APPENDIX II. TO VOLUME II.

OF THE

SMITHSONIAN CONTRIBUTIONS TO KNOWLEDGE:

CONTAINING

AN EPHEMERIS OF THE PLANET NEPTUNE

FOR THE YEAR 1850.

BY SEARS C. WALKER, ESQ.

Gideon & Co., Printers, Washington, D. C.

SMITHSONIAN INSTITUTION, *April*, 1850.

This Ephemeris of the planet Neptune was prepared for the Nautical Almanac, but appears this year again among the Smithsonian Contributions, by permission of the Hon. WM. BALLARD PRESTON, Secretary of the Navy.

JOSEPH HENRY,

Secretary of the Smithsonian Institution.

CHARLES HENRY DAVIS, LIEUT.,

Superintendent of the Nautical Almanac.

LETTER

FROM

LIEUTENANT C. H. DAVIS,

SUPERINTENDENT OF THE NAUTICAL ALMANAC,

TO

JOSEPH HENRY, LL.D.,

SECRETARY OF THE SMITHSONIAN INSTITUTION.

SIR: With the authority of the Hon. Secretary of the Navy, I have the pleasure to submit to you for publication the Ephemeris of the planet Neptune, for the year 1850, prepared for the Nautical Almanac by Sears C. Walker, Esq. This is a continuation of the Ephemeris of 1849, which appeared in Appendix I to Vol. II, of the Smithsonian Contributions; being based on the same theory, elements, formulæ, and constants, viz., Prof. Peirce's theory, and Mr. Walker's elements, as originally published in the Proceedings of the American Academy for April 4, 1848.

In his introduction to the Ephemeris of 1848, Mr. Walker remarked, "Prof. Peirce's new theory of Uranus may now be considered as complete. That of Neptune can hardly be expected to make further advances till another opposition is observed." And in 1849, the opposition of 1848 having been in the mean time observed and discussed, without indicating any sensible correction, he added, "I have accordingly not attempted any change in the elements used as the basis of the Ephemeris of 1849."

The theory and elements have now been submitted to the test of a second opposition, that of 1849, and Mr. Walker still finds that no sensible correction is required in the basis of the Ephemeris for 1850. This result is as gratifying as it is unexpected. It evinces the great care bestowed by Prof. Peirce upon his second essay to perfect the theory of Neptune, and the remarkable accuracy with which the elements of Mr. Walker were determined, from data that could never have been regarded as sufficient to furnish a complete orbit.

As this subject is one of general interest, and as it holds a prominent place in the history of astronomical science in America, I will make no apology for entering here more fully into its consideration.

The venerable and eminent astronomer and mathematician, Bernhard von Lindenau, in a recent paper, entitled "Contribution to the history of the discovery of Neptune," after stating the condition in which this very peculiar question was left by the discoverers, Le Verrier and Adams, expresses his expectation that it will soon be brought to a satisfactory conclusion by a new investigation on the part of these geometers.

"It is to be expected," he observes, "that the former results of the computations will undergo a material change; for, if we apply to the perturbations of Neptune by Uranus, computed by Peirce, the proposition of La Place, controlling the equations of the perturbations of long period, viz., that the reciprocal perturbations of two planets are to each other as the products of the masses by the square roots of the semi-axis major, (Méc. Cél., Vol. III, p. 147,) we shall obtain for Uranus values very different from those on which the investigations of Le Verrier and Adams are based. If the question was in the beginning to solve the inverse problem of perturbations, we must now come back to the direct problem, which is, to determine by means of the perturbations of Uranus by Jupiter, Saturn, and Neptune, taken in connection with the observations of Uranus from 1690 to 1848, an orbit of Uranus which will represent in the best manner the whole of the observations."*

After finishing his paper, however, and while waiting to see the subject brought to a satisfactory termination by a new investigation on the part of Le Verrier or Adams, Lindenau received *the new and important work* (such are his words) on Neptune, contained in Vol. II. of the Smithsonian Contributions to Knowledge, by the American astronomer, Walker, whose first elliptic elements he had previously communicated.

He was thus led to append a supplement to the "Contribution," in which he gives the more essential points of the further development of the theory of Neptune and Uranus, and speaks of the labors of Mr. Walker in the following terms: "By using all the observations made in the old and new world in the years 1795, 1846–'47,–'48,† (amounting to more than a thousand,) and taking into account the perturbations of Neptune by Jupiter, Saturn, and Uranus, computed by Peirce, Mr. Walker obtained elements which represent not only the two observations of Lalande, but also all the recent ones within the limits of a few seconds. [Tenths of seconds of arc would have been more correct.] So that the Ephemeris computed by him from those elements for the periods from May 8 to 11, 1795, and from August, 1846, to January, 1850, is perfectly sufficient as well for finding the planet as for the comparison of the observed place."

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* This and the following extracts from Lindenau's paper are taken from a translation made by Mr. François de Pourtalès. The original is published by Prof. Schumacher in his supplement to the Astronomical Notices.

† This should be omitted, Mr. Walker having used only those of 1795, 1846, and 1847.

To this testimony, coming from too high a source to be overlooked or disregarded, it may be added as an illustration of the success attending the labors of American astronomers in this new and interesting field of research, that if, during the historical periods of the observations, the Neptune of prediction, and that of the Heavens, were conceived to form a double star, they would have such close proximity that no telescope could separate them, even if it possessed sufficient power to detect their duplicity. There is one circumstance which, indeed, is not to be forgotten; and that is, the great distance of the planet, which prevents the small errors of the best theory of the earth (the point of view of the Ephemeris) from sensibly affecting its projected place in the Heavens, the impressed errors of the latter being only a thirtieth part of the former.

The experience of 1848 and 1849 shows, that for the case of a very remote planet, it is possible, by the exercise of proper care, to compute an ephemeris in advance, that shall surpass the whole season's work of a single observatory in its close agreement with the average work of all. Mr. Walker's comparisons of the Ephemeris with observations for these years will serve as a justification of this remark. The meridian observations only have been used, with the exception of Liverpool in 1849.

Observatory.	Nation.	Astronomer.	Obs.—Eph., for the opposition.				Obs.—Eph., for the quadrature.			
			For R. A. in arc. $\Delta\alpha$	No. of Obs.	For Dec. $\Delta\delta$	No. of Obs.	For R. A. in arc. $\Delta\alpha$	No. of Obs.	For Dec. $\Delta\delta$	No. of Obs.
1848.			"		"		"		"	
Altona	Denmark	Petersen	— 1.20	10	+ 0.41	11	— 0.56	5	— 0.35	5
Athens	Greece	Bouris	+ 0.12	15	+ 0.61	15	— 2.23*	41	+ 1.94*	41
Cambridge	England	Challis	— 0.89	24	+ 1.97	23				
Copenhagen	Denmark	Sievers	+ 2.52	4	- -	- -	+ 0.29	11		
Durham	England	Thompson	— 0.95	4	— 0.46	3	— 0.99	5	+ 1.40	5
Hamburg	Germany	Rümker	— 0.95	26	— 1.29	25	— 0.80	10	— 1.66	10
Königsberg	E. Prussia	Busch	+ 0.81	6	— 1.01	6	+ 0.33	3	— 0.76	3
Markree	Ireland	Graham	— 1.00	6	— 0.46	6	— 0.07	23	+ 0.19	23
Petersburg	Russia	Sawitsch	— 1.22	8	+ 1.40	8	— 0.32	5	— 0.89	4
Average for 1848			— 0.66	103	+ 0.28	97	— 0.56	103	+ 0.28	91
1849.										
Altona	Denmark	Schumacher	- -	- -	- -	- -	— 1.46	10	— 1.28	10
Hamburg	Germany	Rumker	— 0.60	17	— 0.55	17	+ 0.37	18	— 0.67	20
Liverpool	England	Hartnup	— 1.45	3	+ 1.59	3	— 1.23	11	— 0.34	11
Average for 1849			— 0.74	20	— 0.23	20	— 0.55	39	— 0.73	41

* Used with a weight of 20.

Mr. Walker has also furnished the comparison of the ephemeris with the normal places, derived from all the observations yet received.

DATE.	OBSERVATION—EPHEMERIS.			
	For R. A. in arc. Δ α	No. of Obs.	For Declination. Δ δ	No. of Obs.
1795, May 9	+ 0.20″	2	+ 0.55″	2
*1845, October 25	+ 3.40	1	+ 2.38	1
1846, September 26	— 0.21	160	+ 0.55	144
November 6	+ 0.11	343	+ 0.62	297
December 31	+ 0.95	90	+ 0.92	80
1847, April 6	+ 0.42	15	— 0.18	16
August 22	— 0.64	76	+ 0.19	71
November 8	— 0.96	46	+ 0.77	51
December 18	— 0.44	18	+ 0.89	18
1848, August 24	— 0.66	103	+ 0.28	97
November 10	— 0.56	103	+ 0.28	91
1849, August 26	— 0.74	20	— 0.23	20
November 12	— 0.55	39	— 0.73	41

Having, in the first quotation from Lindenau's paper, introduced the mention of the theory of Uranus, it may be well to add a word on that subject.

Professor Peirce, in a communication to the American Academy, made on the 4th of April, 1848, announced that he had completed his investigation into the action of Neptune upon Uranus, from which it appeared that, with the mass of Neptune deduced from Mr. Bond's observations of Lassell's satellite, the theory of Uranus was then perfect, and that the motions of this planet did not indicate that there was any other unknown source of perturbation.

But there is "considerable uncertainty in the determination of the mass of Uranus, which still fluctuates, notwithstanding the most recent observations. It is so difficult to make accurate measures of the elongations of the satellites, on account of their faintness, and of their being seen only under very favorable circumstances of position and atmosphere, that the value of the mass derived from the most recent observations by Lassell and Herschel, of two interior satellites, varies between $\frac{1}{15480}$ and $\frac{1}{26860}$. Mr. Adams, for whose labors this element is of great importance, finds, by a new reduction of the observations of Lassell, $\frac{1}{20897}$, and of those of Herschel, $\frac{1}{21164}$, and thinks accordingly, that a mass of $\frac{1}{21000}$ would approach nearest to the truth." (Lindenau, Suppl.)

Professor Peirce, in his second approximation to the theory of Neptune, adopted the mass of Uranus taken from Lamont's determination by the observation of the satellites. But the mass remains to be determined anew, as he has already stated, by a study of the perturbations produced by Uranus in the orbits

* Lamont's Observation in his Zones, discovered by Mr. Hind.

of Jupiter and Saturn; and this investigation, involving a vast amount of labor, will run through the historical period of that planet. There are recent indications that such a work has been begun by Adams; if, however, it should not be accomplished on the other side of the water, it will be undertaken by Professor Peirce at his earliest leisure.

I will cite, in conclusion, a passage from Lindenau, relating to the discovery of Neptune, expressing an opinion, entertained, as I believe, by the best authorities on the continent of Europe and in this country: "I cannot so well agree with the view of the President of the Astronomical Society, when he treats the merits of Le Verrier and Adams, in the discovery of Neptune, as fraternal; for, leaving out of the question the peculiarities in their modes of proceeding, there is still an important difference in the fact, that the one came out boldly and quickly with his presumed discovery, while the other only communicated the similar result of his labors confidentially to a few friends. The fact that the French, English, Prussian, and German astronomers had no great confidence in Le Verrier's theoretical place of Neptune, is shown by the delay in searching for it; and Challis, who had first undertaken the search in a systematic manner, says: 'I confess that in the whole of the undertaking I had too little confidence in the indications of theory, though, perhaps, not less than most other astronomers might have felt under the same circumstances.' (Mem. of the Astro. Soc., Vol. XIV, p. 224.")

Very respectfully, your obedient servant,

CHARLES HENRY DAVIS.

1850. April 5th.

EPHEMERIS OF NEPTUNE FOR 1850.

APPARENT PLACE OF NEPTUNE FOR MEAN NOON, GREENWICH.

Date.	Right Ascension of Neptune.	South Declination of Neptune.	Date.	Right Ascension of Neptune.	South Declination of Neptune.
1850.	° ′ ″	° ′ ″	1850.	° ′ ″	° ′ ″
Jan. 1	334 55 24.22	— 11 11 6.59	July 31	338 26 38.63	— 9 54 18.37
9	335 8 1.10	— 11 6 15.31	August 1	338 25 19.95	— 9 54 50.77
17	335 22 0.95	— 11 0 52.87	2	338 24 0.31	— 9 55 23.52
25	335 37 9.41	— 10 55 4.82	3	338 22 39.74	— 9 55 56.61
Feb. 2	335 53 12.06	— 10 48 56.37	4	338 21 18.27	— 9 56 30.02
10	336 9 54.89	— 10 42 33.41	5	338 19 55.95	— 9 57 3.74
18	336 27 2.76	— 10 36 1.07	6	338 18 32.80	— 9 57 37.74
26	336 44 19.56	— 10 29 25.82	7	338 17 8.83	— 9 58 12.02
March 6	337 1 30.59	— 10 22 53.31	8	338 15 44.08	— 9 58 46.58
14	337 18 21.76	— 10 16 28.99	9	338 14 18.60	— 9 59 21.39
22	337 34 36.98	— 10 10 19.00	10	338 12 52.42	— 9 59 56.43
30	337 50 3.38	— 10 4 28.98	11	338 11 25.56	— 10 0 31.68
April 7	338 4 28.36	— 9 59 3 54	12	338 9 58.05	— 10 1 7.16
15	338 17 39.73	— 9 54 7.15	13	338 8 29.91	— 10 1 42.85
23	338 29 25.88	— 9 49 44.99	14	338 7 1.19	— 10 2 18.72
May 1	338 39 38.07	— 9 46 0.32	15	338 5 31.95	— 10 2 54.76
9	338 48 8.43	— 9 42 56.30	16	338 4 2.24	— 10 3 30.95
17	338 54 49.69	— 9 40 35.76	17	338 2 32.10	— 10 4 7.29
25	338 59 37.00	— 9 39 0.54	18	338 1 1.54	— 10 4 43.77
June 2	339 2 27.85	— 9 38 11.47	19	337 59 30.56	— 10 5 20.35
10	339 3 20.55	— 9 38 9.16	20	337 57 59.18	— 10 5 57.03
18	339 2 15.42	— 9 38 52.99	21	337 56 27.43	— 10 6 33.81
26	338 59 16.11	— 9 40 21.52	22	337 54 55.37	— 10 7 10.67
30	338 57 5.17	— 9 41 21.79	23	337 53 23.05	— 10 7 47.59
July 1	338 56 28.31	— 9 41 38.48	24	337 51 50.49	— 10 8 24.56
2	338 55 49.80	— 9 41 55.80	25	337 50 17.75	— 10 9 1.56
3	338 55 9.66	— 9 42 13.76	26	337 48 44.88	— 10 9 38.58
4	338 54 27.90	— 9 42 32.34	27	337 47 11.92	— 10 10 15.61
5	338 53 44.51	— 9 42 51.55	28	337 45 38.89	— 10 10 52.64
6	338 52 59.51	— 9 43 11.37	29	337 44 5.80	— 10 11 29.65
7	338 52 12.92	— 9 43 31 78	30	337 42 32.67	— 10 12 6.64
8	338 51 24.75	— 9 43 52.78	31	337 40 59.52	— 10 12 43.59
9	338 50 35.03	— 9 44 14.36	Sept. 1	337 39 26.39	— 10 13 20.49
10	338 49 43.80	— 9 44 36.51	2	337 37 53.32	— 10 13 57.31
11	338 48 51.08	— 9 44 59.23	3	337 36 20.36	— 10 14 34.02
12	338 47 56.88	— 9 45 22.51	4	337 34 47.55	— 10 15 10.64
13	338 47 1.25	— 9 45 46.35	5	337 33 14.93	— 10 15 47.17
14	338 46 4.19	— 9 46 10.75	6	337 31 42.55	— 10 16 23.56
15	338 45 5.73	— 9 46 35.68	7	337 30 10.45	— 10 16 59.79
16	338 44 5.90	— 9 47 1.12	8	337 28 38.68	— 10 17 35.85
17	338 43 4.73	— 9 47 27.07	9	337 27 7.27	— 10 18 11.74
18	338 42 2.23	— 9 47 53.51	10	337 25 36.28	— 10 18 47.45
19	338 40 58.39	— 9 48 20.44	11	337 24 5.60	— 10 19 22.96
20	338 39 53.24	— 9 48 47.85	12	337 22 35.41	— 10 19 58.26
21	338 38 46.83	— 9 49 15.73	13	337 21 5.71	— 10 20 33.31
22	338 37 39.17	— 9 49 44.08	14	337 19 36.55	— 10 21 8.09
23	338 36 30.29	— 9 50 12.90	15	337 18 7.96	— 10 21 42.62
24	338 35 20.23	— 9 50 42.17	16	337 16 39.97	— 10 22 16.89
25	338 34 9.00	— 9 51 11.87	17	337 15 12.62	— 10 22 50 89
26	338 32 56.64	— 9 51 41.97	18	337 13 45.92	— 10 23 24.59
27	338 31 43.18	— 9 52 12.48	19	337 12 19.95	— 10 23 57.98
28	338 30 28.63	— 9 52 43.38	20	337 10 54.71	— 10 24 31.06
29	338 29 13.00	— 9 53 14.66	21	337 9 30.23	— 10 25 3.80
30	338 27 56.32	— 9 53 46.33	22	337 8 6.53	— 10 25 36.18

Ephemeris of Neptune—Continued.

APPARENT PLACE OF NEPTUNE FOR MEAN NOON, GREENWICH.

Date.	Right Ascension of Neptune.			South Declination of Neptune.			Date.	Right Ascension of Neptune.			South Declination of Neptune.
1850.	°	′	″	°	′	″	1850.	°	′	″	° ′ ″
Sept. 23	337	6	43.65	— 10	26	8.22	Nov. 13	336	25	31.97	— 10 41 27.62
24	337	5	21.63	— 10	26	39.89	14	336	25	27.86	— 10 41 28.14
25	337	4	0.51	— 10	27	11.19	15	336	25	25.70	— 10 41 27.90
26	337	2	40.30	— 10	27	42.10	16	336	25	25.50	— 10 41 26.90
27	337	1	20.99	— 10	28	12.60	17	336	25	27.24	— 10 41 25.14
28	337	0	2.66	— 10	28	42.68	18	336	25	30.93	— 10 41 22.62
29	336	58	45.35	— 10	29	12.33	19	336	25	36.54	— 10 41 19.36
30	336	57	29.07	— 10	29	41.54	20	336	25	44.10	— 10 41 15.34
Oct. 1	336	56	13.87	— 10	30	10.30	21	336	25	53.64	— 10 41 10.55
2	336	54	59.80	— 10	30	38.59	22	336	26	5.14	— 10 41 5.01
3	336	53	46.96	— 10	31	6.41	23	336	26	18.59	— 10 40 58.72
4	336	52	35.27	— 10	31	33.75	24	336	26	34.01	— 10 40 51.67
5	336	51	24.75	— 10	32	0.60	25	336	26	51.40	— 10 40 43.86
6	336	50	15.42	— 10	32	26.94	26	336	27	10.74	— 10 40 35.30
7	336	49	7.36	— 10	32	52.78	27	336	27	32.03	— 10 40 25.99
8	336	48	0.62	— 10	33	18.09	28	336	27	55.27	— 10 40 15.92
9	336	46	55.23	— 10	33	42.84	29	336	28	20.49	— 10 40 5.10
10	336	45	51.22	— 10	34	7.04	30	336	28	47.67	— 10 39 53.52
11	336	44	48.57	— 10	34	30.68	Dec. 1	336	29	16.80	— 10 39 41.20
12	336	43	47.31	— 10	34	53.75	2	336	29	47.89	— 10 39 28.14
13	336	42	47.48	— 10	35	16.23	3	336	30	20.91	— 10 39 14.33
14	336	41	49.11	— 10	35	38.13	4	336	30	55.86	— 10 38 59.77
15	336	40	52.21	— 10	35	59.43	5	336	31	32.75	— 10 38 44.46
16	336	39	56.79	— 10	36	20.12	6	336	32	11.56	— 10 38 28.43
17	336	39	2.88	— 10	36	40.19	7	336	32	52.28	— 10 38 11.66
18	366	38	10.51	— 10	36	59.65	8	336	33	34.90	— 10 37 54.16
19	366	37	19.73	— 10	37	18.50	9	336	34	19.42	— 10 37 35.94
20	336	36	30.54	— 10	37	36.73	10	336	35	5.82	— 10 37 16.99
21	336	35	42.96	— 10	37	54.31	11	336	35	54.11	— 10 36 57.32
22	336	34	57.01	— 10	38	11.23	12	336	36	44.24	— 10 36 36.94
23	436	34	12.71	— 10	38	27.49	13	336	37	36.23	— 10 36 15.87
24	336	33	30.07	— 10	38	43.09	14	336	38	30.02	— 10 35 54.10
25	336	32	49.09	— 10	38	58.04	15	336	39	25.62	— 10 35 31.64
26	336	32	9.81	— 10	39	12.31	16	336	40	23.06	— 10 35 8.49
27	336	31	32.25	— 10	39	25.90	17	336	41	22.28	— 10 34 44.65
28	336	30	56.45	— 10	39	38.80	18	336	42	23.29	— 10 34 20.12
29	336	30	22.39	— 10	39	51.01	19	336	43	26.07	— 10 33 54.93
30	336	29	50.09	— 10	40	2.54	20	336	44	30.50	— 10 33 29.08
31	336	29	19.57	— 10	40	13.36	21	336	45	36.68	— 10 33 2.57
Nov. 1	336	28	50.82	— 10	40	23.47	22	336	46	44.58	— 10 32 35.40
2	336	28	23.88	— 10	40	32.86	23	336	47	54.27	— 10 32 7.57
3	336	27	58.79	— 10	40	41.52	24	336	49	5.63	— 10 31 39.10
4	336	27	35.56	— 10	40	49.46	25	336	50	18.66	— 10 31 10.00
5	336	27	14.20	— 10	40	56.67	26	336	51	33.36	— 10 30 40.29
6	336	26	54.73	— 10	41	3.13	27	336	52	49.67	— 10 30 9.96
7	336	26	37.17	— 10	41	8.85	28	336	54	7.62	— 10 29 39.01
8	336	26	21.50	— 10	41	13.83	29	336	55	27.08	— 10 29 7.45
9	336	26	7.74	— 10	41	18.08	30	336	56	48.14	— 10 28 35.29
10	336	25	55.90	— 10	41	21.59	31	336	58	10.79	— 10 28 2.54
11	336	25	45.98	— 10	41	24.34	1851.				
12	336	25	38.00	— 10	41	26.35	Jan. 1	336	59	34.97	— 10 27 29.17

Date 1850.		Radius Vector.	Heliocentric co-ordinates referred to the apparent equinox and equator.			Logarithm of the distance from the Earth.
		r	x	y	z	Log. Δ
January	1	29.97053	+ 26.97693	— 11.82129	— 5.544177	1.4852562
	9	.97038	26.98776	.80002	.535722	.4867189
	17	.97017	26.99856	.77872	.527269	.4879855
	25	.96996	27.00933	.75743	.518818	.4890324
February	2	.96976	.02008	.73614	.510366	.4898460
	10	.96955	.03081	.71486	.501916	.4904138
	18	.96934	.04151	.69358	.493467	.4907257
	26	.96913	.05219	.67230	.485018	.4907786
March	6	.96892	.06284	.65102	.476567	.4905744
	14	.96871	.07348	.62973	.468111	.4901181
	22	.96850	.08409	.60844	.459648	.4894156
	30	.96830	.09469	.58713	.451181	.4884792
April	7	.96809	.10528	.56582	.442708	.4873295
	15	.96788	.11584	.54450	.434227	.4859821
	23	.96767	.12637	.52317	.425740	.4844612
May	1	.96747	.13690	.50184	.417244	.4827933
	9	.96727	.14741	.48048	.408739	.4810050
	17	.96706	.15791	.45909	.400223	.4791266
	25	.96686	.16841	.43767	.391697	.4771922
June	2	.96666	.17889	.41624	.383162	.4752353
	10	.96645	.18935	.39480	.374623	.4732881
	18	.96625	.19980	.37335	.366081	.4713911
	26	.96605	.21023	.35190	.357537	.4695771
July	4	.96585	.22063	.33044	.348994	.4678793
	12	.96565	.23101	.30898	.340454	.4663326
	20	.96546	.24137	.28750	.331913	.4649689
	28	.96526	.25171	.26603	.323375	.4638154
August	5	.96506	.26203	.24453	.314838	.4628966
	13	.96486	.27233	.22304	.306300	.4622325
	21	.96466	.28260	.20156	.297762	.4618404
	29	.96446	.29284	.18009	.289223	.4617277
September	6	.96426	.30306	.15862	.280683	.4618990
	14	.96407	.31326	.13715	.272138	.4623539
	22	.96388	.32344	.11568	.263587	.4630824
	30	.96368	.33360	.09420	.255032	.4640698
October	8	.96349	.34374	.07271	.246471	.4652965
	16	.96330	.35387	.05120	.237904	.4667382
	24	.96310	.36399	.02969	.229329	.4683635
November	1	.96291	.37409	11.00817	.220744	.4701396
	9	.96272	.38418	10.98663	.212148	.4720315
	17	.96253	.39425	.96504	.203542	.4739974
	25	.96234	.40430	.94343	.194931	.4760012
December	3	.96215	.41434	.92181	.186315	.4780031
	11	.96196	.42437	.90019	.177693	.4799638
	19	.96178	.43439	.87855	.169067	.4818449
	27	.96159	.44440	.85690	.160442	.4836138
	35	.96141	.45439	.83525	.151819	.4852387