

UNIVERSITY OF ILLINOIS

DIGITAL COMPUTER

LIBRARY ROUTINE V 1 - 82

TITLE Legendre Polynomials, $P_n(x)$
 TYPE Closed
 NUMBER OF WORDS 25
 TEMPORARY STORAGE 0, 1, 2, 3 and $n + 1$ locations at $S3, 1S3, \dots, nS3$
 ACCURACY

About $2^{-39} \sum_{i=0}^{n-2} (2x)^i$ (maximum) (due to roundoff error).

DURATION $.75 + 3.6 (n-1)$ milliseconds

Preset Parameter: $S3$ must contain the address a , at which the table of $1/2 P_0(x), 1/2 P_1(x), \dots, 1/2 P_n(x)$ is to start.

DESCRIPTION The routine is entered with x in A and the orders

p	50 nF	where q is the address of the routine.
	50 pF	
$p + 1$	26 qF	

The routine will be left with $1/2 P_0(x), 1/2 P_1(x), \dots, 1/2 P_n(x)$ in the locations $S3, 1S3, 2S3, \dots, nS3$.

The computation is made via the recursion relation:

$$1/2 P_e(x) = x 1/2 P_{e-1}(x) + e - 1/e [x 1/2 P_{e-1}(x) - P_{e-2}(x)]$$

*NOTE

If the routine is entered with $n = 0$ or $1, 1/2 P_0(x), 1/2 P_1(x), 1/2 P_2(x)$ will be computed. If entered with $n \geq 2$, then this remark applies.

DATE 12/9/53 Rt: 6/5/58
 PROGRAMMED BY J. N. Snyder
 APPROVED BY J. P. Nash

LOCATION	ORDER	NOTES	PAGE 1
0	40 F S5 1F	Store argument Plant exit	
1	L4 L 46 23L	Constant and link address	
2	42 17L L5 F		
3	10 1F 40 1S3	$1/2 P_1(x) = 1/2 x$ to 1S3	
4	49 S3 41 1F	$1/2 P_0(x) = 1/2$ to S Clear 1 for counter	
5	L5 4L 46 13L	Set computer to compute	
6	L4 24L 46 9L	$1/2 P_2(x)$ and store in 2S3	
7	L4 24L 46 15L		
8	L5 14L 46 1F	Set counter to $e = 2$	
9	50 ()F 7J F	by 6,19 From 22	
10	40 3F 50 24L	Compute $1/2 P_e(x)$	
11	L5 1F L0 24L		
12	66 1F L5 3F		
13	L0 ()F 40 2F	by 5,20	
14	7J 2F L4 3F		
15	40 ()F L5 1F	by 7,22 Store in eS3	
16	L4 24L 40 1F	Advance counter to $e + 1$ and test for $e + 1 = n + 1$	

LOCATION	ORDER		NOTES	PAGE 2
17	L0 23L 32 ()F	by 2	Link	
18	L5 9L L4 24L			
19	46 9L L5 13L			
20	L4 24L 46 13L		Advance addresses in computer	
21	L5 15L L4 24L			
22	46 15L 26 9L			
23	00 (n+1)F 00 F	by 1	Test for constant for exit	
24	00 1F 00 F		Unit of count and address advancer	