POOL Program No. C1-136

TITLE: Polynomial Evaluation and Comparison

AUTHOR: Arthur I. Larky
Department of Electrical Engineering
Lehigh University
Bethlehem, Pa.

DATE: March 25, 1959

CLASSIFICATION C1

ABSTRACT:

Evaluates any real polynomial for each of a series of values of the independent variable, and compares the results with a series of values supplied by the user. The calculations are done using Floating Point Interpretive System 24.0.

SC-0519 Printed in USA

Polynomial Evaluation and Comparison Program No. C1-136

DESCRIPTION

The user supplies the coefficients of a polynomial, f(x), and a series of points (x,y_{given}). For each point the program calculates and prints $y_{calc} = f(x)$, the ratio y_{given}/y_{calc}, and the cumulative sum of the squared deviations $\Sigma[y_{calc} - y_{given}]^2$.

OPERATING PROCEDURE

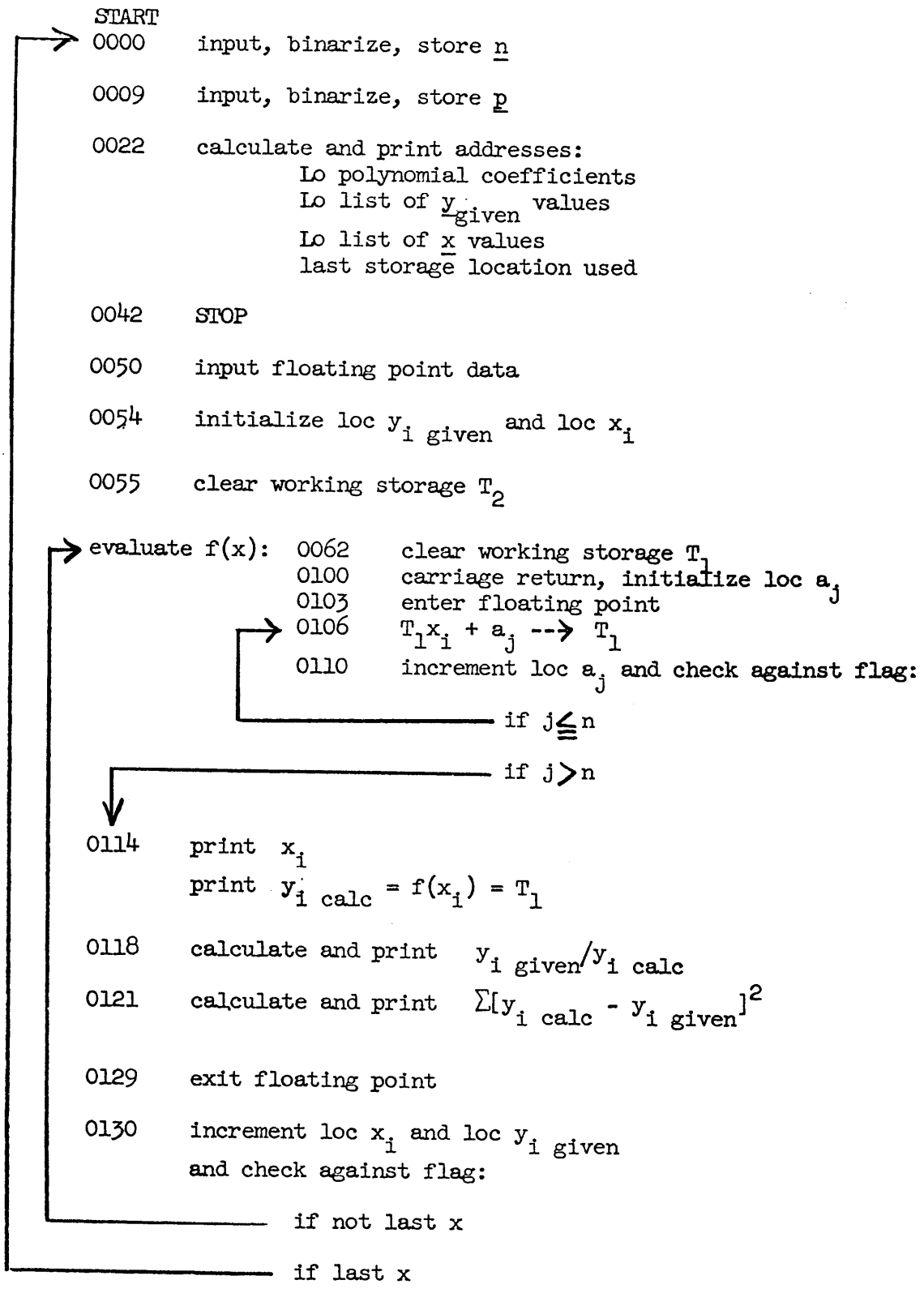
1) Load a program input routine, preferably 10.4.
2) Input 24.0, preferably with Lo = 1100, followed by 11.6-12.6.
3) Input the program. [The program tape consists of title, abbreviated program description, tape feed, ".0000000'", the coding, and ";0006300'.0000000'".]
4) Change program locations 0050,0051,0103,0104 to Lo of 24.0, if not 1100. Change program locations 0047,0048 to the RU pair for the shift-left-and-binarize subroutine in the program input routine used, if not 10.4.
5) Transfer to Lo of the program.
6) When the letter "n" prints out, type the degree of the polynomial as a one- or two-digit number, $0 \leq n \leq 63$.
7) When the letter "p" prints out, type the number of $\underline{x}$ values, as a one- or two-digit number, $0 < p \leq 63$.
8) The computer will now print out:
   a) The starting location required for the fill of the polynomial coefficients.
   b) The starting location required for the fill of the given $\underline{y}$ values.
   c) The starting location required for the fill of the $\underline{x}$ values.
   d) The last storage location used.

   Note: The floating point data is stored sequentially starting at Lo + 0207. Data tapes may be prepared in advance on this basis.
9) The computer will stop at Lo + 0042. A start will lead to a call for the input of the data under (8) above, in 24.0 format. The polynomial coefficients must be supplied in descending order (i.e., constant term last).
10) The following is printed out for each $\underline{x}$ value, in one line:
   a) x
   b) the calculated y value
   c) the ratio y_{given}/y_{calc}.
   d) $\Sigma[y_{calc} - y_{given}]^2$, the sum being taken up to and including the point in question.
11) After all $\underline{p}$ lines are printed out, control is returned to the input step (6) above.

STORAGE

2 tracks and 7 sectors, plus $n + 1 + 2p$ data storage locations following the program, plus location 6345, in addition to those locations used by 24.0.

FLOW CHART


START
0000 input, binarize, store n
0009 input, binarize, store p
0022 calculate and print addresses:
Lo polynomial coefficients
Lo list of y given values
Lo list of x values
last storage location used
0042 STOP
0050 input floating point data
0054 initialize loc y i given and loc x i
0055 clear working storage T 2
evaluate f(x):
0062 clear working storage T 1
0100 carriage return, initialize loc a j
0103 enter floating point
0106 T 1 x i + a j --> T 1
0110 increment loc a j and check against flag:
if j ≦ n
if j > n
0114 print x i
print y i calc = f(x i) = T 1
0118 calculate and print y i given/y i calc
0121 calculate and print Σ[y i calc - y i given]2
0129 exit floating point
0130 increment loc x i and loc y i given
and check against flag:
if not last x
if last x

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	C1-136	A. I. Larky	POOL Review	March 25, '59

PROBLEM: Polynomial Evaluation and Comparison — TRACK

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	1						
	1	☒					
		0000	XP	1643	1		"car. ret"
		0001	Z	[ ]	1	(0015) (0018) (0134)	delay & p
		0002	XP	2545	1		"n"
		0003	XZ	0100	1	☒ (0152)	delay & 1@23
		0004	R	0049	1	}	Input n, the order
		0005	U	0044	1	}	of the polynomial
		0006	A	0042	1	La	
		0007	A	0010	1	☒ 1@29	
		0008	Y	0112	1	F_1	
00000004	1	0009	P	1864	1		"tab"
		0010		4	1	(0007) (0020) (0131)	delay & 1@29
		0011	P	21GJ	1	☒	"p"
		0012	2000000		1	(0155)	delay & 1@6
		0013	R	0049	1	}	Input p, the number
		0014	U	0044	1	}	of points to be checked
		0015	Y	0001	1	☒ p	
		0016	A	0112	1	F_1	
		0017	Y	0203	1	F_2	
		0018	A	0001	1	p	
		0019	Y	0205	1	☒ F_4	
		0020	S	0010	1	1@29	
		0021	Y	0200	1	F_3	
		0022	XP	1644	1		"car. ret"
		0023	B	0042	1	☒ La	
		0024	R	0145	1	}	Print loc. to start filling
		0025	U	0140	1	}	polynomial coefficients
		0026	B	0112	1	F_1	
		0027		13	1	☒	delay
		0028	XP	2443	1		"tab"
		0029	R	0145	1	}	Print loc. to start filling
		0030	U	0140	1	}	given y values
		0031	B	0203	1	☒ F_2	

FORM LP-10 SC-0520

☒ CARRIAGE RETURN

1 = CONDITIONAL STOP CODE

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Royal McBee Corporation
DATA PROCESSING DIV.
PORT CHESTER, NEW YORK

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PROBLEM: Polynomial Evaluation and Comparison | TRACK

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	'						
	'	☒					
		0032	XZ	6300	'	(0146)	delay & mask
		33	XP	2405	'		"fab"
		34	R	0145	'		Print loc. to start filling
		35	U	0140	'	☒	x values
		36	B	0200	'	F_3	
,0000002	'	37	F	7Q	'	(0157)	
		38	P	1805	'		"fab"
		39	R	0145	'	☒	Print last storage
		40	U	0140	'		location used
		41		20	'		delay
		42		207	'	(0006) (0023) (0101)	STOP & La
		43	U	0050	'	☒	
,0000010	'	44	P	00QJ	'		(Start of input subroutine)
		45	C	3WG4	'	dump	
		46	I	00W4	'		
		47	R	00WJ	'	☒ (=XR 0063)	Binarizing subroutine
		48	U	00J8	'	(=XU 0050)	in 10.4
		49	U[	]	'	(0004)(0013)	(Exit of input subroutine)
		50	R	0G00	'	(=XR 1100)	Enter floating point
		51	U	0G00	'	☒ (=XU 1100)	24.0
		52	I	0000	'		Input all f.p. data
		53	E	0000	'		Exit floating point
		54	B	0112	'	F_1	
		55	Y	0118	'	☒ B_{y_1}	
		56	Y	0121	'	B_{y_1}	
		57	B	0203	'	F_2	
		58	Y	0106	'	P_{x_1}	
		59	Y	0114	'	☒ B_{x_1}	
		60	C	0204	'	dump	
		61	C	0204	'	T_2	
		62	C	0201	'	dump	Start to evaluate f(x)
		0063	C	0201	'	☒ T_1	

FORM LP-12

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☒ CARRIAGE RETURN

' = CONDITIONAL STOP CODE

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PROBLEM: Polynomial Evaluation and Comparison

TRACK:

PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	1						
	1	☒					
		0100	XP	1643	1		"car. ret."
		0101	B	0042	1	La	
		0102	Y	0108	1	A a_j	
		0103	XR	1100	1	☒	Enter floating point
		0104	XU	1100	1		
		0105	E	0108	1	loc a_j	
		0106	P	[ ]	1	x_i (0058) (0136)	
		0107	M	0201	1	☒ T_1	
		0108	A	[ ]	1	a_j (0102) (0105) (0111)	
		0109	H	0201	1	T_1	
		0110	XI	0001	1		
		0111	Y	0108	1	☒ loc a_j	
		0112	XZ	[ ]	1	(0008) (0016) (0026) (0054)	F_1
		0113	U	0107	1		Here if $j \leq n$
		0114	B	[ ]	1	x_1 (0059) (0135)	Here if $j > n$
		0115	XP	0000	1	☒	Print x_i
		0116	B	0201	1	T_1	
		0117	XP	0000	1		Print y calc
		0118	B	[ ]	1	y_i (0055) (0130) (0132)	
		0119	D	0201	1	☒ T_1	
		0120	XP	0000	1		Print y_{given}/y_{calc}
		0121	B	[ ]	1	y_i (0056) (0133)	
		0122	S	0201	1	T_1	
		0123	H	0201	1	☒ difference	
		0124	XU	0000	1		
		0125	M	0201	1	difference	
		0126	A	0204	1	T_2	
		0127	XP	0000	1	☒	Print $\Sigma [y_{calc} - y_{given}]^2$
		0128	H	0204	1	T_2	
		0129	XE	0000	1		Exit floating point
		0130	B	0118	1	$B y_i$	
		0131	A	0010	1	☒ 1e29	

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PROGRAM INPUT CODES	STOP	LOCATION	INSTRUCTION OPERATION	INSTRUCTION ADDRESS	STOP	CONTENTS OF ADDRESS	NOTES
	1						
	1	☒					
		0132	Y	0118	1	By:	
		33	Y	0121	1	By:	
		34	A	0001	1	p	
		35	Y	0114	1	☒ Bxi	
		36	Y	0106	1	Pxi	
		37	S	0205	1	B [F4]	
		38	T	0062	1		if not done
		39	U	00000	1	☒	if done
		40	H	0162	1	#	Start address print sub.
		41	R	0163	1	}	Print track
		42	U	0146	1	}	
		43	R	0163	1	☒ }	Print sector
		44	U	0146	1	}	
		45	U	[ ]	1	(0024) (0029) (0034) (0039)	Exit address print sub
		46	E	0032	1	3W00	Enter track/sector print
		47	XZ	0033	1	☒	
		48	S	0206	1	9WJ	
		49	T	0151	1	→ print	
		50	U	0148	1		
		51	A	0037	1	☒ F7Q	
		52	N	0003	1	1@23	
		53	Y	0154	1		
		54	P	[ ]	1	(0153)	tens digit
		55	M	0012	1	☒ 1@6	
		56	Y	0160	1		
		57	B	0162	1	#	
		58	N	0202	1	1@25	
		59	XZ	0045	1	☒	
		60	P	[ ]	1	(0156)	units digit
		61	U	0163	1		
,0000009	1	62	[	]	1	(0140) (0157)	#
		0163	U	[ ]	1	☒ (0141) (0143)	Exit track/sector print

FORM LP-12

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	1						
	1	☒					
		0200		[ ]	1	(0021) (0036)	F_3
		01	[ ]		1	(0062) (0063) etc.	T_1
		02		40	1	(0158)	1e25
		03		[ ]	1	☒ (0017) (0034) (0057)	F_2
		04	[ ]		1	(0060) (0061) (0126) (0128)	T_2
		05	B[ ]		1	(0019) (0137)	F_4
		06		9WJ	1	(0148)	
		07			1	☒	← Start of floating point data storage, $(n+1+2p)$ locations
		08			1		
		09			1		
		10			1		
		11			1	☒	
		12			1		
		13			1		
		14			1		
		15			1	☒	
		16			1		
		17			1		
		18			1		
		19			1	☒	
		20			1		
		21			1		
		22			1		
		23			1	☒	
		24			1		
		25			1		
		26			1		
		27			1	☒	
		28			1		
		29			1		
		30			1		
		0231			1	☒	

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