UNCLASSIFIED

AD 405 054

DEFENSE DOCUMENTATION CENTER

FOR

SCIENTIFIC AND TECHNICAL INFORMATION

CAMERON STATION, ALEXANDRIA. VIRGINIA



UNCLASSIFIED

Office of Naval Research

Contract Nonr-1866(32)

NR - 371 - 016

Technical Report

on

TABLES OF THE GENERALIZED STIRLING NUMBERS OF THE FIRST KIND

by

William F. Pickard

March 1, 1963

The research reported in this document was supported by Grant 21869 of the National Science Foundation. Publication was made possible through support extended to Cruft Laboratory, Harvard University, by the Navy Department (Office of Naval Research), the Signal Corps of the U.S. Army, and the U.S. Air Force under ONR Contract Nonr-1866(32). Reproduction in whole or in part is permitted for any purpose of the United States Government.

Technical Report No. 404

Cruft Laboratory
Harvard University
Cambridge, Massachusetts

MOTICE: When government or other drawings, specifications or other data are used for any purpose other than in connection with a definitely related government procurement operation, the U. S. Government thereby incurs no responsibility, nor any obligation whatsoever; and the fact that the Government may have formulated, furnished, or in any way supplied the said drawings, specifications, or other data is not to be regarded by implication or otherwise as in any manner licensing the holder or any other person or corporation, or conveying any rights or permission to manufacture, use or sell any patented invention that may in any way be related thereto.

TABLES OF THE GENERALIZED STIRLING NUMBERS OF THE FIRST KIND

by

William Fi Pickard*

Division of Engineering and Applied Physics

Gordon McKay Laboratory, Harvard University

Cambridge, Massachusetts

ABSTRACT

The generalized Stirling numbers of the first kind are defined, certain of their basic properties discussed, and tables given for the square grid k = 0(1)10 and j = 0(1)10 with l = -10(1)10.

^{*}The work reported in this paper was supported by a grant from the National Science Foundation.

The use of the losenge diagram [1] to construct polynomial approximations, for interpolation, for the step by step integration of differential equations, for the derivation of formulae for numerical differentiation, and for other purposes, requires the evaluation of the factorial polynomials

(1)
$$(u-\ell)^{[k]} = (u-\ell)(u-\ell-1)\cdots(u-\ell-k+1)$$

where ℓ and k are integers, k being non-negative and ℓ unrestricted Since $(u-\ell)^{[k]}$ is a polynomial of degree k it can be represented as

$$(u - \ell)^{[k]} = \ell S_0^k u^k + \ell S_1^k u^{k-1} + \cdots + \ell S_k^k$$

$$= \sum_{j=0}^k \ell S_j^k u^{k-j}$$
(2)

where the coefficients ${}_{i}S_{j}^{k}$ can be called the generalized Stirling numbers of the first kind in analogy with the terminology used for the numbers ${}_{0}S_{j}^{k}$. The ${}_{i}S_{j}^{k}$ are conveniently determined using the recursive relationship

and the obvious identities

(4a)
$$\int_{0}^{\infty} s_{0}^{k} = 1$$
 $k = 0, 1, 2, \cdots$

Equation (3) is readily derived by expanding

(5)
$$(u-\ell)^{[k+1]} = (u-\ell-k) (u-\ell)^{[k]}$$

and equating the coefficients of the several powers of u.

Only the $_{l}S_{j}^{k}$ for l=0 have been extensively tabulated [2]; those for $l\neq 0$ appear to have been largely neglected. In order to facilitate the construction of formulas from the losenge diagram, the IBM 7090 at the Harvard University Computing Center was utilized to calculate the $_{l}S_{j}^{k}$ over the square grid k=0(1)10, j=0(1)10 with l=-10(1)10. The results of these calculations are presented in Table I; a blank indicates that the number was zero and the word OVERFLOW that the absolute value of the number exceeded 34, 359, 738, 367.

REFERENCES

- K. S. Kunz, "Numerical Analysis", McGraw-Hill Book Company, Inc., New York, 1957, chapter 4.
- A. Fletcher, J. C. P. Miller, L. Rosenhead, and L. J. Comrie, "An Index of Mathematical Tables", Second Edition, Addison-Wesley Publishing Company, Inc., Reading, 1962, section 4.9231.

	2	9628836	2		2	
	•	3628600 10628640	•	36.288U 36.2880	d >	-40320
	-	1814400 6999840 12753576	•	362880 1026576 1026576	•••	40320 40320 -69264
	-	604800 2592720 5753720 8409500	 ;	181440 663696 1172700 1172700	-	40320 109584 109584 -8540
	Ç	151200 662640 1580508 2655764 3416930	•	60480 241128 509004 723680	ۍ	20160 69264 118124 118124 18124
01}	2	30240 127860 305956 537628 761166 902055	50 . B	151 20 602 16 1339 38 2146 76 2693 25 2693 25	{8 5	6720 24552 48860 67284 67284
_	-	5040 19524 44524 77224 111769 140889 157773	•	3024 11274 24574 40369 54649 63273	•	1680 5944 12154 13424 22449 22449 17913
	3	720 2414 5000 8115 11515 14560 16884 18150	ĸ	504 1650 3325 3325 7140 8624 9450	m	336 1066 2070 3135 4025 4536 4536 4536 9990
	2	90 242 431 635 835 1015 1162 1366	2	72 191 135 485 625 772 870 870	2	56 146 355 355 546 511 546
	-	0 1 1 1 2 8 4 4 8 8 4 8 8 8 8 8 8 8 8 8 8 8 8 8	-	- 14 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4		2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
	0		•	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		
••	/_	9-NW406-892	-/-	0-0m400-462	/=	0-Nm4500~002

	}		1		1		
	2		2		2		
	•	00001	o	-+320	တ	2880	
	•	-5940 11016	••	1440	•	-720 576	
	-	5040 5040 -8028 -7900	1	-720 1368 5340	-	240 -324 -4100	
	9	5040 13068 13068 -64 -12790	6	720 720 -1044 -1324 3590	9	120 188 944 -820	
~-	S	25 20 80 28 131 32 63 63 -32 55	20	720 1764 1764 140 -1638	5	120 120 -154 -252 -411	
11	4	840 2754 5104 6769 6769 4809	9-=}	360 1044 1624 1624 889 -231	4	120 274 274 231 -231 231	
	80	210 638 1175 1665 1960 1960 1638	3	120 342 542 735 735 735 735 735 735	80	60 154 225 225 225 140 -126 -150	
	2	42 107 179 295 322 322 294	2	30 17,7 15,5 17,5 17,5 1,4	2	20 47 47 85 85 70 70 70 70 70 70	
	-	7 113 118 22 25 25 27 28 27 27	-	6 11 11 11 12 21 20 21 18 18	-	2 4 4 5 5 4 5 5 6 5 6 5 6 5 6 6 6 6 6 6 6	
	0		-		0		,
	/		7		/=	~~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~~ ~	

2	1	_ 1		1		
_		2		2		•
a	-2880	6	4320	•	-10060	
•	578 578	••	-720 -2664	•••	11016	
~ -	\$1-	r~	144 324 -5340	~	-240 -1368 7900	
Œ	-820 -820 -820	G	-36 -36 944 3590	9	48 186 -1324	
	-24 -24 -28 196 -1365	ر م	* † † † † † † † † † † † † † † † † † † †	22	- 12 - 28 - 28 2 52 1638 32 55	(CONTINUED)
}	24 24 24 24 273 273	{3	-6 4 49 49 -231	{=-2		TARIF T ((
**	2 2 2 2 2 2 3 2 3 3 4 3 4 3 4 3 4 3 4 3	**	951 951 951 96	ю	-2 15 35 -252 -1050	
.•	, 22 % % % ~ 1 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9	2	*=== *;	2	2214273	
•	42000024 5	-	₩₩.₽₽₩₩ \$£₽₩	-	2 3 3 3 4 7 1 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	
•				•		_
7	2 0-NM4NG-002		0-Nm400-002		0-0m488-ee6	

		: #			Ne see
•	\$ ************************************	•	8. X	•	- X 788 - 1922-6-
-	9 1 9 2 9 3	-	4032 6 102657 6	•	40320 1026576 1275576
~	27 28 28 28 28 28 28 28 28 28 28 28 28 28	~	-5040 -107594 -1172704	.	-5040 -109584 -1172700 -8409503
•	21-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-	•	720 1306.1 118124 729681	•	720 1395-8 1118-124 723-8-8 3416-830
 S	12 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	s 0-	-120 -1343- -13432- -267325	 	-120 -1764 -13132 -6786 -2690 25
{}	-26 -26 -48 -4809 -17913	}	24 274 1624 6769 22449	+-}	24 274 1624 624 6327 15773
m	2 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -	K	122. 123. 123. 123. 123. 123. 123. 123.	m	- 50 - 225 - 225 - 136 - 456 - 9450 - 18150
~	7758256	2	~ = # # # # # # # # # # # # # # # # # #	2	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2
-	757775	-	1		11
7				· 72	
/=		/=	~ - · · · · · · · · · · · · · · · · · ·	*	

, s	***************************************	•			103763/600	
•	- 34.2800	•	-1993486	•	-19639600	
•	31234 613746 613746 7027934	•	1814-08 3634-139 27007-012	•	4452860 101378680 832791136	
~	-40320 -463404 -5753734 -34967140	~	-181440 -2592720 -19971308	-	-40480b -7899846 -54231712 -288643240	
•	\$040 69264 509004 2658764 11028590	•	20160 241128 1590508 7494416 28699460	•	60480 642840 4628156 17893196	
{-+2 5	-720 -8028 -4860 -214676 -761166 -7310945	{-+3 5	-24552 -24552 -133936 -537628 -1767387 -5036235	{-+4 s	-6720 -6216 -309954 -1159420 -3663088	
*	120 1804 1843 5449 14084 32441	+	340 475 475 48151 4864 4861111 6861115 686964	-}	24574 77224 2594 24944 25944 24944	
м	12806 12806 12806 12806 12806 12806 12806 12806	ю.	- 342 - 342 - 11 75 - 31 35 - 31 35 - 1454 - 1454 - 27342 - 481 50	MS	21- 21- 2021- 2025	
2	262 295 295 295 295 1266 1266 1266	~	245 245 245 1162 245 245 245 245 245 245	~	8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	
-	111111111111111111111111111111111111111	-	777777777777777777777777777777777777777	-	1126444611	
0		•	वर्ग वर्ग वर्ग क्यां क्यां क्यां क्यां क्यां क्यां क्यां	•]	त्रमें क्यों वर्ण वर्ण वर्ण वर्ण क्यों क्यों वर्ण वर्ण	
7	***N# +#* -##	7		7	******	

i				1	
2	3632428650	2	10897286400	\$	29059430450
တ	-259459200	6	51891840 703404576 -726485760 5198985576-11277554400 10897286400	s	121080960 1576890000 -1816214400 11235811536-27046454400 29059430450
•	19958400 284574960 2201931576	*0	51891840 703404576 5198985576-	•••	121080960 1576890000 11235811336-
~	-1663200 -20353120 -3695464 -136954640	-	-3991680 -46536624 -299705400 -1406288100	~	-8648640 -97053936 -603682596 -2743963940
۵	151200 1557660 895148 3792304 131590430	ဖွ	332640 3272686 18083484 73772180 247226930	æ	665280 6314664 33775244 133767584 436325840
(* + 5 5	-15120 -127860 -617624 -2231012 -6631009	-6	-30240 -24504 -113504 -3977764 -11563650	+7 5	-55440 -434568 -1961470 -6666156 -18909891 -47210835
•	1680 11274 44524 134449 342769 775929	9+=}	3024 19524 74524 218344 741849 7197273	f=+7	5040 31594 117454 336049 816249 1768609 3520713
מא	-210 -1066 -3325 -8175 -17360 -53346 -59346	מא	-336 -1650 -5000 -11985 -26885 -46816 -81900 -135450	80	-504 -2414 -7155 -16815 -34300 -63504 -109494
2	30 107 251 485 485 1330 2002 2886 4020	2	42 146 335 635 1075 1687 2550 3570 4920	2	56 191 431 803 1345 2086 3066 4326 5910
-	11. 13. 13. 13. 13. 13. 13. 13. 13. 13.	-	- 13 - 13 - 21 - 30 - 40 - 13 - 105	-	-7 -15 -24 -34 -45 -57 -64 -115
<u>-</u>	0-Nn450-0-0	7.	**************	/-	######################################

	4			1	2
S	DVERFLOR	2	JVERFL3₩	2	OVERFLOW
đ	-4151347200 DVERFLDM	o	-8821612800 DVERFLOW	o	1764:1225600 DVERFLOW
æ	59200 29600 00016	••	518918400 6366517200 ÖYERFLDH	•	980179200 11728552G0-17647225600 OVERFLOW DVERFLOW
 -	-17297280 -188204400 -1137868848	۲	-32432400 -343976400 -2030997852 -8797620060	~	3603600 31813200 -57657600 159168428 -598482000 592678484 -3453513704 1825849430-14724404900
æ	1235520 11393808 59354028 229442156 731873960	9	2162160 19471500 99236556 375923456 1176812090	ဖ	3603600 31813200 159168428 592678484
* + 8	-95040 -725592 -3197348 -1063058 -29554812	{=+9 5	-15440 -1153956 -4985316 -16275700 -44493813	? =+10 5	-240240 -1743100 -7491484 -24083892 -64903734 -154530705
* -	7920 48504 176554 495544 1182769 2522289	{ *	11880 71394 255424 705649 1659889 3492489	<i>f</i>	17160 101524 358024 976024 2267769 4717209
*	-720 -3382 -9850 -22785 -45815 -48120 -142632 -230250	33	-990 -4578 -13145 -30015 -59640 -107800 -181818	ко	-1320 -6026 -17100 -38625 -73680 -136080 -227556 -361050
•	72 242 242 539 995 1645 2557 3682 5154 6990	2	90 299 659 11275 1975 1975 6054 8160	2	110 362 791 1435 2533 5085 7026
-	-8 -17 -38 -50 -63 -77 -108	-	-9 -19 -30 -42 -63 -64 -100 -137	-	-10 -21 -33 -46 -46 -46 -108 -108 -126
_		0			
7	6-NW+106-00B	7	- ころくららてるの	7	

Anthrito Sunty Assess	3497	WIRCHIGH FIRE	
		Genzander Vright Air Boreinpasset Genter Vright Patheron Air Force Best Gan Aires Wonney	Librarian Businal Surance of Mandards Librar Rose St. Hardward Sulfdag Westington St. S. C.
	Commenting Consoni, ngaw and Alexander of Consonies of the Consonies of the Consonies of the Same, the Food Same [2]	Commence	
The tor	To part of bright on com	Air Perse Semeste of Yestendage Air Perse Semeste of Yestendage Yester Perses on Air Perse Sele William Affair MELS Library AF Special Weapone Greater	Bunder, Golessie Br. Bari Gallen Indianal Busarier Agency Physical Science Bridge Peri George Manks, Maryland
		Alta Ports Houses	Fort George Mench, Maryland Se. M. Spannings Spainted Spainter Agency Physical Spainter Agency Physical Spainter Port George Monday, Maryland
Total (4)	Art. GROTIA Commonter Villat Air Berningment Caster Villat Air Berningment Caster Galo Galo WELAA Lineary	Privide Air Porce Base Florida	Personal Solonias Stoteles Personal Solonia, Maryland Stoteles Solonias Solonias Solonias Solonias Solonias
State of the lates		U. S. Goost Gazid 1960 S. Garest, N. W. Wachington 25, D. G. Atta: Sint	Cheng Stang University Secritical Implementag Superimons Taines, Taines Republic of China After Producer China-Hel Chen Steel, Sup. Superimons
State of three Secretary	internal Scientify Agency Physical Scientes Striages (4) Programs Services, Maryland Ann. St. Airin Macking Assessed Prof. A. Reprinted Supergrams of the Control of the Control Supergrams of the Control of the Contro	M. A. Hrismanich, Chief Systems Semponent Breach Sentremic Warther Section Signal Corps Agazay White Wards Proving Ground Nov Mandes	Mr. B. B. Jenes Repartment of Identification Univ. Gallage of No. Synthesisters Resis, Sufficiency, England
State of Horni Reseases Sections of the 1877 (A) Section of S. S. C. (1871 Aller St. A. Bertolik, Gods 627 State of Horni Breasesh	Assessed Prof. A. Reprinted Separation of Macroton Separation Interest of Senters Subserving University Park Lee August V, Galdberg Lee August V, Galdberg Assessed Macroton	Nov Medes Mr. A. D. Bedrestes Ngmi Derre Linion Office Mr. A. D. Bedrestes Mr. Derre Linion Office Mr. Derre Linion Mr. Rese 133 Cambridge Mr. Meansburge Control Mr. Meansburge Mr. Manuella	Producer Paul Basel Miles Gasha City University Dayl. of Employering Stranges 13 Mahi Ogfenacht (Einsles Gasha, Jujan
Other of threat Breatensh Statement of the State (8) Verbauer of the State (8) Antes Other St. S. G. State Oth	Antidate Courtery of Behave Brosseyh and Javelepenesi Brosseyh and Brosseyanes Beard Beportment of Brokey Verhington M. B. G.	Dubling Mr. Ream 131 Cambridge Mr. Massachusetta Chief Surepeas Office	Bennid G. Stinson Bept. of Electrical Hung. University of Artesian Torons 21, Artesian
Commanding Colleges Open of Metal Research of Research (d) Research (d) Research (d) Research (d)	Oblige of Morei Operations Separatement of the Mary West Selme 25, S. C. Alles Op. 26	Chief, Burupeas Office ARISE Command Shift Building 10 Buo Raventein Bracelle, Bolgium	Professor Jaromo R. Singer Div. of Electrical Engineering University of California
Obiel, Descen of Stage Description of the Story (I) Variation 14, B. G. Ann Company (I)	Chief of Shrul Operations Separates of the Harry Verbington St., B. C. Attac Q5-12	97 J. Anton Madrona Ordennou Materiale Res. Giller Watertown Argent Tutortown, Maccochecotte	Professor Charles Mintel Department of Physics University of California Beckeley 4, California
Alle Person Bour	Chief of Hovel Questions Superiment of the Henry Weshington 26, P. C. Attn: Op-413	Artiapen Giber AFTA Reference Genter Artiapen Mai Besten Artispen 18, Virginia	German Li, Changeria Germania University Waltham, Mustachangens
Chief of Horst Received Supermost of the Hory Varieties 25, D. C. Alta Clob 401	Chief, Bureau of Astematics Separatement of the Newy Weekington JS, B. C. Adm: 18-4	Standard Research Institute Documents Genter Monte Party, Calaborate Atte: Mary Los Flaids	Professor H. G. Booker Subset of Mostrical Inglessoring Cornell University Shoes, New York
Egypte district Research Office of Short Research Off Smither Research Destan, Mosterchante Gammanire Offices	Technical Library U. S. Howal Proving Ground Babligson, Volginia	Dr. C. M. Fapon Bopt. of Electrical Baginsoring Galibrate Institute of Technology Paradems, California	inverse, unities of Engineering University Relatio Library: University Relation flow York University New York 33, New York
Commanding Officer Office of three Received John Creece Library Smitting St Snat Readable Street Chicago 1, Minote	Director Metal Ordannos Laboratory White Shik, Maryland Librarian	Stanford Electronics Lab. Stanford University Stanford, California Aria: Document Library Applied Electronics Lab.	E. A. Chapman, Librarian Beneselaer Polytechnic Institute Ames Blates Blais Tray, New York
Commenting Officer Office of Blood Research Streetury How York 13, New York	Librarian U.S. Blond Food Gradeste School Menterey, Galdbreid Air Force Office of Scientific Bornaria Air Force Office of Scientific Bornaria Air Bornards and Srealequence General Vanagion 21, 3 C. Asia SET, Flygich Division	Department of Electrical Businessins	Troy, New York Reduct Piessey Superincent of Busineering Gate hashing of Technology Water ratey Tircle Gloveland & Chica
Commanding Officer Office of Shroll Recentry 1650 Shotl Group Street Postdoon, California	Area: SET, Physics Division Commanding General Bosto Air Brostonal	Baltimore E, Staryland	Daimontey Tirele Cleveland & Ohio Bapt. of Mercinal Baginsoring Chee Inciding of Technology
Commenting Officer Office of Hotel Recearch 1400 Geory Secont Sen Francisco 7, California	Generating General Bette Air Period Griffice Air Period Bette Bett Bette	Radiotion Laboratory Johns Humbles University 1915 St. Pend Breest "all! 5 3, Maryland	Bupt. of Mastrical Engineering Class Institute of Technology Entworking Circle Chrosland 6, Chie Atta: G. Study, Uned Br. G. J. Pathonica
Hend, Dorument Services Traducted Information Division (Breat Records) Laboratory Traduction Its, D. C.	Commanding Gane reli Rume Air Beresingment Gridles A'r Perre Bee Bane, New York Atte: hCR	Director, Lincoln Laboratory in Jo. Incident of Technology Bedford, Managements Mr. John Management	Br. G. J. Fullenhosh Betelle Memorial Institute Columbus, Chie Altin: Electrical Engineering Division Librarian
Martin A. Gardens Magneties Srench, Code 6416 Solid State Straign Shock Recease Laboratory Washington 25, B. C.	Commander Air Forces Combridge Research Contay 230 Albary Street Combridge 37, Massenshusetts Attas CE 29	Mr. John Boute Der macet Rasm Soccorch Lab. of Eboutranics Mace. Institute of Technology Combridge 19, Maceachusotte	Inglinering Library Brown University Providence, Heads Island Professor A. W. Branton
Commenting Officer F.B. Mr Air Severyment Conter Johnstoffe, Peneryment After HABC Library	Commendar Air Porte Cambridge Ressarch Conter 130 Albany Street Cambridge 37, Maccochusette Aith: Callan	Mose institute of Turkeningy Lab. for investion Recental Cambridge 39, Maccockweets	Problems A. W. Breaten Supt. of Shortrieni Engineering University of Toube Anoths 12, Toube Mr. withing Way
V.S. M. Air Development Conter- letarettin, Posseriemia	Commission Commission Commission AF Cart Printing Research Laboratories Literator G. Blome on Field Sedied, Metalesianeste Affel Sv. Heilingsweith	Library, Hosin A 219 Lincoln Laboratory F. O. Box 73 Lorington 73, Marcachaectte	Mr. s'islam Way Research Libraries Trater hattrament Gosp. 3367 Galances Bustovard Hollywood M., Galifornia
Chief, Barren of Accommunics Superiment of the Herry Violenties SI, B. C. Alter SI-1		Timery one Analysis Department Willer Ben Laboratories University of Michigan Willer Ben Advance Typilani, hitologan	
Original States of the Control of the States	Wright Air Bereisment Gamer Wright Penteron Air Force Base One Attn: WCRR Santin Corposition Org. 10th Section	SOLID #	TAYE CHILY
Dr. John S. Paprin égyfied Physics and Factile Devices group Minerary Mestrenius Co. F. G. Sea 1865 Chatraster, Florida	Banka Corporation Org. 1434, Studio Rose Affective Mere Municipal Attack Br. G. W. Barrisson, Jr. Studio Corporation	Martin A. Garzione, Nead Porsangustin Section Information Breach tolk State British State State Control Home Section Laboratory Washington St. D. C. Amis Cities 645	Professor R. R. Markey Separament of Physics Washington Visiversity R. Leuin, Missauet
Beginnering Liberry Berry Ministeren Steelermins Co. Contractor, Francis	Sundia Garperentes Sundia Sens Alternativo, New Mentico Attas Editority Striction 1923-1 Mr. Refuser Turner	Br. Baister Becoules, Jr.	Microster Research Institute Polysofth is Bottlette of Breaklyn 16 Jahres von Bress Brechten, Her York Amit Liberatus
Dr. Labor Street Septemb Profess Springer	Mr. Richert Turner Gran rai Bioteria Gampany Africand Bioternatic Gamer Gernali Salvaretty Bhon, New York	Ordinare Materiale Accessed Laboratory Visirium Arcensi Visirium Arcensi Visirium Arcensi Mingl Trebissed Catings Hincip, Agen	Dr. Melny Stapics Arthur B. Little, Inc. 13 Acton Park Combridge Cl. Macandascotte
Property Conta, Librarian St. Spring Great Walter St., Management	Library Althoras Instruments Lab. Wat Waterna Board Identitie, Long Inlead, How York Excepting, Working Group	Month, Japan Statemacy Research Laboratory Striction of Statemacon Supinsoring Veteratity of California Statemacy 4, Oak forms Statemacy 4, Oak forms Mate: Libertine	Dr. Simon Puner Lincoln Laboratoriae Sur 7) Lordagon, Montaineasta
Seport Librarian Spreada Blastole Probante Inc. Spreada Statune Statelan 169 Forth January Waltham, Minesakusana	AND VICENTIAL TOP THE		Mr. William H. From Proce Bingle Corporation JA A Direct Budhay, Macadamoune
Validam, Maccoduscess Provinces Control Control Validam Laboury Replaced Maccodingsons Validam Maccodingsons Validam Maccodingsons	Hotels Received Laboratories Receive Metallurghest Gampany See 16th, Magra Yulfe, New York	Johns Hapkins University John and Charles Street Whitehead Hall Delitinate I A. Maryinad Affini Mr. J. Q. Arlines	Br. Blancel W. Gaston 661 Wantstein America Dr. Lette, Microsof
J. S. Ottoma Street Laboratory	Librarica General Electric Research Lab. P. G. Sen 1989 Schempskip, How York Wootinghouse Montric Com.		Dr. W. M. Welch Sell Pringhoup Labo., Inc. Morroy PMR, More Jorcey
	Vestinghence Meatric Corp. Secured Laboratories South Read, Cherchill Bove. Pinchargh 34, Pennsylvania	Professor (. Love Department of Physics University of Minnesota Minnespelle, Minnesota	Librarian BM Votesn Laboratorios 612 West 519th Street How York 27, How York
Smirtes G. H. Tang Bell Saley one Late. Startey Hill, New Jersey Liferian	Prof. C. S. H. Spelleck P. G. Sun 344 Selecte, New Jones	BLECTROMAGNETH	SADIATION CHILT
Andreas	By. Mairie W. Adress 911 Shot Generators Street Papellorith.	Mirrowen Brownest Incidents	dr. J. B. Separa, Jr., budding id, Surm Sair Spine Instantial Laboratory Sairce City, Galdania Publisher S. N. B. Separah
Principa, New Jories	Lebestery Arrivance foresterments Minorita, New York	Breaklyn, How York	Problems G. B. St. Sydbook L. G. Son Mé Interior, New Joseph

One Copy Woman Character Street

ţ