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The total vertex irregularity strength of symmetric cubic graphs from the Foster's Census

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Abstract

Foster (1932) performed a mathematical census for all connected symmetric cubic (trivalent) graphs of order n with $n \leq 512$. This census was then continued by Conder et al. (2006) and they obtained the complete list of all connected symmetric cubic graphs with order $n \leq 768$. In this paper, we determine the total vertex irregularity strength of such graphs obtained by Foster. As a result, all the values of the total vertex irregularity strengths of the symmetric cubic graphs of order n of Foster census strengthen the conjecture stated by Nurdin, Baskoro, Gaos & Salman (2010), namely $\lceil (n+3)/4 \rceil$.

Keywords: symmetric cubic graphs, total vertex irregularity strength, algorithms, Foster's census
Mathematics Subject Classification: 05C78

1. Introduction

All graphs in this paper are simple and finite. Let $G(V, E)$ be a graph with a non-empty and finite set of vertices V and a set of edges E. If $xy \in E$ then x is called *adjacent* to y and vice

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versa. The *degree* of a vertex v in G is defined as the number of vertices adjacent to v in G. If all vertices in G have the same degree, say k, then the graph G is called *regular* of degree k. In particular, if $k = 3$ then G is called *cubic* or *trivalent*. The *distance* between two vertices x and y in G is defined as the length of a shortest path connecting x and y, and denoted by $d(x, y)$.

For any graph $G(V, E)$, any mapping $\alpha : V \cup E \to \{1, 2, \cdots, k\}$ is called a k-labeling of G. The *weight* $wt(u)$ of a vertex u in G, under α, is defined as $wt(u) = \alpha(u) + \sum_{uw \in E} \alpha(uw)$. The labeling α of G is called a *total vertex irregular labeling* if all the (vertex) weights are distinct, namely $wt(u) \neq wt(w)$ for any two distinct vertices u and w. The *total vertex irregularity strength* of graph G is defined as the smallest integer t such that G admits a total vertex irregular t-labeling, and it is denoted by $\text{tvs}(G)$.

In [1], it is shown that for a star $K_{1,n}$ and a complete graph K_n we have that $\text{tvs}(K_{1,n}) = \lceil \frac{n+1}{2} \rceil$ and $\text{tvs}(K_n) = 2$ for $n \geq 2$. Moreover, if a graph G has n vertices with minimum and maximum degrees δ and Δ, respectively then the lower and upper bounds of the $\text{tvs}(G)$ are as follows:

$$\left\lceil \frac{n + \delta}{\Delta + 1} \right\rceil \leq tvs(G) \leq n + \Delta - 2\delta + 1. \quad (1)$$

Therefore, if G is a regular graph of degree r, then we have:

$$\left\lceil \frac{n + r}{r + 1} \right\rceil \leq tvs(G) \leq n - r + 1. \quad (2)$$

Nurdin et al [8] gave a well-known conjecture for any graph as follows.

Conjecture 1. *Let G be a connected graph having n_i vertices of degree i, $(i = \delta, \delta + 1, \delta + 2, \cdots, \Delta)$, where δ and Δ are the minimum and the maximum degree of G, respectively. Then,*

$$tvs(G) = \max \left\{ \left\lceil \frac{\delta + n_\delta}{\delta + 1} \right\rceil, \ \left\lceil \frac{\delta + n_\delta + n_{\delta+1}}{\delta + 2} \right\rceil, \ ..., \ \left\lceil \frac{\delta + \sum_{i=\delta}^{\Delta} n_i}{\Delta + 1} \right\rceil \right\}.$$

In particular, if G is a regular of degree 3, then we have the following conjecture.

Conjecture 2. *Let G be a cubic graph of order n. Then,*

$$tvs(G) = \left\lceil \frac{n + 3}{4} \right\rceil.$$

A graph G is *symmetric* or *arc-transitive* if for any vertices x, y, v, w with $x \sim y$ and $v \sim w$, there is an automorphism $f : V(G) \to V(G)$ such that $f(x) = v$ and $f(y) = w$. R.M. Foster (1932) conducted a census connected symmetric cubic graphs for small orders. He was able to enumerate all non-isomorphic connected symmetric cubic graphs with at most 512 vertices. All the graphs obtained are denoted by F_{nZ}, where F commemorates Foster, n is the number of vertices, and the letter $A, B, C, \cdots$ is appended to indicate the first, second, etc. All cubic symmetric graphs connected up to 512 vertices (Foster's results) have been published by Bouwer et al [2]. (1988). This census has been continued up to 768-vertex graphs by Conder and Dobcsányi (2002)[4]. For the next update for all known symmetric cubic graphs, see the work of Royle [15], with order at most 1000 vertices. (This data is complete up to 768 vertices, but only includes Cayley graphs for 770-998 vertices.) Conder [6] then enumerate all symmetric cubic graphs up to 2048 vertices in August 2006.

Some of the well-known symmetric cubic graphs are the utility graph $K_{3,3}$, the Petersen graph, the Heawood graph, the Möbius–Kantor graph, the Pappus graph, the Desargues graph, the Nauru graph, the Coxeter graph, the Tutte–Coxeter graph, the Dyck graph, the Foster graph and the Biggs–Smith graph.

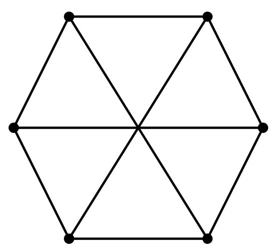

Figure 1. utility graph

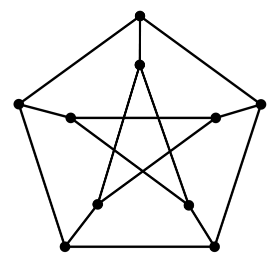

Figure 2. Petersen graph

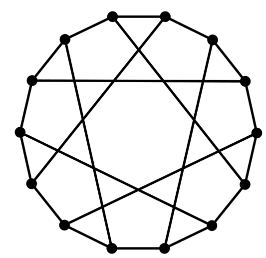

Figure 3. Heawood graph

In this paper, we propose an algorithm to determine the total vertex irregularity strength for the symmetric cubic graphs from Foster's census. By using this algorithm, we obtain that the values of all the total vertex irregularity strengths of such graphs F_{nZ} with $4 \leq n \leq 512$ are $\lceil \frac{n+3}{4} \rceil$, which confirm Conjecture 2.

2. Main Results

Let $G(V, E)$ be a connected cubic graph of order $n \geq 4$. The following algorithm is designed to establish a total vertex irregular labeling ϕ of graph G with $\phi(e) \leq t$ for any edge $e \in E$ and $\phi(x) \geq 1$ for any vertex $x \in V$, where $t = \lceil (n+3)/4 \rceil$. These two properties will be proved in Theorems 1 and 2.

The proposed algorithm consists of two stages: ordering and labeling. In the first stage, we order all vertices of G in bread first search ordering such that vertices $x_1, x_2, \ldots, x_n$ have loads $4, 5, \ldots, n+3$ (see steps 5,6 and 7). In the second stage, we label all the vertices and edges of G with respect to the order of vertices in the first stage. Once we meet a vertex x_j to be labeled, then we also label all the adjacent edges. In the labeling, we always try to distribute the load $b(x_j)$ of the vertex x_j to its adjacent edges as much as possible by keeping the label of x_j itself as small as possible. We also consider the capacity of the edges, namely $cap(xy) = \max\{\lceil (b(x)/4 \rceil, \lceil b(y)/4 \rceil\}$ (see steps 10 and 11).

In this paper, we apply this algorithm to all connected symmetric cubic graphs of the Foster's census. As we know that Foster's census on connected symmetric cubic graphs from 4 vertices up to 998 vertices generate 332 graphs.

Algorithm 1 Total vertex irregular labeling

procedure TOTAL VERTEX IRREGULAR LABELING $\phi(F, n)$
    Input: $F = (V, E)$ symmetric cubic graphs on n vertices of the Foster's census
    Output: $\phi(F)$
    Define $t = \lceil \frac{3+n}{4} \rceil$
    Choose an initial vertex of F at random, say x_1.
    Order all vertices of F starting from x_1, and then its neighbours, denoted by x_2, x_3 and x_4 in any order, and then assign by $x_j (j \geq 5)$ the first unlabeled vertex which is adjacent to x_k, with k is the smallest index as possible. If there are two or more such unlabeled vertices adjacent to x_k then select (if any) the one which is also adjacent to other x_t, with t as the smallest integer less than k, otherwise select any vertex. Do this until the last vertex, and as a result, we have ordered vertices: $x_1, x_2, x_3, \cdots x_n$ in graph F.
    for $i = 1 \to n$ **do** $b(x_i) \leftarrow 3 + i$ (define load $b(x)$ for all ordered vertices by 4 until $3 + n$)
    for $i = 1 \to |E(F)|$ **do** (define the capacity of all edges)
        $cap(e_i) = \max\{\lceil \frac{b(x_a)}{4} \rceil, \lceil \frac{b(x_b)}{4} \rceil\}$ if $e_i = x_a x_b$
    $\phi(x_1) = 1$ and $\phi(x_1x_2) = \phi(x_1x_3) = \phi(x_1x_4) = 1$
    for $j = 2 \to n$ **do**
        Let x_a, x_b, x_c be the neighbours of x_j with $b(x_a) < b(x_b) < b(x_c)$.
        if $b(x_c) < b(x_j)$ **then**
            $\phi(x_j) = b(x_j) - (\phi(x_a x_j) + \phi(x_b x_j) + \phi(x_c x_j))$
        else if $b(x_b) < b(x_j)$ **then**
            $\phi(x_c x_j) = \min\{b(x_j) - (\phi(x_a x_j) + \phi(x_b x_j)) - 1, cap(x_c x_j)\}$
            $\phi(x_j) = b(x_j) - (\phi(x_a x_j) + \phi(x_b x_j) + \phi(x_c x_j))$
        else
            $\phi(x_b x_j) = \min\{\lfloor \frac{b(x_j) - \phi(x_a x_j) - 1}{2} \rfloor, cap(x_b x_j)\}$
            $\phi(x_c x_j) = \min\{\lceil \frac{b(x_j) - \phi(x_a x_j) - 1}{2} \rceil, cap(x_c x_j)\}$
            $\phi(x_j) = b(x_j) - (\phi(x_a x_j) + \phi(x_b x_j) + \phi(x_c x_j))$
    $A \leftarrow \emptyset$
    for $j = 1 \to n$ **do**
        if $\phi(v_j) > t$ **then** $A \leftarrow A \cup \{v_j\}$
    for $v_j \in A$, x be a neighbours of v_j, and y be the neighbours of x **do**
        $s = \phi(v_j) - t$
        $\phi(v_j) = t$
        $\phi(v_j x) \leftarrow \phi(v_j x) + s$
        $\phi(x) \leftarrow \phi(x) - s$
        if $\phi(x) \leq 0$ **then**
            $\phi(x) \leftarrow \phi(x) + s$
            $\phi(xy) \leftarrow \phi(xy) - s$
            $\phi(y) \leftarrow \phi(y) + s$
    return $\phi(F, n)$

By applying this algorithm to 332 such graphs, we obtain all the total vertex irregular labelings of such graphs and their total vertex irregularity strengths, as shown in the Appendix and google drive [16].

These results strengthen the truth of Conjecture 2. Figures 4 and 5 give an examples of the total labeling on graphs F006 and F008 by using this algorithm.

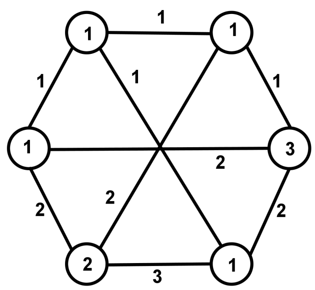

Figure 4. Utility or Thomsen Graph ($K_{3,3}$ or F006)

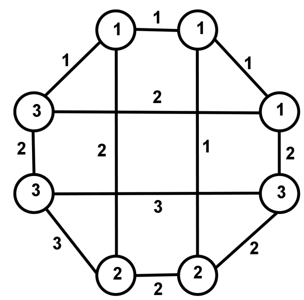

Figure 5. Hypercube or F008

Theorem 2.1. *Let F be any connected cubic graph. Applying Algorithm 1 to F, we obtain that for every $xy \in E(F)$:*

$$\phi(xy) \leq \lceil \tfrac{n+3}{4} \rceil.$$

Proof. Let $xy \in E(F)$. By steps 9, 16, 19, and 20 in the algorithm, $\phi(xy) \leq cap(xy)$. Therefore, $\phi(xy) \leq \max\{\lceil \frac{b(x)}{4} \rceil, \lceil \frac{b(y)}{4} \rceil\} \leq \lceil \frac{n+3}{4} \rceil$.

□

The following theorem guarantees that all vertex labels will be at least one.

Theorem 2.2. *Let F be a connected cubic graph and $x \in V(F)$. Applying Algorithm 1 to F, we have*

$$\phi(x) \geq 1.$$

Proof. Let x be any vertex of F with load $b(x)$. Let x_a, x_b, x_c be the neighbours of x with $b(x_a) < b(x_b) < b(x_c)$. Let $xx_a, xx_b, xx_c \in E(F)$. To show that $\phi(x) \geq 1$ consider the following three cases.

Case 1 $b(x_c) < b(x)$.
In this case, all edges adjacent to x have been labeled. It means that $\phi(xx_a) = \lceil \frac{b(x_a)}{4} \rceil \leq \lceil \frac{b(x)}{4} \rceil$, $\phi(xx_b) = \lceil \frac{b(x_b)}{4} \rceil \leq \lceil \frac{b(x)}{4} \rceil$, $\phi(xx_c) = \lceil \frac{b(x_c)}{4} \rceil \leq \lceil \frac{b(x)}{4} \rceil$. According to step 14, label of the vertex x is that $\phi(x) = b(x) - \{\phi(xx_a) + \phi(xx_b) + \phi(xx_c)\} \geq b(x) - 3\lceil \frac{b(x)}{4} \rceil \geq 1$, so that $\phi(x) \geq 1$.

Case 2 $b(x_b) < b(x)$.
In this case, two edges adjacent to x have been labeled. According to step 16, we have that $\phi(xx_c) = \min\{b(x) - (\phi(xx_a) + \phi(xx_b)) - 1, cap(xx_c)\} \geq \lceil \frac{b(x)}{4} \rceil$, $\phi(xx_a) \leq \lceil \frac{b(x)}{4} \rceil$, and $\phi(xx_b) \leq \lceil \frac{b(x)}{4} \rceil$. By step 17, $\phi(x) = b(x) - \{\phi(xx_a) + \phi(xx_b) + \phi(xx_c)\} \geq b(x) - \{2\lceil \frac{b(x)}{4} \rceil + \phi(xx_c)\} \geq 2\lfloor \frac{b(x)}{4} \rfloor - \lceil \frac{b(x)}{4} \rceil \geq \lfloor \frac{b(x)}{4} \rfloor + 1 \geq \lfloor \frac{b(x)}{4} \rfloor \geq 1$. Therefore, $\phi(x) \geq 1$.

Case 3 $b(x_a) < b(x)$.
According to steps 19 and 20, the edge labels are $\phi(xx_b) = \min\{\lfloor \frac{b(x)-\phi(xx_a)-1}{2} \rfloor, cap(xx_b)\} \leq \lfloor \frac{b(x)-\phi(xx_a)-1}{2} \rfloor$ and $\phi(xx_c) = \min\{\lceil \frac{b(x)-\phi(xx_a)-1}{2} \rceil, cap(x_c x_j)\} \leq \lfloor \frac{b(x)-\phi(xx_a)-1}{2} \rfloor$. Because of $\phi(xx_b) < \lfloor \frac{b(x)-\phi(xx_a)-1}{2} \rfloor$ then $\phi(x) = b(x) - \{\phi(xx_a) + \phi(xx_b) + \phi(xx_c)\} \geq b(x) - \phi(xx_a) - 2\lfloor \frac{b(x)-\phi(xx_a)-1}{2} \rfloor \geq 1$, thus $\phi(x) \geq 1$. □

A Python code program has been written to employ Algorithm 1 in finding all the total vertex irregular labelings and the total vertex irregularity strengths of the symmetric cubic graphs from Foster's census. The summary of the results can be seen in Tabel 2.1 and 2.2. The complete results on the labelings for the graphs with at most 86 vertices can be seen in the Appendix. While the complete result for the total vertex irregularity strength of the symmetric cubic graphs from Foster's census can be seen on google drive [16].

Table 2.1
The Total Vertex Irregularity Strength of Foster's Census Graphs ($F004$ to $F648C$)

No.	Graph	tvs (F_n)
1	F004	2
2	F006	3
3	F008	3
4	F010	4
5	F014	5
6	F016	5
7	F018	6
8	F020A	6
9	F020B	6
10	F024	7
11	F026	8
12	F028	8
13	F030	9
14	F032	9
15	F038	11
16	F040	11
17	F042	12
18	F048	13
19	F050	14
20	F054	15
21	F056A	15
22	F056B	15
23	F056C	15
24	F060	16
25	F062	17
26	F064	17
27	F072	19
28	F074	20
29	F078	21
30	F080	21
31	F084	22
32	F086	23
33	F090	24
34	F096A	25
35	F096B	25
36	F098A	26
37	F098B	26
38	F102	27
39	F104	27
40	F108	28
41	F110	29
42	F112A	29
43	F112B	29
44	F112C	29
45	F114	30
46	F120A	31
47	F120B	31
48	F122	32
49	F126	33
50	F128A	33
51	F128B	33
52	F134	35
53	F144A	37
54	F144B	37
55	F146	38
56	F150	39
57	F152	39
58	F158	41
59	F162A	42
60	F162B	42
61	F162C	42
62	F168A	43
63	F168B	43
64	F168C	43
65	F168D	43
66	F168E	43
67	F168F	43
68	F182A	47
69	F182B	47
70	F182C	47
71	F182D	47
72	F186	48
73	F192A	49
74	F192B	49
75	F192C	49
76	F194	50
77	F200	51
78	F204	52
79	F206	53
80	F208	53
81	F216A	55
82	F216B	55
83	F216C	55
84	F218	56
85	F220A	56
86	F220B	56
87	F220C	56
88	F222	57
89	F224A	57
90	F224B	57
91	F224C	57
92	F234A	60
93	F234B	60
94	F240A	61
95	F240B	61
96	F240C	61
97	F242	62
98	F248	63
99	F250	64
100	F254	65
101	F256A	65
102	F256B	65
103	F256C	65
104	F256D	65
105	F258	66
106	F266A	68
107	F266B	68
108	F278	71
109	F288A	73
110	F288B	73
111	F294A	75
112	F294B	75
113	F296	75
114	F302	77
115	F304	77
116	F312A	79
117	F312B	79
118	F314	80
119	F326	83
120	F336A	85
121	F336B	85
122	F336C	85
123	F336D	85
124	F336E	85
125	F336F	85
126	F338A	86
127	F338B	86
128	F342	87
129	F344	87
130	F350	89
131	F360A	91
132	F360B	91
133	F362	92
134	F364A	92
135	F364B	92
136	F364C	92
137	F364D	92
138	F364E	92
139	F364F	92
140	F364G	92
141	F366	93
142	F378A	96
143	F378B	96
144	F384A	97
145	F384B	97
146	F384C	97
147	F384D	97
148	F386	98
149	F392A	99
150	F392B	99
151	F398	101
152	F400A	101
153	F400B	101
154	F402	102
155	F408A	103
156	F408B	103
157	F416	105
158	F422	107
159	F432A	109
160	F432B	109
161	F432C	109
162	F432D	109
163	F432E	109
164	F434A	110
165	F434B	110
166	F438	111
167	F440A	111
168	F440B	111
169	F440C	111
170	F446	113
171	F448A	113
172	F448B	113
173	F448C	113
174	F450	114
175	F456A	115
176	F456B	115
177	F458	116
178	F468	118
179	F474	120
180	F480A	121
181	F480B	121
182	F480C	121
183	F480D	121
184	F482	122
185	F486A	123
186	F486B	123
187	F486C	123
188	F486D	123
189	F488	123
190	F494A	125
191	F494B	125
192	F496	125
193	F500	126
194	F504A	127
195	F504B	127
196	F504C	127
197	F504D	127
198	F504E	127
199	F506A	128
200	F506B	128
201	F512A	129
202	F512B	129
203	F512C	129
204	F512D	129
205	F512E	129
206	F512F	129
207	F512G	129
208	F518A	131
209	F518B	131
210	F536	135
211	F542	137
212	F546A	138
213	F546B	138
214	F554	140
215	F558	141
216	F566	143
217	F570	144
218	F576A	145
219	F576B	145
220	F576C	145
221	F576D	145
222	F578	146
223	F582	147
224	F584	147
225	F592	149
226	F600A	151
227	F600B	151
228	F602A	152
229	F602B	152
230	F608	153
231	F614	155
232	F618	156
233	F624A	157
234	F624B	157
235	F626	158
236	F632	159
237	F648A	163
238	F648B	163
239	F648C	163

Table 2.2
The Total Vertex Irregularity Strength of Foster's Census Graphs ($F648D$ to $F998$)

No.	Graph	tvs (F_n)
240	F648D	163
241	F648E	163
242	F648F	163
243	F650	164
244	F654	165
245	F660	166
246	F662	167
247	F666	168
248	F672A	169
249	F672B	169
250	F672C	169
251	F672D	169
252	F672E	169
253	F672F	169
254	F672G	169
255	F674	170
256	F686A	173
257	F686B	173
258	F686C	173
259	F688	173
260	F698	176
261	F702A	177
262	F702B	177
263	F720A	181
264	F720B	181
265	F720C	181
266	F722A	182
267	F722B	182
268	F726	183
269	F728A	183
270	F728B	183
271	F734	185
272	F744A	187
273	F744B	187
274	F746	188
275	F750	189
276	F758	191
277	F762	192
278	F774	195
279	F776	195
280	F784A	197
281	F784B	197
282	F794	200
283	F798A	201
284	F798B	201
285	F800	201
286	F806A	203
287	F806B	203
288	F818	206
289	F824	207
290	F832	209
291	F834	210
292	F840	211
293	F842	212
294	F854A	215
295	F854B	215
296	F864A	217
297	F864B	217
298	F864C	217
299	F864D	217
300	F866	218
301	F872	219
302	F878	221
303	F880	221
304	F882A	222
305	F882B	222
306	F888A	223
307	F888B	223
308	F896A	225
309	F896B	225
310	F896C	225
311	F906	228
312	F912A	229
313	F912B	229
314	F914	230
315	F926	233
316	F936A	235
317	F936B	235
318	F938A	236
319	F938B	236
320	F942	237
321	F950	239
322	F960A	241
323	F960B	241
324	F960C	241
325	F962A	242
326	F962B	242
327	F968	243
328	F974	245
329	F976	245
330	F978	246
331	F992	249
332	F998	251

3. Conclusion

In this paper, we give the total vertex irregularity strengths of the connected symmetric cubic graphs obtained from The Foster's census. All the values strengthen the Conjecture of Nurdin et al. [8].

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References

[1] M. Bača, S. Jendrol', M. Miller, J. Ryan, On Irregular Total Labellings, Discrete Math., **307** (2005), 1378–1388.

[2] Bouwer, I. Z., Chernoff, W. W., Monson, B., and Star, Z. The Foster Census. Charles Babbage Research Centre, (1988).

[3] G. Chartrand, M.S. Jacobson, J. Lehel, O.R. Oellermann, S. Ruiz, F. Saba, Irregular Networks, Congr. Numer., **64** (1988), 187–192.

[4] Conder, M., Dobcsányi, P. Trivalent Symmetric Graphs Up to 768 Vertices, J. Combin. Math. Combin. Comput. **40** (2002), 41-63.

[5] Conder, M., Dobcsányi, P., Trivalent Symmetric Graphs Up to 768 Vertices, J. Combin. Math. Combin. Comput, **40** 2002, 41-63.

[6] Conder, M, Trivalent (cubic) Symmetric Graphs on Up to 2048 Vertices, http://www.math.auckland.ac.nz/ conder/symmcubic2048list.txt.

[7] D. A. Holton, J. Sheehan, The Petersen graph, Cambridge University Press. (1993).

[8] Nurdin, E.T. Baskoro, N.N. Gaos, A.N.M. Salman, On the Total Vertex Irregularity Strength of Trees, Discrete Math., **310** (2010), 3043–3048.

[9] Rikayanti and E.T. Baskoro, Algorithms of Computing the Total Vertex Irregularity Strength of Some Cubic Graphs, International Journal of Mathematics and Computer Sciences. **16** no 3 (2021), 897-905.

[10] S. Jendrol, V. Zoldak, The Irregularity Strength of Generalized Petersen Graphs, Math. Slovaca, **45** (1995), 107–113.

[11] D.R. Silaban, E.T. Baskoro, H. Kekaleniate, S. Lutpiah, K.A. Sugeng, Algorithm to Construct Graph with Total Vertex Irregularity Strength Two, Procedia Computer Science, **74** (2015), 132–137.

[12] R. Ramdani, A.N.M. Salman, H. Assiyatun, On the Total Irregularity Strength of Regular Graphs, Journal of Mathematical and Fundamental Sciences, **47** (2015), 281–295.

[13] Susilawati, E.T. Baskoro, R. Simanjuntak, Total Vertex-irregularity Labelings for Subdivision of Several Classes of Trees, Procedia Computer Science **74** (2015), 112–117.

[14] Susilawati, E.T. Baskoro, R. Simanjuntak, Total vertex irregularity strength of trees with maximum degree five, Electronic Journal of Graph Theory and Applications, **6** (2) (2018), 250–257.

[15] Royle. G, Cubic Symmetric Graphs (The Foster Census), http://school.maths.uwa.edu.au/ gordon/remote/foster/#census.

[16] https://drive.google.com/drive/folders/1TZkZuokFvP99rLxzQijrjM9kMYGDUj7I.

Appendix

The following is the result of applying Algorithm 1 to all connected symmetric cubic graphs from Foster's Census. The results provide the total vertex irregular labelings and the total vertex irregularity strengths of such graphs.

The first line states the name of the graph. The second line shows the value of tvs. In each graph, Column 1 contains the name of the vertices in graph F. Columns 2, 3, and 4 provide the vertex neighbours of the vertices of Column 1. Column 5 is the label of the vertices of Column 1. Columns 6, 7 and 8 are the labels of the three edges adjacent to vertices of Column 1. Column 9 is the weight of the vertices in Column 1.

F004
tvs (F004) = 2
0 1 2 3 1 1 1 1 4
1 0 2 3 1 1 1 2 5
2 0 1 3 2 1 1 2 6
3 0 1 2 2 1 2 2 7

F006
tvs (F006) = 3
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 4 5 1 1 2 2 6
3 0 4 5 1 1 2 3 7
4 1 2 3 3 1 2 2 8
5 1 2 3 2 2 2 3 9

F008
tvs (F008) = 3
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 4 6 1 1 2 2 6
3 0 5 6 1 1 2 3 7
4 1 2 7 2 1 2 3 8
5 1 3 7 2 2 2 3 9
6 2 3 7 2 2 3 3 10
7 4 5 6 2 3 3 3 11

F010
tvs (F010) = 4
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 6 8 1 1 3 3 8
5 1 7 9 1 2 3 3 9
6 2 4 9 1 2 3 4 10
7 2 5 8 3 2 3 3 11
8 3 4 7 4 2 3 3 12
9 3 5 6 3 3 3 4 13

F014
tvs (F014) = 5
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 11 1 1 3 3 8
5 1 12 13 1 2 3 3 9
6 2 10 12 1 2 3 4 10
7 2 11 13 1 2 4 4 11
8 3 11 12 2 2 4 4 12
9 3 10 13 1 3 4 5 13
10 4 6 9 4 3 3 4 14
11 4 7 8 4 3 4 4 15
12 5 6 8 5 3 4 4 16
13 5 7 9 5 3 4 5 17

F018
tvs (F018) = 6
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 11 14 1 2 3 4 10
7 2 10 15 1 2 4 4 11
8 3 13 15 1 2 4 5 12
9 3 12 14 1 3 4 5 13
10 4 7 17 2 3 4 5 14
11 5 6 16 4 3 3 6 16
12 4 9 16 2 3 4 6 15
13 5 8 17 5 3 4 5 17
14 6 9 17 4 4 5 5 18
15 7 8 16 4 4 5 6 19
16 11 12 15 3 6 6 6 21
17 10 13 14 5 5 5 5 20

F020A
tvs (F020A) = 6
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 7 10 1 1 3 3 8
5 1 6 11 1 2 3 3 9
6 2 5 13 1 2 3 4 10
7 3 4 12 2 2 3 5 12
8 2 9 15 1 2 4 4 11
9 3 8 14 1 3 4 5 13
10 4 11 18 2 3 4 5 14
11 5 10 17 2 3 4 6 15
12 7 14 18 3 5 5 5 18
13 6 15 17 1 4 5 6 16
14 9 12 16 3 5 5 6 19
15 8 13 16 2 4 5 6 17
16 14 15 19 4 6 6 6 22
17 11 13 19 3 6 6 6 21
18 10 12 19 4 5 5 6 20
19 16 17 18 5 6 6 6 23

F020B
tvs (F020B) = 6
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 11 15 1 2 3 4 10
7 2 10 14 1 2 4 4 11
8 3 13 15 1 2 4 5 12
9 3 12 14 1 3 4 5 13
10 4 7 16 2 3 4 5 14
11 5 6 16 5 3 3 5 16
12 4 9 17 2 3 4 6 15
13 5 8 17 4 3 4 6 17
14 7 9 18 4 4 5 6 19
15 6 8 18 3 4 5 6 18
16 10 11 19 4 5 5 6 20
17 12 13 19 3 6 6 6 21
18 14 15 19 4 6 6 6 22
19 16 17 18 5 6 6 6 23

F024
tvs (F024) = 7
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 14 1 1 3 3 8
5 1 10 13 1 2 3 3 9
6 2 12 16 1 2 3 4 10
7 3 12 15 1 2 4 5 12
8 2 11 18 1 2 4 4 11
9 3 10 17 1 3 4 5 13
10 5 9 21 2 3 4 7 16
11 4 8 20 1 3 4 6 14
12 6 7 19 5 3 4 6 18
13 5 19 23 1 3 6 7 17
14 4 19 22 1 3 5 6 15
15 7 20 23 3 5 6 7 21
16 6 21 22 1 4 7 7 19
17 9 20 22 4 5 6 7 22
18 8 21 23 2 4 7 7 20
19 12 13 14 7 6 6 5 24
20 11 15 17 5 6 6 6 23
21 10 16 18 5 7 7 7 26
22 14 16 17 5 6 7 7 25
23 13 15 18 6 7 7 7 27

F026
tvs (F026) = 8
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 17 1 3 4 5 13
9 2 10 18 1 2 4 4 11
10 4 9 22 1 3 4 6 14
11 5 7 20 2 4 3 7 16
12 6 8 21 4 3 4 7 18
13 4 23 24 1 3 5 6 15
14 5 24 25 2 5 7 7 21
15 6 23 25 2 4 6 7 19
16 7 21 23 1 3 7 6 17
17 8 22 24 4 5 6 7 22
18 9 20 25 2 4 7 7 20
19 20 21 22 5 8 8 8 29
20 11 18 19 4 7 7 8 26
21 12 16 19 5 7 7 8 27
22 10 17 19 3 6 6 8 23
23 13 15 16 7 5 6 6 24
24 13 14 17 5 6 7 7 25
25 14 15 18 7 7 7 7 28

F028
tvs (F028) = 8
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 15 19 1 2 3 4 10
7 2 14 18 1 2 4 4 11
8 3 17 21 1 2 4 5 12
9 3 16 20 1 3 4 5 13
10 4 15 25 1 3 5 5 14
11 5 14 24 2 3 5 6 16
12 4 17 23 1 3 5 6 15
13 5 16 22 1 3 6 7 17
14 7 11 27 3 4 5 8 20
15 6 10 26 2 3 5 8 18
16 9 13 26 6 4 6 8 24
17 8 12 27 5 4 5 8 22
18 7 20 23 3 4 7 7 21

19 6 21 22 2 4 6 7 19
20 9 18 25 6 5 7 7 25
21 8 19 24 5 5 6 7 23
22 13 19 23 7 7 7 8 29
23 12 18 22 6 6 7 8 27
24 11 21 25 8 6 7 7 28
25 10 20 24 7 5 7 7 26
26 15 16 27 6 8 8 8 30
27 14 17 26 7 8 8 8 31

F030
tvs (F030) = 9
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 11 1 1 3 3 8
5 1 12 13 3 2 3 1 9
6 2 14 15 1 2 3 4 10
7 2 16 17 1 2 4 4 11
8 3 18 19 1 2 4 5 12
9 3 20 21 1 3 4 5 13
10 4 22 24 1 3 5 5 14
11 4 23 25 1 3 5 6 15
12 5 27 29 1 3 6 6 16
13 5 26 28 1 1 8 7 17
14 6 23 27 1 3 7 7 18
15 6 22 26 1 4 7 7 19
16 7 25 29 1 4 7 8 20
17 7 24 28 2 4 7 8 21
18 8 23 28 2 4 7 9 22
19 8 22 29 3 5 7 8 23
20 9 25 26 4 4 8 8 24
21 9 24 27 5 5 7 8 25
22 10 15 19 7 5 7 7 26
24 10 17 21 8 5 7 7 27
23 11 14 18 9 5 7 7 28
25 11 16 20 8 6 7 8 29
27 12 14 21 9 6 7 8 30
29 12 16 19 9 6 8 8 31
26 13 15 20 9 8 7 8 32
28 13 17 18 9 7 8 9 33

F032
tvs (F032) = 9
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 13 1 1 3 3 8
5 1 10 14 1 2 3 3 9
6 2 12 18 1 2 3 4 10
7 3 12 17 1 2 4 5 12
8 2 11 16 1 2 4 4 11
9 3 10 15 1 3 4 5 13
10 5 9 22 2 3 4 7 16
11 4 8 21 1 3 4 6 14
12 6 7 20 4 3 4 7 18
13 4 26 30 1 3 5 6 15
14 5 26 29 1 3 6 7 17
15 9 28 31 1 5 8 8 22
16 8 27 31 1 4 7 8 20
17 7 28 30 1 5 8 7 21
18 6 27 29 1 4 7 7 19
19 26 27 28 7 9 9 9 34
20 12 23 24 4 7 9 8 28
21 11 24 25 1 6 8 8 23
22 10 23 25 1 7 9 9 26
23 20 22 29 8 9 9 9 35
24 20 21 30 8 8 8 8 32
25 21 22 31 7 8 9 9 33
26 13 14 19 4 5 6 9 24
27 16 18 19 6 7 7 9 29
28 15 17 19 6 8 8 9 31
29 14 18 23 4 7 7 9 27
30 13 17 24 4 6 7 8 25
31 15 16 25 5 8 8 9 30

F038
tvs (F038) = 11
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
7 1 11 16 1 2 3 3 9
6 2 12 14 1 2 3 4 10
9 2 10 17 1 2 4 4 11
5 3 11 15 1 2 4 5 12
8 3 12 18 1 3 4 5 13
10 4 9 28 1 3 4 6 14
13 4 32 35 1 3 5 6 15
11 7 5 26 3 3 4 6 16
16 7 35 29 1 3 6 7 17
12 6 8 27 4 3 4 7 18
14 6 34 37 1 4 7 7 19
17 9 37 31 1 4 7 8 20
15 5 33 36 1 5 7 8 21
18 8 36 30 1 5 8 8 22
28 10 21 24 1 6 8 8 23
32 13 21 20 1 5 9 9 24
35 13 16 23 3 6 6 10 25
26 11 22 25 1 6 9 10 26
29 16 25 19 1 7 9 10 27
27 12 20 23 1 7 10 10 28
34 14 20 22 2 7 10 10 29
37 14 17 25 6 7 7 10 30
31 17 24 19 3 8 9 11 31
33 15 21 22 6 7 9 10 32
36 15 18 24 8 8 8 9 33
30 18 23 19 5 8 10 11 34
21 28 32 33 9 8 9 9 35
24 28 31 36 10 8 9 9 36
20 32 27 34 8 9 10 10 37
23 35 27 30 8 10 10 10 38
22 26 34 33 10 9 10 10 39
25 26 29 37 11 10 9 10 40
19 29 31 30 9 10 11 11 41

F040
tvs (F040) = 11
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 15 18 1 2 3 4 10
7 2 14 19 1 2 4 4 11
8 3 17 20 1 2 4 5 12
9 3 16 21 1 3 4 5 13
10 4 23 31 1 3 5 5 14
11 5 22 30 1 3 6 6 16
12 4 25 29 1 3 5 6 15
13 5 24 28 1 3 6 7 17
14 7 23 33 1 4 7 8 20
15 6 22 32 1 3 7 7 18
16 9 25 33 4 4 7 9 24
17 8 24 32 1 4 8 9 22
18 6 27 29 1 4 7 7 19
19 7 26 28 1 4 8 8 21
20 8 26 31 2 5 9 7 23
21 9 27 30 3 5 9 8 25
22 11 15 35 7 6 7 10 30
23 10 14 34 4 5 7 10 26
24 13 17 34 8 6 8 10 32
25 12 16 35 6 5 7 10 28
26 19 20 35 10 8 9 10 37
27 18 21 34 9 7 9 10 35
28 13 19 36 7 7 8 11 33
29 12 18 36 5 6 7 11 29
30 11 21 37 7 6 8 10 31
31 10 20 37 5 5 7 10 27
32 15 17 38 7 7 9 11 34
33 14 16 38 8 8 9 11 36
34 23 24 27 8 10 10 10 38
35 22 25 26 10 10 10 10 40
36 28 29 39 8 11 11 11 41
37 30 31 39 8 10 10 11 39
38 32 33 39 9 11 11 11 42
39 36 37 38 10 11 11 11 43

F042
tvs (F042) = 12
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 15 1 2 4 5 12
6 2 12 14 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 30 1 3 4 6 14
11 5 7 28 2 4 3 7 16
12 6 8 29 4 3 4 7 18
13 4 36 39 1 3 5 6 15
14 6 38 41 1 4 7 7 19
15 5 37 40 1 5 7 8 21
16 7 33 39 1 3 7 6 17
17 9 35 41 1 4 8 7 20
18 8 34 40 1 5 8 8 22
19 31 33 41 8 8 12 10 11 41
20 31 34 39 6 12 10 10 38
21 31 35 40 9 12 11 11 43
22 29 34 36 8 10 10 9 37
23 30 35 37 9 8 9 9 35
24 28 33 38 11 9 9 10 39
25 29 32 38 10 10 11 11 42
26 30 32 36 8 8 11 9 36
27 28 32 37 10 9 11 10 40
28 11 24 27 1 7 9 9 26
29 12 22 25 1 7 10 10 28
30 10 23 26 1 6 8 8 23
31 19 20 21 9 12 12 12 45
32 25 26 27 11 11 11 11 44
33 16 19 24 1 7 10 9 27
34 18 20 22 6 8 10 10 34
35 17 21 23 3 8 11 9 31
36 13 22 26 1 5 9 9 24
37 15 23 27 6 7 9 10 32
38 14 24 25 1 7 10 11 29
39 13 16 20 3 6 6 10 25
40 15 18 21 6 8 8 11 33
41 14 17 19 5 7 7 11 30

F048
tvs (F048) = 13
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 17 1 1 3 3 8
5 1 10 16 1 2 3 3 9
6 2 13 21 1 2 3 4 10
7 3 12 20 1 2 4 5 12
8 2 15 19 1 2 4 4 11
9 3 14 18 1 3 4 5 13
10 5 23 25 1 3 6 6 16
11 4 22 24 1 3 5 5 14
12 7 23 29 1 4 8 9 22
13 6 22 28 1 3 7 7 18
14 9 22 27 5 4 7 8 24
15 8 23 26 1 4 8 7 20
16 5 27 31 1 3 6 7 17
17 4 26 30 1 3 5 6 15
18 9 25 35 2 5 8 10 25
19 8 24 34 2 4 7 8 21
20 7 28 33 1 5 8 9 23
21 6 29 32 1 4 7 7 19
22 11 13 14 7 5 7 7 26
23 10 12 15 8 6 8 8 30
24 11 19 43 5 5 7 10 27
25 10 18 42 6 6 8 11 31
26 15 17 47 5 7 5 11 28
27 14 16 46 7 8 6 11 32
28 13 20 45 7 7 8 12 34
29 12 21 44 7 9 7 12 35
30 17 40 46 1 6 11 11 29
31 16 39 47 3 7 12 11 33
32 21 41 43 7 7 12 10 36
33 20 41 42 6 9 12 11 38
34 19 40 44 6 8 11 12 37
35 18 39 45 5 10 12 12 39
36 43 45 46 10 13 13 13 49
37 42 44 47 11 13 13 13 50
38 39 40 41 12 13 13 13 51
39 31 35 38 8 12 12 13 45
40 30 34 38 7 11 11 13 42
41 32 33 38 11 12 12 13 48
42 25 33 37 9 11 11 13 44
43 24 32 36 7 10 10 13 40
44 29 34 37 10 12 12 13 47
45 28 35 36 9 12 12 13 46
46 27 30 36 8 11 11 13 43
47 26 31 37 6 11 11 13 41

F050
tvs (F050) = 14
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 14 1 1 3 3 8
5 1 10 13 1 2 3 3 9
6 2 12 16 1 2 3 4 10
7 3 12 15 1 2 4 5 12
8 2 11 18 1 2 4 4 11
9 3 10 17 1 3 4 5 13
10 5 9 33 2 3 4 7 16
11 4 8 32 1 3 4 6 14
12 6 7 31 4 3 4 7 18
13 5 42 47 1 3 7 6 17
14 4 41 47 1 3 5 6 15
15 7 44 49 1 5 7 8 21
16 6 43 48 1 4 7 7 19
17 9 46 49 1 5 8 8 22
18 8 45 48 1 4 8 7 20
19 37 41 44 5 13 9 10 37
20 36 42 43 8 13 10 10 41
21 35 45 46 9 13 11 12 45
22 36 37 47 2 13 13 10 38
23 35 37 49 8 13 13 12 46
24 35 36 48 7 13 13 11 44
25 31 40 44 9 10 12 11 42
26 31 39 43 9 10 13 11 43
27 33 39 42 8 9 13 9 39
28 32 40 41 6 8 12 9 35
29 33 38 46 9 9 12 10 40
30 32 38 45 7 8 12 9 36
31 12 25 26 1 7 10 10 28
32 11 28 30 1 6 8 8 23
33 10 27 29 1 7 9 9 26
34 38 39 40 11 14 14 14 53
35 21 23 24 13 13 13 13 52
36 20 22 24 11 13 13 13 50
37 19 22 23 10 13 13 13 49
38 29 30 34 10 12 12 14 48
39 26 27 34 11 13 13 14 51
40 25 28 34 9 12 12 14 47
41 14 19 28 1 5 9 9 24
42 13 20 27 1 7 10 9 27
43 16 20 26 1 7 10 11 29
44 15 19 25 4 7 10 11 32
45 18 21 30 3 8 11 9 31
46 17 21 29 4 8 12 10 34
47 13 14 22 3 6 6 10 25
48 16 18 24 5 7 7 11 30
49 15 17 23 5 8 8 12 33

F054
tvs (F054) = 15
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 14 1 1 3 3 8
5 1 10 13 1 2 3 3 9
6 2 12 18 1 2 3 4 10
7 3 12 17 1 2 4 5 12
8 2 11 16 1 2 4 4 11
9 3 10 15 1 3 4 5 13
10 5 9 21 2 3 4 7 16
11 4 8 20 1 3 4 6 14
12 6 7 19 4 3 4 7 18
13 5 46 51 1 3 7 6 17
14 4 45 51 1 3 5 6 15
15 9 50 53 1 5 8 8 22
16 8 49 52 1 4 8 7 20
17 7 48 53 1 5 7 8 21
18 6 47 52 1 4 7 7 19
19 12 22 23 1 7 10 10 28
20 11 25 27 1 6 8 8 23
21 10 24 26 1 7 9 9 26
22 19 40 48 7 10 14 11 42
23 19 39 47 9 10 14 10 43
24 21 42 46 7 9 14 9 39
25 20 41 45 5 8 13 9 35
26 21 44 50 7 9 14 10 40
27 20 43 49 6 8 13 9 36
28 39 40 51 1 13 14 10 38
29 42 44 52 5 14 14 12 45
30 41 43 53 10 13 13 12 48
31 38 40 46 2 15 14 10 41
32 37 39 45 1 13 14 9 37
33 38 42 49 6 15 14 11 46
34 37 41 50 10 13 13 13 49
35 37 44 47 6 13 14 11 44
36 38 43 48 7 15 13 12 47
37 32 34 35 13 13 13 13 52
38 31 33 36 12 15 15 15 57
39 23 28 32 12 14 13 14 53
40 22 28 31 12 14 14 14 54
41 25 30 34 11 13 13 13 50
42 24 29 33 13 14 14 14 55
43 27 30 36 12 13 13 13 51
44 26 29 35 14 14 14 14 56
45 14 25 32 1 5 9 9 24
46 13 24 31 1 7 9 10 27
47 18 23 35 1 7 10 11 29
48 17 22 36 2 7 11 12 32
49 16 27 33 3 8 9 11 31
50 15 26 34 3 8 10 13 34
51 13 14 28 3 6 6 10 25
52 16 18 29 4 7 7 12 30
53 15 17 30 5 8 8 12 33

F056A
tvs (F056A) = 15
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 21 1 3 4 6 14
11 5 7 19 2 4 3 7 16
12 6 8 20 4 3 4 7 18
13 4 47 53 1 3 5 6 15
14 5 48 55 1 5 7 8 21
15 6 49 54 1 4 7 7 19
16 7 50 53 1 3 7 6 17
17 9 51 54 1 4 8 7 20
18 8 52 55 1 5 8 8 22
19 11 24 27 1 7 9 9 26
20 12 22 25 1 7 10 10 28
21 10 23 26 1 6 8 8 23
22 20 42 52 8 10 13 11 42
23 21 40 51 5 8 13 9 35
24 19 41 50 7 9 14 9 39
25 20 45 49 9 10 14 10 43
26 21 43 47 6 8 13 9 36
27 19 44 48 7 9 14 10 40
28 39 41 54 4 15 14 12 45
29 37 42 53 1 14 13 10 38
30 38 40 55 8 15 13 12 48
31 38 39 51 5 15 15 11 46
32 37 38 52 7 14 15 13 49
33 37 39 50 2 14 15 10 41
34 41 44 49 5 14 14 11 44
35 42 45 47 1 13 14 9 37
36 40 43 48 9 13 13 12 47
37 29 32 33 12 14 14 14 54
38 30 31 32 13 15 15 15 58
39 28 31 33 12 15 15 15 57
40 23 30 36 11 13 13 13 50
41 24 28 34 13 14 14 14 55
42 22 29 35 13 13 13 13 52
43 26 36 46 10 13 13 15 51
44 27 34 46 13 14 14 15 56
45 25 35 46 10 14 14 15 53
46 43 44 45 14 15 15 15 59
47 13 26 35 1 5 9 9 24
48 14 27 36 3 7 10 12 32
49 15 25 34 1 7 10 11 29
50 16 24 33 1 7 9 10 27
51 17 23 31 3 8 9 11 31
52 18 22 32 2 8 11 13 34
53 13 16 29 3 6 6 10 25
54 15 17 28 4 7 7 12 30
55 14 18 30 5 8 8 12 33

F056B
tvs (F056B)=15
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 17 1 1 3 3 8
5 1 10 16 1 2 3 3 9
6 2 13 19 1 2 3 4 10
7 3 12 18 1 2 4 5 12
8 2 15 21 1 2 4 4 11
9 3 14 20 1 3 4 5 13
10 5 13 25 2 3 5 6 16
11 4 12 26 1 3 5 5 14
12 7 11 28 3 4 5 10 22
13 6 10 27 2 3 5 8 18
14 9 15 30 4 4 6 10 24
15 8 14 29 2 4 6 8 20
16 5 23 32 1 3 6 7 17
17 4 22 31 1 3 5 6 15
18 7 24 36 1 5 8 9 23
19 6 24 35 1 4 7 7 19
20 9 23 34 2 5 8 10 25
21 8 22 33 2 4 7 8 21
22 17 21 40 4 5 7 11 27
23 16 20 39 4 6 8 12 30
24 18 19 38 5 8 7 13 33
25 10 42 53 1 6 11 11 29
26 11 41 53 1 5 10 10 26
27 13 46 55 1 8 11 12 32
28 12 45 54 1 10 13 13 37
29 15 44 55 1 8 13 13 35
30 14 43 54 1 10 14 14 39
31 17 32 48 3 6 8 11 28
32 16 31 47 4 7 8 12 31
33 21 35 52 5 8 9 14 36
34 20 36 51 5 10 10 15 40
35 19 33 50 5 7 9 13 34
36 18 34 49 5 9 10 14 38
37 53 54 55 14 15 15 15 59
38 24 45 46 10 13 14 13 50
39 23 42 43 7 12 12 15 46
40 22 41 44 8 11 11 13 43
41 26 40 49 6 10 11 14 41
42 25 39 50 9 11 12 13 45
43 30 39 52 13 14 15 15 57
44 29 40 51 11 13 13 15 52
45 28 38 48 13 13 14 14 54
46 27 38 47 12 11 13 12 48
47 32 46 51 8 12 12 15 47
48 31 45 52 5 11 14 14 44
49 36 41 50 14 14 14 14 56
50 35 42 49 11 13 13 14 51
51 34 44 47 13 15 15 15 58
52 33 43 48 10 14 15 14 53
53 25 26 37 6 11 10 15 42
54 28 30 37 13 13 14 15 55
55 27 29 37 9 12 13 15 49

F056C
tvs (F056C) = 15
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 15 18 1 2 3 4 10
7 2 14 19 1 2 4 4 11
8 3 17 21 1 2 4 5 12
9 3 16 20 1 3 4 5 13
10 4 23 29 1 3 5 5 14
11 5 22 28 1 3 6 6 16
12 4 25 31 1 3 5 6 15
13 5 24 30 1 3 6 7 17
14 7 23 32 1 4 7 8 20
15 6 22 33 1 3 7 7 18
16 9 25 34 3 4 7 10 24
17 8 24 35 1 4 8 9 22
18 6 27 36 1 4 7 7 19
19 7 26 37 1 4 8 8 21
20 9 27 39 1 5 9 10 25
21 8 26 38 1 5 8 9 23
22 11 15 45 4 6 7 13 30
23 10 14 44 3 5 7 11 26
24 13 17 47 5 6 8 13 32
25 12 16 46 4 5 7 12 28
26 19 21 49 10 8 8 12 38
27 18 20 48 7 7 9 12 35
28 11 49 51 1 6 12 12 31
29 10 48 50 1 5 10 11 27

30 13 48 53 1 7 12 13 33
31 12 49 52 1 6 11 11 29
32 14 47 51 3 8 13 13 37
33 15 46 50 3 7 12 12 34
34 16 45 53 5 10 13 14 42
35 17 44 52 7 9 11 13 40
36 18 47 55 2 7 13 14 36
37 19 46 54 5 8 12 14 39
38 21 45 55 5 9 13 14 41
38 21 45 55 5 9 13 14 41
39 20 44 54 8 10 11 14 43
40 43 50 51 13 15 14 14 56
41 43 52 53 12 15 15 15 57
42 43 54 55 13 15 15 15 58
43 40 41 42 14 15 15 15 59
44 23 35 39 11 11 11 11 44
45 22 34 38 11 13 13 13 50
46 25 33 37 11 12 12 12 47
47 24 32 36 13 13 13 13 52
48 27 29 30 11 12 10 12 45
49 26 28 31 13 12 12 11 48
50 29 33 40 9 11 12 14 46
51 28 32 40 12 12 13 14 51
52 31 35 41 10 11 13 15 49
53 30 34 41 11 13 14 15 53
54 37 39 42 12 14 14 15 55
55 36 38 42 11 14 14 15 54

F060
tvs (F060) = 16
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 17 1 1 3 3 8
5 1 10 16 1 2 3 3 9
6 2 13 21 1 2 3 4 10
7 3 12 20 1 2 4 5 12
8 2 15 19 1 2 4 4 11
9 3 14 18 1 3 4 5 13
10 5 22 35 1 3 6 6 16
11 4 23 34 1 3 5 5 14
12 7 25 39 1 4 8 9 22
13 6 24 38 1 3 7 7 18
14 9 27 37 1 4 9 10 24
15 8 26 36 1 4 7 8 20
16 5 29 40 1 3 6 7 17
17 4 28 41 1 3 5 6 15
18 9 31 45 1 5 9 10 25
19 8 30 44 1 4 8 8 21
20 7 33 43 1 5 8 9 23
21 6 32 42 1 4 7 7 19
22 10 37 49 1 6 11 12 30
23 11 36 48 1 5 10 10 26
24 13 35 50 3 7 9 15 34
25 12 34 50 9 8 10 15 42
26 15 39 49 6 7 11 14 38
27 14 38 48 12 9 12 13 46
28 17 31 52 1 5 11 11 28
29 16 30 51 3 6 10 13 32
30 19 29 53 6 8 10 16 40
31 18 28 53 12 9 11 16 48
32 21 33 52 5 7 11 13 36
33 20 32 51 10 8 11 15 44
34 11 25 55 1 5 10 11 27
35 10 24 54 4 6 9 12 31
36 15 23 59 5 8 10 16 39
37 14 22 58 10 10 11 16 47
38 13 27 57 2 7 12 14 35
39 12 26 56 8 9 11 15 43
40 16 47 56 1 7 12 13 33
41 17 46 57 1 6 11 11 29
42 21 47 55 2 7 15 13 37
43 20 46 54 8 9 14 14 45
44 19 46 58 3 8 14 16 41
45 18 47 59 8 10 15 16 49
46 41 43 44 14 11 14 14 53
47 40 42 45 16 12 15 15 58
48 23 27 51 12 10 13 15 50
49 22 26 52 15 12 14 14 55
50 24 25 53 14 15 15 16 60
51 29 33 48 14 13 15 15 57
52 28 32 49 14 11 13 14 52
53 30 31 50 14 16 16 16 62
54 35 43 59 14 12 14 16 56
55 34 42 58 11 11 13 16 51
56 39 40 57 16 15 13 15 59
57 38 41 56 14 14 11 15 54
58 37 44 55 15 16 16 16 63
59 36 45 54 13 16 16 16 61

F062
tvs (F062) = 17
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 21 1 3 4 6 14
11 5 7 19 2 4 3 7 16
12 6 8 20 4 3 4 7 18
13 4 53 59 1 3 5 6 15
14 5 54 61 1 5 7 8 21
15 6 55 60 1 4 7 7 19
16 7 56 59 1 3 7 6 17
17 9 57 60 1 4 8 7 20
18 8 58 61 1 5 8 8 22
19 11 24 27 1 7 9 9 26
20 12 22 25 1 7 10 10 28
21 10 23 26 1 6 8 8 23
22 20 48 58 6 10 15 11 42
23 21 46 57 5 8 13 9 35
24 19 47 56 7 9 14 9 39
25 20 45 55 8 10 15 10 43
26 21 43 53 6 8 13 9 36
27 19 44 54 7 9 14 10 40
28 37 40 59 1 14 13 10 38
29 38 42 61 7 13 16 12 48
30 39 41 60 3 15 15 12 45
31 39 42 54 4 15 16 12 47
32 37 41 55 4 14 15 11 44
33 38 40 53 1 13 14 9 37
34 39 44 57 6 15 14 11 46
35 37 45 56 2 14 15 10 41
36 38 43 58 10 13 13 13 49
37 28 32 35 12 14 14 14 54
38 29 33 36 13 13 13 13 52
39 30 31 34 15 15 15 15 60
40 28 33 52 10 13 14 16 53
41 30 32 52 13 15 15 16 59
42 29 31 52 13 16 16 16 61
43 26 36 51 9 13 13 16 51
44 27 34 49 12 14 14 16 56
45 25 35 50 10 15 15 17 57
46 23 49 51 5 13 16 16 50
47 24 49 50 8 14 16 17 55
48 22 50 51 10 15 17 16 58
49 44 46 47 14 16 16 16 62
50 45 47 48 14 17 17 17 65
51 43 46 48 15 16 16 16 63
52 40 41 42 16 16 16 16 64
53 13 26 33 1 5 9 9 24
54 14 27 31 3 7 10 12 32
55 15 25 32 1 7 10 11 29
56 16 24 35 1 7 9 10 27
57 17 23 34 3 8 9 11 31
58 18 22 36 2 8 11 13 34
59 13 16 28 3 6 6 10 25
60 15 17 30 4 7 7 12 30
61 14 18 29 5 8 8 12 33

F064
tvs (F064) = 17
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 16 1 1 3 3 8
5 1 10 17 1 2 3 3 9
6 2 13 19 1 2 3 4 10
7 3 12 18 1 2 4 5 12
8 2 15 21 1 2 4 4 11
9 3 14 20 1 3 4 5 13
10 5 23 26 1 3 6 6 16
11 4 22 25 1 3 5 5 14
12 7 24 28 1 4 8 9 22
13 6 24 27 1 3 7 7 18
14 9 23 30 2 4 8 10 24
15 8 22 29 1 4 7 8 20
16 4 32 37 1 3 5 6 15
17 5 31 38 1 3 6 7 17
18 7 34 40 1 5 8 9 23
19 6 33 39 1 4 7 7 19
20 9 36 42 1 5 9 10 25
21 8 35 41 1 4 8 8 21
22 11 15 49 2 5 7 12 26
23 10 14 48 2 6 8 14 30
24 12 13 47 6 8 7 13 34
25 11 54 63 1 5 10 11 27
26 10 53 62 1 6 12 12 31
27 13 58 63 1 7 14 13 35
28 12 57 62 2 9 16 14 41
29 15 56 62 1 8 15 14 38
30 14 55 63 8 10 13 13 44
31 17 56 59 1 6 12 13 32
32 16 55 60 1 5 11 11 28
33 19 54 61 3 7 12 14 36
34 18 53 61 4 8 14 16 42
35 21 57 60 3 8 15 13 39
36 20 58 59 6 9 15 15 45
37 16 47 51 1 6 11 11 29
38 17 47 50 1 7 12 13 33
39 19 48 52 1 7 14 15 37
40 18 49 52 6 9 12 16 43
41 21 48 51 4 8 14 14 40
42 20 49 50 9 10 12 15 46
43 59 60 61 15 17 17 17 66
44 52 55 56 14 17 17 17 65
45 51 53 58 16 17 17 17 67
46 50 54 57 16 16 16 16 64
47 24 37 38 16 13 11 12 52
48 23 39 41 12 14 14 14 54
49 22 40 42 11 12 12 12 47
50 38 42 46 15 13 15 16 59
51 37 41 45 11 11 14 17 53
52 39 40 44 14 15 16 17 62
53 26 34 45 12 12 14 17 55
54 25 33 46 10 10 12 16 48
55 30 32 44 9 13 11 17 50
56 29 31 44 13 15 12 17 57
57 28 35 46 16 16 15 16 63
58 27 36 45 14 14 15 17 60
59 31 36 43 13 13 15 17 58
60 32 35 43 10 11 13 17 51
61 33 34 43 14 14 16 17 61
62 26 28 29 16 12 14 14 56
63 25 27 30 12 11 13 13 49

F072
tvs (F072) = 19
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 14 1 1 3 3 8
5 1 10 13 1 2 3 3 9
6 2 12 18 1 2 3 4 10
7 3 12 17 1 2 4 5 12
8 2 11 16 1 2 4 4 11
9 3 10 15 1 3 4 5 13
10 5 9 21 2 3 4 7 16
11 4 8 20 1 3 4 6 14
12 6 7 19 4 3 4 7 18
13 5 64 69 1 3 7 6 17
14 4 63 69 1 3 5 6 15
15 9 68 71 1 5 8 8 22
16 8 67 70 1 4 8 7 20
17 7 66 71 1 5 7 8 21
18 6 65 70 1 4 7 7 19
19 12 22 23 1 7 10 10 28
20 11 25 27 1 6 8 8 23
21 10 24 26 1 7 9 9 26
22 19 46 66 6 10 15 11 42
23 19 47 65 8 10 15 10 43
24 21 51 64 7 9 14 9 39
25 20 50 63 5 8 13 9 35
26 21 49 68 7 9 14 10 40
27 20 48 67 6 8 13 9 36
28 40 41 69 1 13 14 10 38
29 43 45 71 4 16 16 12 48
30 42 44 70 2 15 16 12 45
31 39 41 64 2 15 14 10 41
32 38 40 63 1 13 14 9 37
33 37 45 68 4 16 16 13 49
34 37 44 67 3 16 16 11 46

35 38 43 66 6 13 16 12 47
36 39 42 65 3 15 15 11 44
37 33 34 59 13 16 16 17 62
38 32 35 58 9 13 13 17 52
39 31 36 57 9 15 15 18 57
40 28 32 55 9 13 14 17 53
41 28 31 54 8 14 14 18 54
42 30 36 54 12 15 15 18 60
43 29 35 55 14 16 16 17 63
44 30 34 53 10 16 16 19 61
45 29 33 53 13 16 16 19 64
46 22 58 60 8 15 17 18 58
47 23 57 60 8 15 18 18 59
48 27 59 62 4 13 17 17 51
49 26 59 61 7 14 17 18 56
50 25 58 62 3 13 17 17 50
51 24 57 61 5 14 18 18 55
52 60 61 62 17 19 19 19 74
53 44 45 56 16 19 19 19 73
54 41 42 56 14 18 18 19 69
55 40 43 56 15 17 17 19 68
56 53 54 55 18 19 19 19 75
57 39 47 51 16 18 18 18 70
58 38 46 50 14 17 17 17 65
59 37 48 49 16 17 17 17 67
60 46 47 52 17 18 18 19 72
61 49 51 52 16 18 18 19 71
62 48 50 52 13 17 17 19 66
63 14 25 32 1 5 9 9 24
64 13 24 31 1 7 9 10 27
65 18 23 36 1 7 10 11 29
66 17 22 35 2 7 11 12 32
67 16 27 34 3 8 9 11 31
68 15 26 33 3 8 10 13 34
69 13 14 28 3 6 6 10 25
70 16 18 30 4 7 7 12 30
71 15 17 29 5 8 8 12 33

F074
tvs (F074) = 20
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 21 1 3 4 6 14
11 5 7 19 2 4 3 7 16
12 6 8 20 4 3 4 7 18
13 4 65 71 1 3 5 6 15
14 5 66 73 1 5 7 8 21
15 6 67 72 1 4 7 7 19
16 7 68 71 1 3 7 6 17
17 9 69 72 1 4 8 7 20
18 8 70 73 1 5 8 8 22
19 11 24 27 1 7 9 9 26
20 12 22 25 1 7 10 10 28
21 10 23 26 1 6 8 8 23
22 20 54 67 7 10 15 10 42
23 21 52 65 5 8 13 9 35
24 19 53 66 6 9 14 10 39
25 20 51 70 7 10 15 11 43
26 21 49 69 6 8 13 9 36
27 19 50 68 8 9 14 9 40
28 37 40 71 1 14 13 10 38
29 38 41 73 3 17 16 12 48
30 39 42 72 2 16 15 12 45
31 39 45 69 3 16 16 11 46
32 38 43 70 2 17 17 13 49
33 37 44 68 2 14 15 10 41
34 41 48 66 2 16 17 12 47
35 42 46 67 2 15 16 11 44
36 40 47 65 1 13 14 9 37
37 28 33 56 7 14 14 19 54
38 29 32 57 15 17 17 17 66
39 30 31 55 11 16 16 19 62
40 28 36 59 8 13 13 18 52
41 29 34 60 14 16 16 18 64
42 30 35 58 11 15 15 19 60
43 32 62 63 12 17 20 18 67
44 33 61 62 3 15 19 20 57
45 31 61 63 10 16 19 18 63
46 35 59 64 9 16 18 18 61
47 36 60 64 3 14 18 18 53
48 34 58 64 11 17 19 18 65
49 26 57 63 3 13 17 18 51
50 27 55 61 4 14 19 19 56
51 25 56 62 5 15 19 20 59
52 23 57 60 2 13 17 18 50
53 24 55 58 3 14 19 19 55
54 22 56 59 6 15 19 18 58
55 39 50 53 17 19 19 19 74
56 37 51 54 16 19 19 19 73
57 38 49 52 17 17 17 17 68
58 42 48 53 18 19 19 19 75
59 40 46 54 17 18 18 18 71
60 41 47 52 15 18 18 18 69
61 44 45 50 19 19 19 19 76
62 43 44 51 17 20 20 20 77
63 43 45 49 16 18 18 18 70
64 46 47 48 18 18 18 18 72
65 13 23 36 1 5 9 9 24
66 14 24 34 3 7 10 12 32
67 15 22 35 1 7 10 11 29
68 16 27 33 1 7 9 10 27
69 17 26 31 3 8 9 11 31
70 18 25 32 2 8 11 13 34
71 13 16 28 3 6 6 10 25
72 15 17 30 4 7 7 12 30
73 14 18 29 5 8 8 12 33

F078
tvs (F078) = 21
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 21 1 3 4 6 14
11 5 7 19 2 4 3 7 16
12 6 8 20 4 3 4 7 18
13 4 69 75 1 3 5 6 15
14 5 70 77 1 5 7 8 21
15 6 71 76 1 4 7 7 19
16 7 72 75 1 3 7 6 17
17 9 73 76 1 4 8 7 20
18 8 74 77 1 5 8 8 22
19 11 24 27 1 7 9 9 26
20 12 22 25 1 7 10 10 28
21 10 23 26 1 6 8 8 23
22 20 51 71 7 10 15 10 42
23 21 49 69 5 8 13 9 35
24 19 50 70 6 9 14 10 39
25 20 48 74 7 10 15 11 43
26 21 46 73 6 8 13 9 36
27 19 47 72 8 9 14 9 40
28 37 40 75 1 14 13 10 38
29 38 42 77 3 17 16 12 48
30 39 41 76 2 16 15 12 45
31 39 44 73 3 16 16 11 46
32 38 43 74 2 17 17 13 49
33 37 45 72 2 14 15 10 41
34 42 54 70 2 16 17 12 47
35 41 52 71 2 15 16 11 44
36 40 53 69 1 13 14 9 37
37 28 33 61 7 14 14 19 54
38 29 32 62 15 17 17 17 66
39 30 31 60 11 16 16 19 62
40 28 36 59 8 13 13 18 52
41 30 35 57 10 15 15 20 60
42 29 34 58 14 16 16 18 64
43 32 64 68 12 17 20 18 67
43 32 64 68 12 17 20 18 67
44 31 65 66 10 16 18 19 63
45 33 63 67 3 15 19 20 57
46 26 65 68 2 13 18 18 51
47 27 63 66 4 14 19 19 56
48 25 64 67 4 15 20 20 59
49 23 62 68 2 13 17 18 50
50 24 60 66 3 14 19 19 55
51 22 61 67 4 15 19 20 58
52 35 59 61 8 16 18 19 61
53 36 58 62 4 14 18 17 53
54 34 57 60 9 17 20 19 65
55 63 64 65 20 20 20 20 80
56 57 58 59 18 21 21 21 81
57 41 54 56 18 20 20 21 79
58 42 53 56 15 18 18 21 72
59 40 52 56 14 18 18 21 71
60 39 50 54 17 19 19 19 74
61 37 51 52 16 19 19 19 73
62 38 49 53 17 17 17 17 68
63 45 47 55 18 19 19 20 76
64 43 48 55 18 20 20 20 78
65 44 46 55 14 18 18 20 70
66 44 47 50 18 19 19 19 75
67 45 48 51 17 20 20 20 77
68 43 46 49 15 18 18 18 69
69 13 23 36 1 5 9 9 24
70 14 24 34 3 7 10 12 32
71 15 22 35 1 7 10 11 29
72 16 27 33 1 7 9 10 27
73 17 26 31 3 8 9 11 31
74 18 25 32 2 8 11 13 34
75 13 16 28 3 6 6 10 25
76 15 17 30 4 7 7 12 30
77 14 18 29 5 8 8 12 33

F080
tvs (F080) = 21
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 7 1 1 2 2 6
3 0 8 9 1 1 2 3 7
4 1 10 12 1 1 3 3 8
5 1 11 13 1 2 3 3 9
6 2 15 19 1 2 3 4 10
7 2 14 18 1 2 4 4 11
8 3 17 21 1 2 4 5 12
9 3 16 20 1 3 4 5 13
10 4 23 35 1 3 5 5 14
11 5 22 34 1 3 6 6 16
12 4 25 37 1 3 5 6 15
13 5 24 36 1 3 6 7 17
14 7 27 42 1 4 7 8 20
15 6 26 43 1 3 7 7 18
16 9 29 44 1 4 9 10 24
17 8 28 45 1 4 8 9 22
18 7 31 38 1 4 8 8 21
19 6 30 39 1 4 7 7 19
20 9 33 40 1 5 9 10 25
21 8 32 41 1 5 8 9 23
22 11 47 57 1 6 11 12 30
23 10 46 56 1 5 10 10 26
24 13 49 59 1 6 12 13 32
25 12 48 58 1 5 11 11 28
26 15 47 65 1 7 13 13 34
27 14 46 64 3 7 13 15 38
28 17 49 67 1 8 16 17 42
29 16 48 66 6 9 14 17 46
30 19 49 60 1 7 14 14 36
31 18 48 61 2 8 14 16 40
32 21 47 62 7 8 15 14 44
33 20 46 63 10 9 13 16 48
34 11 51 63 1 6 12 12 31
35 10 50 62 1 5 10 11 27
36 13 53 61 1 7 12 13 33
37 12 52 60 1 6 11 11 29
38 18 51 67 2 8 15 16 41
39 19 50 66 2 7 13 15 37
40 20 53 65 6 10 16 17 49
41 21 52 64 4 9 14 18 45
42 14 54 57 1 8 15 15 39
43 15 55 56 1 7 14 13 35
44 16 55 59 4 10 17 16 47
45 17 54 58 3 9 17 14 43
46 23 27 33 14 10 13 13 50
47 22 26 32 19 11 13 15 58
48 25 29 31 15 11 14 14 54
49 24 28 30 20 12 16 14 62
50 35 39 79 10 10 13 19 52
51 34 38 78 14 12 15 19 60
52 37 41 78 12 11 14 19 56
53 36 40 79 17 12 16 19 64
54 42 45 79 19 15 17 19 70
55 43 44 78 17 14 17 19 67
56 23 43 75 10 10 13 18 51
57 22 42 74 12 12 15 20 59
58 25 45 77 11 11 14 19 55
59 24 44 76 15 13 16 19 63

60 30 37 74 12 14 11 20 57
61 31 36 75 18 16 13 18 65
62 32 35 76 9 14 11 19 53
63 33 34 77 14 16 12 19 61
64 27 41 73 16 15 18 20 69
65 26 40 72 16 13 17 20 66
66 29 39 73 16 17 15 20 68
67 28 38 72 18 17 16 20 71
68 71 72 73 19 21 21 21 82
69 71 74 75 19 21 20 20 80
70 71 76 77 18 21 21 21 81
71 68 69 70 20 21 21 21 83
72 65 67 68 17 20 20 21 78
73 64 66 68 18 20 20 21 79
74 57 60 69 17 20 20 20 77
75 56 61 69 16 18 18 20 72
76 59 62 70 15 19 19 21 74
77 58 63 70 16 19 19 21 75
78 51 52 55 19 19 19 19 76
79 50 53 54 16 19 19 19 73

F084
tvs (F084) = 22
0 1 2 3 1 1 1 1 4
1 0 4 5 1 1 1 2 5
2 0 6 8 1 1 2 2 6
3 0 7 9 1 1 2 3 7
4 1 11 16 1 1 3 3 8
5 1 10 17 1 2 3 3 9
6 2 13 21 1 2 3 4 10
7 3 12 20 1 2 4 5 12
8 2 15 19 1 2 4 4 11
9 3 14 18 1 3 4 5 13
10 5 13 35 2 3 5 6 16
11 4 12 34 1 3 5 5 14
12 7 11 37 3 4 5 10 22
13 6 10 36 2 3 5 8 18
14 9 15 39 3 4 6 11 24
15 8 14 38 2 4 6 8 20
16 4 23 28 1 3 5 6 15
17 5 22 29 1 3 6 7 17
18 9 25 31 1 5 9 10 25
19 8 24 30 1 4 8 8 21
20 7 27 33 1 5 8 9 23
21 6 26 32 1 4 7 7 19
22 17 25 40 1 6 11 12 30
23 16 24 41 2 5 9 11 27
24 19 23 43 4 8 9 15 36
25 18 22 42 5 9 11 17 42
26 21 27 45 3 7 10 13 33
27 20 26 44 5 8 10 16 39
28 16 29 59 3 6 8 11 28
29 17 28 58 3 7 8 13 31
30 19 32 61 4 8 10 15 37
31 18 33 60 5 10 11 17 43
32 21 30 63 4 7 10 13 34
33 20 31 62 5 9 11 15 40
34 11 46 52 1 5 10 10 26
35 10 47 53 1 6 11 11 29
36 13 51 57 1 8 11 12 32
37 12 50 56 1 10 13 14 38
38 15 49 55 1 8 13 13 35
39 14 48 54 1 11 14 15 41
40 22 47 65 6 12 13 19 50
41 23 46 64 5 11 12 18 46
42 25 48 69 13 17 17 19 66
43 24 49 68 10 15 15 18 58
44 27 50 67 10 16 16 20 62
45 26 51 66 7 13 14 20 54
46 34 41 71 5 10 12 17 44
47 35 40 70 6 11 13 18 48
48 39 42 75 12 14 17 21 64
49 38 43 74 8 13 15 20 56
50 37 44 73 13 13 16 18 60
51 36 45 72 7 11 14 20 52
52 34 53 77 5 10 13 17 45
53 35 52 76 6 11 13 19 49
54 39 56 78 12 15 17 21 65
55 38 57 78 8 13 15 21 57
56 37 54 77 12 14 17 18 61
57 36 55 76 7 12 15 19 53
58 29 69 72 1 13 18 19 51
59 28 68 73 1 11 17 18 47
60 31 65 74 11 17 19 20 67
61 30 64 75 5 15 18 21 59
62 33 66 71 11 15 20 17 63
63 32 67 70 3 13 20 19 55
64 41 61 80 12 18 18 22 70
65 40 60 79 15 19 19 22 75
66 45 62 80 16 20 20 22 78
67 44 63 79 17 20 20 22 79
68 43 59 79 14 18 17 22 71
69 42 58 80 17 19 18 22 76
70 47 63 82 15 18 19 21 73
71 46 62 81 13 17 17 21 68
72 51 58 83 16 20 19 22 77
73 50 59 83 14 18 18 22 72
74 49 60 81 19 20 20 21 80
75 48 61 82 19 21 21 21 82
76 53 57 81 15 19 19 21 74
77 52 56 82 13 17 18 21 69
78 54 55 83 17 21 21 22 81
79 65 67 68 20 22 22 22 86
80 64 66 69 19 22 22 22 85
81 71 74 76 20 21 21 21 83
82 70 75 77 21 21 21 21 84
83 72 73 78 21 22 22 22 87

F086
tvs (F086) = 23
0 1 2 3 1 1 1 1 4
1 0 4 7 1 1 1 2 5
2 0 6 9 1 1 2 2 6
3 0 5 8 1 1 2 3 7
4 1 10 13 1 1 3 3 8
5 3 11 14 1 2 4 5 12
6 2 12 15 1 2 3 4 10
7 1 11 16 1 2 3 3 9
8 3 12 18 1 3 4 5 13
9 2 10 17 1 2 4 4 11
10 4 9 21 1 3 4 6 14
11 5 7 19 2 4 3 7 16
12 6 8 20 4 3 4 7 18
13 4 77 83 1 3 5 6 15
14 5 78 85 1 5 7 8 21
15 6 79 84 1 4 7 7 19
16 7 80 83 1 3 7 6 17
17 9 81 84 1 4 8 7 20
18 8 82 85 1 5 8 8 22
19 11 24 27 1 7 9 9 26
20 12 22 25 1 7 10 10 28
21 10 23 26 1 6 8 8 23
22 20 51 79 7 10 15 10 42
23 21 49 77 5 8 13 9 35
24 19 50 78 6 9 14 10 39
25 20 48 82 7 10 15 11 43
26 21 46 81 6 8 13 9 36
27 19 47 80 8 9 14 9 40
28 37 40 83 1 13 14 10 38
29 38 42 84 2 15 16 12 45
30 39 41 85 3 16 17 12 48
31 39 45 78 2 16 17 12 47
32 38 43 79 2 15 16 11 44
33 37 44 77 1 13 14 9 37
34 42 53 81 3 16 16 11 46
35 41 52 82 2 17 17 13 49
36 40 54 80 2 14 15 10 41
37 28 33 67 8 13 13 18 52
38 29 32 65 10 15 15 20 60
39 30 31 66 11 16 16 21 64
40 28 36 60 7 14 14 19 54
41 30 35 58 11 17 17 21 66
42 29 34 59 10 16 16 20 62
43 32 69 74 6 16 20 19 61
44 33 70 75 4 14 17 18 53
45 31 68 76 11 17 19 18 65
46 26 73 76 2 13 18 18 51
47 27 71 74 4 14 19 19 56
48 25 72 75 6 15 20 18 59
49 23 70 73 2 13 17 18 50
50 24 68 71 3 14 19 19 55
51 22 69 72 3 15 20 20 58
52 35 67 75 14 17 18 18 67
53 34 66 76 8 16 21 18 63
54 36 65 74 3 15 20 19 57
55 64 69 71 20 23 22 22 87
56 64 70 72 18 23 21 21 83
57 64 68 73 19 23 21 21 84
58 41 62 63 17 21 22 22 82
59 42 61 62 16 20 22 22 80
60 40 61 63 10 19 22 22 73
61 59 60 65 20 22 22 22 86
62 58 59 66 22 22 22 22 88
63 58 60 67 19 22 22 22 85
64 55 56 57 20 23 23 23 89
65 38 54 61 15 20 20 22 77
66 39 53 62 17 21 21 22 81
67 37 52 63 13 18 18 22 71
68 45 50 57 15 19 19 21 74
69 43 51 55 16 20 20 22 78
70 44 49 56 13 17 17 21 68
71 47 50 55 15 19 19 22 75
72 48 51 56 18 20 20 21 79
73 46 49 57 12 18 18 21 69
74 43 47 54 19 19 19 19 76
75 44 48 52 18 18 18 18 72
76 45 46 53 16 18 18 18 70
77 13 23 33 1 5 9 9 24
78 14 24 31 3 7 10 12 32
79 15 22 32 1 7 10 11 29
80 16 27 36 1 7 9 10 27
81 17 26 34 3 8 9 11 31
82 18 25 35 2 8 11 13 34
83 13 16 28 3 6 6 10 25
84 15 17 29 4 7 7 12 30
85 14 18 30 5 8 8 12 33