permitting the program to supply its own estimates. These are given on the agendum in the column headed estimates and are always in complex form even though all coefficients are real. Again the imaginary part of each estimate follows immediately its corresponding real part. If the program is allowed to produce the estimate it will use .01 + 01i for all roots. The constant .01 can be changed to any constant B in B + Bi by indicating such at location 2092.

The printed output is very simple and almost self-explanatory. The first line gives the program number and title. Immediately below this are listed all coefficients (4 per line) in the descending order, $a_n, \ldots, a_1, a_o$. This is followed by the calculated roots with their real parts in column 2 and their imaginary parts in column 3. Column 1 is only a line label and for the roots appears in descending order. Many extra zeros may appear throughout but these are to be ignored. A sample printout is shown on page 3.

The program operates in floating point arithmetic and some error stops are possible. If overflow occurs during solving for the roots, a stop will ensue. A similar stop occurs if any root fails to converge within seven significant decimal places.

An agendum form is attached and should be consulted for the meanings of any undefined symbols used in the text.

PROGRAM 259 ROOT FINDER

00000	10000000+ 0	-10000000+ 0	-23804000+ 0	20000000+ 0
00001	17508000+ 0	-99000000- 1	-38290000- 1	00000000000
00002	00000000000	00000000000	00000000000	00000000000
00003	00000000000	00000000000	00000000000	00000000000

ROOTS	REAL	IMAG
00006	-29880751- 1	00000000000
00005	13023019+ 0	00000000000
00004	-10565335+ 0	00000000000
00003	99557838- 1	39723096- 2
00002	99557839- 1	-39722951- 2
00001	-93811751- 1	00000000000
00000	00000000000	00000000000

AGENDUM FOR
ROOTS OF A POLYNOMIAL (Program 259)

Parameter	Address		Remarks
n	1066		Degree of the polynomial
j	1067		0 if all coefficients are real 1 if coefficients are complex
ID no.	1068		Identification & run number < 32768

INTEGERS

Address	Coefficients	exp
2300		
2301		
2302		
2303		
2304		
2305		
2306		
2307		
2308		
2309		
2310		
2311		
2312		
2313		
2314		
2315		
2316		

Address	B	exp
2092		

Address	First Estimates	exp
2350		
2351		
2352		
2353		
2354		
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2356		
2357		
2358		
2359		
2360		
2361		
2362		
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2380		

FLOATING POINT NUMBERS