

What are the mystery digits?

Chris Christensen

Department of Mathematics and Statistics

Northern Kentucky University

“24” or “a 2 and a 4?”

0 3 8 2 4

JN-25, 1 June 1939

Codebook

15072	總	20017			【No】
35240	總	60000			
71964	粉塵機	62580			
70723	此方	16777	煤機		
30078	煤機	36054			
10003		55091	煤機		
60106	此方	47740	煤機		
75317	此方	30052	煤機		【No】
15005	此方	07143	煤機		
47748	此方	66003			
80500	此方	30020			【No】
80000	此方	99109	之		
44745	此方	72330	之		
83072	此方	20392	之		
73443	此方	09670	之		
31700	此方	32427	之		
45104	此方	49515	之		
10590	此方	05703	之		
74445	此方	30250	之		
60577	此方	24135	之		
90211	此方	07307	之		
55003	此方	60000	之		
05030	此方	12210	之		
61137	此方	01024	之		
10204	此方	20940	之		
39741	此方	47107	之		
70002	此方	62031	之		
40254	此方	22420	之		
11632	此方	60430	之		
72034	此方	00140	之		
03916	此方	69900	之		
24204	此方	70074	之		
61700	此方	30907	之		
74730	此方	05147	之		
12753	此方	30000	之		
50445	此方	09294	之		
00530	此方	67926	之		
43001	此方	30002	之		
29400	此方	34314	之		
07471	此方	07701	之		
00000	此方	47770	之		
40000	此方	74032	之		
00004	此方	33000	之		
00043	此方	60022	之		
22200	此方	70000	之		
20100	40501	34100			

JN-25

Codebook

15072	雞	20017											
92240	鷄	60040											
71964	鷄 (Kana)	62580											
70724	此方 (一)	1677	鷄										
30078	鷄	30054											
18000	鷄	50091											
60106	鷄 (Kana)	47740	鷄										
75317	鷄 (一)	30052	鷄										
15005	此方 (一)	01143	鷄										
47748	此方 (一)	66003	鷄										
80500	鷄 (一)	30020	鷄										
80000	鷄 (一)	99100	鷄										
44745	鷄 (一)	72330	鷄										
83072	鷄 (一)	20392	鷄										
73443	鷄 (一)	09670	鷄										
31700	鷄 (一)	32420	鷄										
45104	鷄 (一)	49515	鷄										
10590	鷄 (一)	05730	鷄										
74445	鷄 (一)	30250	鷄										
60577	鷄 (一)	24130	鷄										
90211	鷄 (一)	07300	鷄										
55000	鷄 (一)	60000	鷄										
00000	鷄 (一)	12210	鷄										
61107	鷄 (一)	01020	鷄										
10204	鷄 (一)	20940	鷄										
39741	鷄 (一)	47100	鷄										
70002	鷄 (一)	62030	鷄										
40254	鷄 (一)	22400	鷄										
11632	鷄 (一)	60430	鷄										
72034	鷄 (一)	00140	鷄										
00916	鷄 (一)	69900	鷄										
24204	鷄 (一)	70070	鷄										
61700	鷄 (一)	00900	鷄										
74730	鷄 (一)	05140	鷄										
32750	鷄 (一)	30000	鷄										
50445	鷄 (一)	09294	鷄										
00530	鷄 (一)	69920	鷄										
40001	鷄 (一)	00000	鷄										
29400	鷄 (一)	34314	鷄										
07471	鷄 (一)	09700	鷄										
00000	鷄 (一)	49770	鷄										
40000	鷄 (一)	74000	鷄										
00000	鷄 (一)	33000	鷄										
00000	鷄 (一)	60000	鷄										
22200	鷄 (一)	70000	鷄										

Additive book

168													
	35	64	97	50	77	83	19	70	65	92	80	41	
56	86525	59794	32265	08721	77747	89646	08961	74287	44623	90851	55394	54330	
82	63198	09068	59878	37751	01138	74273	44192	92006	12605	82010	57238	75927	
40	72724	27833	17904	71001	63492	86531	31923	20299	55093	27751	63186	92086	
95	54330	28894	80450	44570	67705	86319	24662	51618	45172	86582	16021	10741	
24	74397	88526	61091	44295	03673	41630	37861	83122	94238	04579	63389	18055	
06	41533	76632	12766	00038	28662	22407	22798	35885	55749	09056	01029	48561	
31	60896	18432	93846	21732	73653	24408	80571	60318	41684	27174	42081	56048	
54	63963	84748	07521	79122	96207	93780	34538	89199	37779	09235	25343	46622	
16	87300	16491	90526	23039	03307	85018	91431	27965	71858	79261	31533	99972	
99	30867	94691	93820	38391	50284	78935	19028	86926	77860	41659	78361	22528	
04	82592	25246	06918	67415	70785	63695	69931	50394	45537	52570	76841	28518	
13	07383	90671	54913	38288	56848	87120	00978	44750	96010	08092	95034	01837	
34	35980	66131	32323	78865	10703	12492	71252	59050	03942	58436	48900	07124	
52	94559	36966	12586	22128	56709	92124	35156	80905	27703	11340	77678	05730	
67	11391	63984	22686	80030	17612	36617	81242	81531	19358	45833	85957	31533	

JN-25 message

(SAMPLE MAIL COPY)

01669

TIHOKI SOSUFU DE KOBYO

I 15 JANUARY 1943

SARA UTU 3972 - WIHI W27 TURA HFO 4

TI TONAHU HAFU 7 // WIMO 6 (NONU 7) HPHO AME 6 WENURANIAHO RASUMEWE

HA WOMI 6 BT

151630 54902 05099 56397 63673

69190 53808 87640 48931 14793

21375 83457 34567 98472 14896 ? G

BT2

49302 67934 56734 89641 57312

51213 50998 63637 91903 35238

51630 54902 VE

1737 G AK

2B// 8350 M

91497

D 13
DUPE

L 749-2

Encoded

10672	艦	20817	
95240	砲	60848	
71964	形原機	67583	
70122	此等	16777	滅
94978	機	36654	
18693		55991	機
90106	此等	47140	機
76217	機	96851	機
15085	機	07143	機
47748	機	66883	
84686	機	30270	之
80880	機	25181	之
44745	機	72320	之
83872	機	28372	之
73483	機	85678	之
51738	機	37427	之
45184	機	48515	之
10598	機	95153	之
74446	機	10759	之
68277	機	24125	之
19211	機	07301	之
15082	機	00688	之
85838	機	12714	之
61137	機	81024	之
40294	機	23449	之
57741	機	47188	之
74835	機	52501	之
48254	機	22428	之
11632	機	68433	之
72834	機	80740	之
45716	機	89183	之
14280	機	74274	之
63765	機	38987	之
14738	機	85181	之
17751	機	28084	之
50445	機	95244	之
80838	機	67028	之
45881	機	88828	之
27408	機	34214	之
57471	機	87781	之
94832	機	47278	之
48538	機	74832	之
65284	機	21872	之
88443	機	58812	之
72268	機	70885	之

United States Navy

24396

Battleship(s)

31143

Ten

74412

Additives

168												
	35	64	97	50	77	83	19	70	65	92	80	41
56	86525	59794	32265	08721	77747	89646	08961	74287	44623	90851	55394	54330
82	63198	09068	59878	37751	01138	74273	44192	92006	12605	82010	57238	75927
40	72724	27833	17904	71001	63492	86531	31923	20299	55093	27751	63186	92086
95	54330	28894	80450	44570	67705	86319	24662	51618	45172	86582	16021	10741
24	74397	88526	61091	44295	03673	41630	37861	83122	94238	04579	63389	18055
06	41533	76632	12766	00038	28662	22407	22798	35885	55749	09056	01029	48561
31	60896	18432	93846	21732	73653	24408	80571	60318	41684	27174	42081	56048
54	63963	84748	07521	79122	96207	93780	34538	89199	37779	09235	25343	46622
16	87300	16491	90526	23039	03307	85018	91431	27965	71858	79261	31533	99972
99	30867	94691	93820	38391	50284	78935	19028	86926	77860	41659	78361	22528
04	82592	25246	06918	67415	70785	63695	69931	50394	45537	52570	76841	28518
13	07383	90671	54913	38288	56848	87120	00978	44750	96010	08092	95034	01837
34	35980	66131	32323	78865	10703	12492	71252	59050	03942	58436	48900	07124
52	94559	36966	12586	22128	56709	92124	35156	80905	27703	11340	77678	05730
67	11391	63984	22686	80030	17612	36617	81242	81531	19358	45833	85957	31533

United States Navy

24396

86525

Battleship(s)

31143

59794

Ten

74412

32265

False sum

	0	1	2	3	4	5	6	7	8	9
0	0	1	2	3	4	5	6	7	8	9
1	1	2	3	4	5	6	7	8	9	0
2	2	3	4	5	6	7	8	9	0	1
3	3	4	5	6	7	8	9	0	1	2
4	4	5	6	7	8	9	0	1	2	3
5	5	6	7	8	9	0	1	2	3	4
6	6	7	8	9	0	1	2	3	4	5
7	7	8	9	0	1	2	3	4	5	6
8	8	9	0	1	2	3	4	5	6	7
9	9	0	1	2	3	4	5	6	7	8

United States Navy

24396

86525

00811

Battleship(s)

31143

59794

80837

Ten

74412

32265

06677

Indicators

Use #3

1 December 1943 -

Group 4

16856

Group 5

35168

2nd from last group

16856

Last group

97168

15 x 12 table of additives

168												
	35	64	97	50	77	83	19	70	65	92	80	41
56	86525	59794	32265	08721	77747	89646	08961	74287	44623	90851	55394	54330
82	63198	09068	59878	37751	01138	74273	44192	92006	12605	82010	57238	75927
40	72724	27833	17904	71001	63492	86531	31923	20299	55093	27751	63186	92086
95	54330	28894	80450	44570	67705	86319	24662	51618	45172	86582	16021	10741
24	74397	88526	61091	44295	03673	41630	37861	83122	94238	04579	63389	18055
06	41533	76632	12766	00038	28662	22407	22798	35885	55749	09056	01029	48561
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54	63963	84748	07521	79122	96207	93780	34538	89199	37779	09235	25343	46622
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99	30867	94691	93820	38391	50284	78935	19028	86926	77860	41659	78361	22528
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13	07383	90671	54913	38288	56848	87120	00978	44750	96010	08092	95034	01837
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52	94559	36966	12586	22128	56709	92124	35156	80905	27703	11340	77678	05730
67	11391	63984	22686	80030	17612	36617	81242	81531	19358	45833	85957	31533

25 July 1944

Group 4

03824

Group 5

03824

3rd from last group

03871

2nd from last group

03871

Hollcroft's problem

The tables cover, for certain values of the parameters, the following abstract situation. Suppose that there are N identical marbles in a box, and that these marbles are numbered from 1 to N inclusive. Let one marble be drawn at a time and replaced after each draw. If this operation is repeated n times, what is the probability that exactly one marble will be drawn at least m times? There are seven tables, giving the answers to this question for the seven values 5, 6, 7, 8, 9, 10, and 100 for N , and for indicated values of n and m .

N marbles numbered 1, 2, ..., N

n draws with replacement

Probability of one marble being drawn at least m times

Tables for $N = 5, 6, 7, 8, 9, 10, \text{ and } 100$

N = 5

<u>n</u>	<u>m = 2</u>	<u>m = 3</u>	<u>m = 4</u>	<u>m = 5</u>
2	.04			
3	.104	.008		
4	.1808	.0272	.0016	
5	.2627	.0579	.0067	.00032
6	.3446	.0989	.0170	.00161
7	.4233	.1480	.0331	.0044
8	.4967	.2031	.0563	.0104
9	.5638	.2618	.0857	.0197
10	.6242	.3222	.1207	.0328
11				
12	.7255	.4426	.2068	.0742
13				
14				
15	.8329	.6019	.3519	.1644
16				
17				
18				
19				
20	.9308	.7939	.5885	.3703
21				
22				
23				
24				
25	.9726	.9018	.7660	.5793
26				
27				
28				
29				
30	.9895	.9558	.8773	.7448
31				
32				
33				
34				
35	.99605	.9810	.9395	.8565

$$P(\geq m \text{ appearances of a number}) = \sum_{k=m}^n \binom{n}{k} \left(\frac{1}{N}\right)^k \left(\frac{N-1}{N}\right)^{n-k}$$

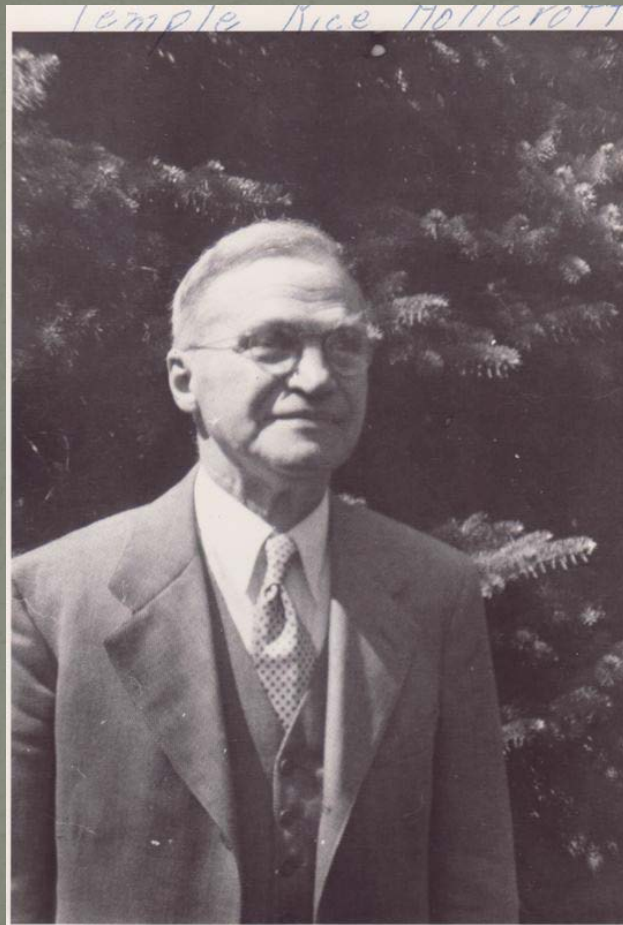
The answer

2 and 4

Too many additives on the page

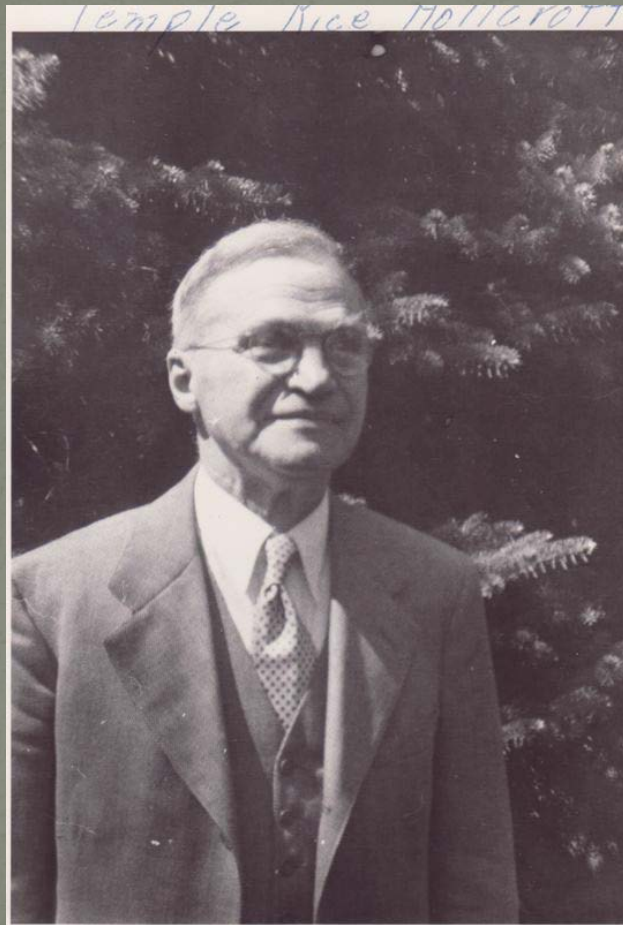
038											
		4	0	8	2	9	5	1	6	3	7
7	Odd	30885	81591	13839	37280	19363	12642	60566	37552	36047	51556
	Even	74868	76901	10081	17212	82770	69607	83232	66848	60463	45567
2	Odd	51556	52067	18948	07784	24049	29890	03383	99094	83897	20627
	Even	45567	13385	73727	08043	93921	57459	57882	69981	88288	67833
6	Odd	84584	70893	01576	57728	78875	95116	35742	58476	19092	55974
	Even	63102	85004	69970	77002	52993	47898	90797	22391	54624	16482
8	Odd	78660	31457	90898	20881	93695	33744	24863	90036	45897	89345
	Even	28421	97662	55093	46090	61297	06505	41348	13203	85491	43716
4	Odd	41318	29697	80771	76675	36756	79754	04369	41560	74567	22971
	Even	13046	63899	98636	43901	57755	02334	32133	87623	05293	63658
1	Odd	83739	72782	96153	67800	51097	05766	78790	09349	65225	47851
	Even	12052	30252	87285	18540	19328	21253	11350	65082	31135	94391
9	Odd	59708	84738	14083	48814	82870	47103	56764	27719	07883	94844
	Even	92959	40472	25534	58177	74115	44500	45307	39175	54596	50313
3	Odd	64112	15788	48730	81710	53694	88953	29736	72203	61245	52097
	Even	47961	48848	98515	82070	37999	37024	11112	24908	98181	87438
5	Odd	00461	32643	53241	27788	73551	38440	14590	21103	35100	98271
	Even	91694	31592	64130	54641	20867	81772	25971	61276	45679	76511
7	Odd	23038	57327	41442	98419	74259	85592	68028	72679	73031	88262
	Even	54336	50636	27090	10712	11860	10729	04931	04744	70715	29493

T. R. (Temple Rice) Hollcroft



- Born 1889 Alton, IN
- Greencastle HS 1908
- Hanover College 1912 and 1914
- Univ of Kentucky 1915
- Cornell 1917 (Virgil Snyder/Felix Klein)
- Joined Wells College, Aurora, NY 1918

T. R. (Temple Rice) Hollcroft



- Wells College, 1918 – 1954
- Chair, 1920 - 1954
- 38 papers
- Associate Secretary of AMS, 1937 – 1950
- Wells College historian
- Cayuga County Historian

But, why T. R. Hollcroft?

T. R. Hollcroft, Jr.

Born 1920, Lexington, KY

“Prepared at Phillips
Exeter Academy”

“Attended Harvard”



JOHN DOUGLAS HOAG
Born September 24, 1919, in Fort Totten, New York. Prepared at Punahou School, Honolulu, Hawaii. Attended University of Hawaii one year before Harvard. At Harvard three years. Home Address: Henry Barracks, Cayey, Puerto Rico. Eliot House. Dramatic Club (2); Excavator's Club (2). Field of Concentration: Anthropology. Intended Vocation: Archaeology.



THEODORE HOAGUE, JR.
Born November 11, 1915, in Boston, Massachusetts. Prepared at Weston High School. At Harvard one and one-half years. Home Address: Deerfield, New Hampshire. College Address: 20 Avon Hill Street. Dramatic Club (1, 2). Field of Concentration: English.



WHITMAN HOBBS
Born January 25, 1919, in Brookline, Massachusetts. Prepared at Phillips Exeter Academy. Home Address: Marion, Massachusetts. Leverett House. *Lampoon*, Literary Board (3). Field of Concentration: American History.



PHILIP BERNARD HOCHSTEIN
Born October 28, 1920, in New York, New York. Prepared at Boston Public Latin School. At Harvard one and one-half years. Home Address: 195 Woodrow Avenue, Dorchester, Massachusetts. Living at home. Field of Concentration: Government.



JAMES HENRY HODGENS, JR.
Born May 9, 1919, in Cambridge, Massachusetts. Prepared at Cambridge High and Latin School. At Harvard one-half year. Home Address: 8 Beech Street, Cambridge, Massachusetts. Living at home.



ERNST HOEFER, JR.
Born November 15, 1921, in Sheboygan, Wisconsin. Prepared at Sheboygan High School and Dwight School. At Harvard one year. Home Address: Sheboygan, Wisconsin. Camera Club (1). Tennis (1). Field of Concentration: Economics. Intended Vocation: Officer United States Navy.



EUGENE HENRY HOFFMAN
Born November 24, 1918, in Bisbee, Arizona. Prepared at Santa Barbara School. Home Address: Cincinnati Country Club, Cincinnati, Ohio. Lowell House. Speakers Club. Field of Concentration: Engineering Sciences. Intended Vocation: Manufacturing.



RICHARD CORT HOLDEN
Born October 7, 1918, in Boston, Massachusetts. Prepared at Gunney School. Home Address: 45 East 9th Street, New York, New York. Kirkland House. *Lampoon* (2-4); Dramatic Club (1-3); Pi Eta Theatricals (3, 4); French Club (1). House Squash (4). Pi Eta. Field of Concentration: English. Intended Vocation: Writing.



TEMPLE RICE HOLLCROFT, JR.
Born April 19, 1920, in Lexington, Kentucky. Prepared at Phillips Exeter Academy. At Harvard two years. Home Address: Aurora, New York. College Address: 351 Harvard Street, Phillips Brooks House (1); Student Union (1); Chess Club (1, 2). House Football (2). Field of Concentration: English. Intended Vocation: Sales.



PAUL MERRICK HOLLISTER, JR.
Born September 2, 1918, in New York, New York. Prepared at Milton Academy. Home Address: 117 East 72nd Street, New York, New York. Winthrop House. Hasty Pudding Theatricals, Scenery (2). Track Squad (1). Hasty Pudding-Institute of 1770; Signet Society. Field of Concentration: Fine Arts. Intended Vocation: Painter.



ROBERT HUGH HOLMES
Born January 18, 1920, in Huron, Illinois. Prepared at Pomona High School. At Harvard two and one-half years. Home Address: 197 Monroe Street, Pomona, California. College Address: 4 Potter Park. Sociology Club (1). Field of Concentration: Sociology.



BRANTLEY HOLT, JR.
Born January 31, 1919, in Seattle, Washington. Prepared at Ellensburg High School. At Harvard three years. Home Address: 913 East 3rd Street, Ellensburg, Washington. Leverett House. Ski Team, Assistant Manager (2, 3). William Hilton Scholarship (1). Field of Concentration: Biology. Intended Vocation: Medicine.

HARVARD COLLEGE

DEAN'S OFFICE

Dean

A. C. HANFORD

Assistant Deans

SARGENT KENNEDY

REGINALD H. PHELPS

R. SKIDDY VON STADE, JR.

4 UNIVERSITY HALL

CAMBRIDGE, MASSACHUSETTS

April 21, 1942

Commander of the Third Naval District
New York, New York

Dear Sir:

Mr. Temple Rice Hollcroft, Jr. was in residence in Harvard College during the year 1937-38, in the Summer School of 1939, and during the year 1939-40. A transcript of his record is appended. As can be seen from his transcript, Hollcroft apparently has far more ability than he cared to show while in College residence. If he wished to, he could get honor grades. However, it was his belief that the day-to-day routines of college course work were of little importance, and he consequently cut many classes and failed to hand in assignments as they were required. We tried in every way possible to get him to see the necessity of sticking to the job at hand, but failed to be able to get satisfactory results. Since he had an unsatisfactory record at his final examination period in 1940, and was then on probation, it was necessary to close his probation for the second and final time.

In my frequent dealings with him, he impressed me as a young man who could do very satisfactory work if he really wished to. There never was any question as to his moral integrity and honesty while here at College.

Very truly yours,

Sargent Kennedy

Washington Post, 1990

Temple Rice Hollcroft, 70, a retired cryptanalyst with the National Security Agency who had lived in the Washington area since 1938 died ... at his home in Silver Spring.

Mr. Hollcroft, who was born in Lexington, KY., attended Harvard University and served in the Navy in World War II. After the war, he joined a predecessor agency of the NSA. He retired from the agency in 1984.

25 November 1944

51st Annual meeting of AMS, Chicago

T. R. Hollcroft: *The probability of repetitions.*

The probability of repetitions is concerned with repetitions only and not with the particular numbers that are repeated. For example, **let one number be drawn at a time from ten and replaced after each draw. Eight may be drawn as follows: 4 3 7 6 4 7 6 7. This set contains one triple and two double repetitions. ... This set is represented by (3221).**

The real story

used no more than two or three times. It was necessary to develop a series of probabilities for small samples, and the answer was found in the person of a member of the American Mathematical Society who, unaware of the purposes to which they were to be put, not only computed the refined tables to meet the statistical requirements of this situation but later quite properly published them as an original contribution to mathematics. When, prior to publishing, he presented part of his findings in a paper before the Society, some of the members openly questioned that any possible use for the data would ever be found. But back in GYP-1 it became the Bible of the small Key Room group who were laboring around the clock on 62.

2 and 4