modern students in a modern language, for Ptolemy's Almagest is the text from which astronomers have drawn knowledge and inspiration for over a thousand years, a longer period of authority than that of any other astronomical author.

The first volume of Halma's edition begins with an elaborate Preface in French which is an historical and critical account of Ptolemy's great book, emphasizing its value to the modern astronomer. This part, though rich in detail, might have been profitably rewritten so as to embody later studies due to Paul Tannery and others. An historical result so very recent that it could not have been included even in a revision, unless written since 1926, is the demonstration that the precession of the equinoxes was known before the time of Hipparchus to the Babylonian astronomer Kidinnu.

Of special historical interest to mathematicians is Ptolemy's spherical trigonometry which he develops more fully than plane trigonometry. In his computation of a table of "chords" he establishes the theorem on the inscribed quadrilateral, that the product of its diagonals is equal to the sum of the products of the opposite sides. A simple and elegant geometric construction (*Ptolemy* I, p. 27), which yields simultaneously the sides of a regular inscribed pentagon and decagon is known to modern engineers, but is not given in elementary texts on geometry because of the comparatively greater difficulty of the proof.

FLORIAN CAJORI

Sieben- und mehrstellige Tafeln der Kreis- und Hyperbelfunktionen und deren Produkte sowie der Gammafunktion, nebst einem Anhang: Interpolations- und sonstige Formeln. By Keiichi Hayashi. Berlin, Julius Springer, 1926. vi+283 pp.

A review of these tables by T. H. Gronwall has already appeared in this Bulletin (vol. 32 (1926), p. 718). Dr. Gronwall's review concerned the contents and scope of the tables; the present review relates to their accuracy.

Wishing to construct a table of two functions auxiliary to the hyperbolic functions, and having read Dr. Gronwall's review, I decided that these tables would facilitate the compilation. Accordingly I procured a volume and used it. A computation formula was used which checked not only the computed values but also the consistency of the tabular values from which they were obtained, and the results have been rather disconcerting.

The first error encountered was in $\sinh x$, $x = .0783$ to $x = .0799$, in which a column of 7's should be a column of 8's. This however is quite probably a proof-reader's error and such errors may easily be corrected by the publisher. But in $\sinh .548$ and $\cosh .548$ the tabulated values are each too large by 0.000005 and the chances of this being an error in proof-reading are small. The chances are diminished by the fact that the same kind of thing occurs in eight other places, and for $x = .782$ and .923 the corresponding error is carried into e^x; $\cosh .872$ and $\sinh .872$ are each in error by 0.0000091618! Such errors could hardly arise from bad proof reading and one wonders what method of systematic checking would fail to reveal them.

All told, from the calculations made which would involve roughly 5% of the digits of the table, 25 groups of errors, as shown below, have been discovered which involve 55 functional values and 81 digits. Further argument seems unnecessary. One cannot fail to have the deepest sympathy with Mr. Hayashi in the enormous loss and disappointment which he sustained when his first calculations were as he states destroyed by fire, and to have the greatest admiration for his perseverance in immediately duplicating the entire work. But after all the value of the table is a matter of its accuracy and until the whole is thoroughly checked the table must be regarded as unreliable and used with caution. When made dependable these tables will be a great asset to any library.

ERRORS IN HAYASHI'S TABLES

Function		*Tabular Value*	*Correct Value*	*Error (T–C)*
sinh	.0783	0.0783700326	0.0783800326	−0.00001
"	.0784	4703397	4803397	"
"	.0785	5706476	5806476	"
"	.0786	6709563	6809563	"
"	.0787	7712657	7812657	"
"	.0788	8715760	8815760	"
"	.0789	9718870	9818870	"
"	.0790	0.0790721988	0.0790821988	"
"	.0791	1725114	1825114	"
"	.0792	2728248	2828248	"
"	.0793	3731390	3831390	"
"	.0794	4734540	4834540	"
"	.0795	5737698	5837698	"
"	.0796	6740864	6840864	"
"	.0797	7744037	7844037	"
"	.0798	8747219	8847219	"
"	.0799	9750409	9850409	"
tanh	.199	0.19461409	0.19641409	−0.0018
"	.332	0.22034672	0.22031672	−0.00003
sinh	.548	0.5758475557	0.5758425557	+0.000005
cosh	"	1.1539524204	1.1539474204	"
sinh	.554	0.5827816469	0.5827766469	+0.000005
cosh	"	1.1574282675	1.1574232675	"
sinh	.672	0.7237367615	0.7237317615	+0.000005
cosh	"	1.2344229449	1.2344179449	"
sinh	.719	0.7825752763	0.7825702763	+0.000005
cosh	"	1.2698145280	1.2698095280	"

Function		*Tabular Value*	*Correct Value*	*Error (T–C)*
sinh	.745	0.8158*385*675	0.8158*535*675	−0.000015
cosh	"	1.2905*728*675	1.2905*878*675	"
$e^{.782}$		2.1858*385*759	2.1858*395*759	−0.000001
sinh	.782	0.8641*742*302	0.8641*747*302	−0.0000005
cosh	"	1.3216*643*457	1.3216*648*457	"
cosh	.838	1.3721*586*405	1.3721*568*405	+0.0000018
sinh	.872	0.9867*783226*	0.9867*874844*	−0.0000091618
cosh	"	1.4049*111297*	1.4049*019679*	+ "
$e^{.923}$		2.5168*265*642	2.5168*295*642	−0.000003
sinh	.923	1.0597*506*444	1.0597*521*444	−0.0000015
cosh	"	1.4570*759*199	1.4570*774*199	"
sinh	.928	1.0671508087	1.0670508087	+0.0001
cosh	1.137	1.71*89*910180	1.71*90*910180	−0.0001
sinh	1.361	1.8218*835*997	1.8218*435*997	+0.00004
cosh	1.363	2.081*9906*903	2.081*8956*903	+0.000005
sinh	1.615	2.4145986265	2.4144986265	+0.0001
cosh	1.933	3.5374616062	3.5274616062	+0.01
sinh	1.942	3.41*64*327851	3.41*46*327851	+0.0018
cosh	1.952	3.5*8*23744152	3.5*9*23744152	−0.01
"	1.953	*8*58265966	*9*58265966	"
"	1.954	*8*92823738	*9*92823738	"
cosh	2.422	5.67*2*5587463	5.67*8*5587463	−0.006
cosh	2.554	6.468*0*023773	6.468*1*023773	−0.0001
$e^{2.717}$		15.1348491214	15.1348495214	−0.0000004
sinh	2.717	7.5343*932*230	7.5343*884*230	+0.0000048
cosh	"	7.6004*658*984	7.6004*610*984	+0.0000048
sinh	2.789	8.1015321270	8.1016321270	−0.0001
sinh	2.803	8.2164134403	8.2167134403	−0.0003

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