$2k$ positions, then the agreement with 222111 is in $6 - 2k$ positions and one of these numbers is at least 4.

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ON THE "$QX + 1$ PROBLEM," Q ODD—II

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In [1] we studied the functions

$$f(n) = \begin{cases} (5n+1)/2 & n \text{ odd} > 1 \\ n/2 & n \text{ even} \\ 1 & n = 1 \end{cases}$$

and

$$g(n) = \begin{cases} (7n+1)/2 & n \text{ odd} > 1 \\ n/2 & n \text{ even} \\ 1 & n = 1 \end{cases}$$

and proved:

1. The only nontrivial circuit of f which is a cycle is

$$13 \xrightarrow{3} 208 \xrightarrow{4} 13.$$

2. The function g has no nontrivial circuits which are cycles.

In this note, we consider briefly the general case for this problem and present the tables generated for the computation of $\log_2(5/2)$ and $\log_2(7/2)$ for the two cases presented in [1].

Let

$$h(n) = \begin{cases} (qn+1)/2 & n \text{ odd, } n > 1,\ q \text{ odd} \\ n/2 & n \text{ even} \\ 1 & n = 1 \end{cases}$$

Then, as in [1], we have

Theorem 1: Let $v_2(m)$ be the highest power of 2 dividing m, $m \in Z$, and let n be an odd integer > 1, then

$$n < h(n) < \cdots < h^k(n), \text{ and } h^{k+1}(n) < h(n),$$

where $k = v_2((q-2)n + 1)$.

Also, the equation corresponding to Eq. (1) in [1] is

$$2^j((q-2)nj + 1) = q^j((q-2)n + 1). \tag{1}$$

Again, we write

$$n \xrightarrow{k} m \xrightarrow{\ell} n^*$$

where $\ell = v_2(m)$, $n^* = m/2^\ell$, $k = v_2((q-2)n + 1)$ and

$$2^k((q-2)m + 1) = q^k((q-2)n + 1)$$

and obtain our usual definition of a circuit.

Finally, we can prove

Theorem 2: There exists n such that $T(n) = n$ only if there are positive integers k, ℓ, h satisfying

$$(2^{k+\ell} - q^k)h = 2^\ell - 1. \tag{2}$$

It would be of great interest to determine those q for which solutions of (2) give rise to a cyclic circuit under h. At present the only q known to do this is $q = 5$. As for those q which give rise to multiple circuit cycles, the only one known besides $q = 5$ is $q = 181$, which has two *double* circuit cycles:

$$27 \xrightarrow{1} 2444 \xrightarrow{2} 611$$
$$611 \xrightarrow{1} 55296 \xrightarrow{11} 27$$

and

$$35 \xrightarrow{1} 3168 \xrightarrow{5} 99$$
$$99 \xrightarrow{1} 8160 \xrightarrow{8} 35.$$

TABLES

TABLE 1. $\mathrm{Log}_2\frac{5}{2}$ to 1200 Decimal Places

1.132192809488736234787031942948939017586483139302458061205475639581593477660862521585013974335937015509965737171025025182682409698426352688827530277299865539385195135265750556864301760919002489166694143337401190312418737510971586646754017918965580673583077968843272588327499252244890238355997641739413792800977275668635547790148674505784588478027104225456097223465795695541537019157641171779247165135002392112714733936144072339721157485100709498789165888083132219480679329823232593119506713995078370033673424807066352750084069176263862535468801536862161841886085899483538132149989302704417920786592260182296537157536723966069511648683684662385850848606299054269946927911627320613400644670484763407043735233674221283089670364579092167721909021421962142457444658524535948448815483459251429540937353906549448632779298424251591181131163298125769450198157503792185538487820355160197378277288881759874332866072712393825202213332805255124882743444884245316546506124148918228679325266429281165992285162734508186007144683955880463312127926400363120145773688790404827105286520335948153247807074832712590336282976999102881681040419750373558623804925499672086216775481010883457989804214485844199738212065312511525

TABLE 2. The Continued Fraction Expansion of $\log_2\frac{5}{2}$

1	3	9	2	2	4	6	2	1	1	3
	1	18	1	6	1	2	1	1	4	1
	42	6	1	4	2	3	1	2	6	1
	3	4	1	8	1	4	1	2	2	7
	1	4	1	1	3	3	1	3	1	1
	7	6	1	5	10	2	2	1	8	1
	2	16	24	1	6	1	8	1	1	5
	1	1	1	1	1	2	1	1	3	7
	1	1	10	3	2	1	3	1	3	1
	2	1	3	11	1	1	1	5	1	5
	3	3	2	2	4	7	1	4	1	1
	2	7	1	3	3	2	32	1	119	1
	2	1	8	17	4	16	1	5	6	13

TABLE 2—Continued

1	2	1	2	1	5393	1	1	2	1	2
	3	3	10	2	1	2	1	1	7	32
	1	6	1	5	1	8	6	1	2	3
	17	1	1	1	4	1	2	12	1	27
	2	1	2	3	2	1	1	7	4	9
	10	1	4	1	5	6	2	3	2	3
	9	1	1	1	2	237	1	2	1	15
	1	1	17	1	1	1	2	3	2	6
	1	2	2	1	5	1	1	1	1	1
	2	1	5	1	23	5	1	1	1	1
	9	2	3	1	14	2	1	1	16	2
	1	1	1	2	1	1	8	1	1	3
	1	1	2	3	33	1	1	2	1	2
	3	3	2	5	12	1	13	1	11	23
	1	2	5	2	3	2	10	4	3	4
	1	1	1	6	4	1	8	5	1	1
	10	6	29	1	3	4	9	1	24	1
	3	8	38	3	1	1	1	1	6	2
	1	3	1	10	1	1	5	1	1	1
	1	1	1	6	3	3	3	9	1	3
	3	1	1	1	7	1	2	1	8	1
	1	16	1	2	1	1	5	1	4	2
	1	228	2	13	2	1	1	9	5	1
	28	1	4	1	1	4	3	1	2	1
	3	3	1	1	2	2	3	1	4	4
	5	2	11	2	1	1	2	1	3	6
	7	6	2	1	78	1	8	28	15	1
	1	1	1	2	1	2	172	2	3	1
	1	1	6	1	105	4	23	--		

TABLE 3. $\log_2 \frac{7}{2}$ *to 1200 Decimal Places*

1.180735492205760410744196931723183080864102662596614078367729172407
03208488621929864978609991702107851073605018893255730459733550189744
35783948545697421659367034036223711232893039172839880533054596558987
42842044049863242710660517715603594755455847742935680180016993525932
50632889709207655100521356641486039729352404730419795633055279942802
67077276110778204971932513254550267027235235681504586808823722107156
62259311528345703426110256015571456055227154958021504336696505010023
34988294495656908806896861271221799915017038085074366218220796188044
13300641248483810021757003214687292291654022734173979996398717392556
21657012062442265868128541719793524331738795293960080126504099080050
86143891504372773197711929325509449755438097944662727688654466455056
66144962718917439479811201832195534767729368027362015384968426483404
28194862620856744723428655525118561153949628390912550087758014235589
14221613005965234270525279790176286862630931786330372331743548294140
06377868059095886491534576253156671578606520583005556279536710386799
55857731719085677755305180653144090746707963928688620808186866798569
85299653671553315728082138583329807569231547710021897097214157437559
6833249986877724904346722049673575206749869960

TABLE 4. The Continued Fraction Expansion of $\log_2 \frac{7}{2}$

1	1	4	5	4	5	4	1	29	1	4
	8	1	1	2	1	31	10	1	2	2
	6	2	3	1	1	197	1	4	5	5
	5	1	10	1	4	4	1	3	14	3
	1	1	1	6	5	1	5	1	1	3
	59	1	11	13	11	1	85	1	5	1
	1	1	2	1	14	1	2	5	1	4
	24	20	1	1	1	1	3	1	1	2
	3	1	1	2	2	1	40	53	3	1
	1	1	7	3	1	1	2	1	1	8
	2	4	4	1	1	3	1	6	7	1
	1	1	1	1	1	1	2	3	1	4
	4	2	1	3	2	3	2	3	68	1
	6	1	3	1	4	1	1	1	5	2
	2	7	2	1	3	163	1	6	2	2
	1	1	1	20	1	21	1	1	6	1
	1	6	44	1	3	1	1	1	91	3
	2	1	1	59	2	2	18	1	5	6
	3	2	2	2	1	1	1	1	12	1
	2	3	2	14	1	2	1	1	3	1
	3	2	1	10	1	1	1	1	5	2
	2	1	6	3	1	4	3	4	1	1
	7	7	9	1	1	5	1	11	1	3
	1	2	1	3	1	4	1	4	1	2
	1	1	1	2	1	1	1	1	1	1
	7	2	3	9	2	4	10	4	1	1
	3	11	2	1	2	1	5	3	2	7
	1	3	1	1	4	1	1	1	3	2
	1	1	1	19	10	7	1	1	2	1
	2	3	8	3	3	26	2	1	12	1
	1	13	1	4	1	7	3	7	1	1
	2	1	1	1	4	2	1	1	1	1
	3	1	2	1	1	4	4	7	8	4
	1	1	6	4	1	3	1	1	1	1
	29	6	1	1	44	16	8	3	2	5
	1	2	15	2	2	3	2	4	1	1
	42	2	2	1	1	2	56	1	1	1
	1	3	2	1	4	1	7	1	5	2
	1	1	5	5	1	8	1	31	1	2
	4	1	4	2	1	1	4	2	4	1
	1	2	1	1	1	4	2	3	4	1
	1	1	1	4	1	1	1	67	5	1
	13	--								

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