

# Fortifying The Messages

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**Abstract:** In this paper, a method for sending secured messages on internet is presented in a very simple way using Special Pythagorean Triangles.

**Index Terms:** Code, encryption, legs, Mathematica, message, primitive solutions, Pythagorean Triangles.

## 1. INTRODUCTION

IN modern times, world is embedded with technologies. In this technological world it is very difficult to secure our messages from hackers. To resolve this problem, we have discovered a new method of cryptography to encrypt our alpha-numeric messages in the form of numbers. Darbari and Darbari [1] have found special Pythagorean Triangles and Darbari and Darbari [2] have given a method of cryptography based on special Pythagorean Triangles whose sum of Two Legs is Undecic. They had found 71 such Triangles and we have extended the number to 245. And we proposed another method for encryption of messages based on these numbers.

## 2 PROPOSED METHODOLOGY

### 2.1 Method of Analysis

**Pythagorean Triangles** have been known since the ancient times. It consists of three positive integers X, Y, Z such that  $X^2 + Y^2 = Z^2$  (1)

The triangle is said to be primitive if  $\gcd(X, Y, Z) = 1$ .

The primitive solutions of the above Pythagorean equation are given by the Euclid's formula [3] -

$$X = p^2 - q^2, Y = 2pq, Z = p^2 + q^2 \quad (2)$$

where  $p, q \in I$  such that  $p > q > 0$  and  $\gcd(p, q) = 1$  where p and q are of opposite parity. Sum of two legs is a power of eleven, that is, undecic: If X and Y are two legs of a right-angled triangle and Z is the hypotenuse, then

$$X + Y = \alpha^{11} \quad (3)$$

$$\text{i.e., } p^2 - q^2 + 2pq = \alpha^{11} \quad (4)$$

### 2.2 Algorithm

Solving equation (4) using the software Mathematica, by the the command

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Reduce  $[p^2 - q^2 + 2pq - \alpha^{11} = 0, \{p, q, \alpha\}]$  the eleven solutions are given by

$$\begin{aligned} \alpha &= (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= -(-1)^{1/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= (-1)^{2/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= -(-1)^{3/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= (-1)^{4/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= -(-1)^{5/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= (-1)^{6/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= -(-1)^{7/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= (-1)^{8/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= -(-1)^{9/11} (p^2 - q^2 + 2pq)^{1/11} \\ \alpha &= (-1)^{10/11} (p^2 - q^2 + 2pq)^{1/11} \end{aligned} \quad (5)$$

Seeking the integral solutions of (5), using Mathematica, by the following command:

$$\begin{aligned} &[p^2 - q^2 + 2pq - \alpha^{11} = 0 \&\&p < q \&\&0 < p < 10^{18} \\ &\&\&0 < q < 10^{18} \&\&0 < \alpha < 10^{11} \&\&GCD[p, q] = 1, \\ &\{p, q, \alpha\}, \text{Integers}, 10000] \end{aligned}$$

## 3 APPLICATION IN CRYPTOGRAPHY

Cryptography is a branch of applied mathematics which deals with coding and decoding of personal messages. These messages are unintelligible to everyone except the authorized users. For this we have derived a method.

### 3.1 Method

In our cryptographic method we have divided the codes in the form of alphabetical blocks as A to Z, then one gap is taken for space between the two words, then taken in the reverse order as Z to A, then again, a gap and the same process continues for seven times. So, we got seven blocks of alphabets. After which we allocated the digits from 0 to 9, and then left a gap. Then we allocated some special characters and left a gap at last.

To allocate the elements, we chose last three digits of p from

the table and put it in a column named as code. We observed that some of the values are repeated which are highlighted and are 399, 154, 797, 166, 068, 220, 270, 913, 915, 728, 279, 387, 459, 269, 189, 594, 987, 566, 647, 881, 846, 471, 330, 039, 208, 540. We used these numbers only once when they first occurred and left them henceforth.

**Step 1: Coding for alphabets-**

Every first-time occurring alphabet, its code is taken from the first block. Every second time occurring alphabet, code is taken from the second block. Similarly, third time occurring is taken from third block and so on up to the seventh block. If any of the alphabet is repeated for the eighth time then its code is taken from the first block, ninth time occurring, code is taken from the second block and the process continues.

**Step 2: Coding for space between the two words-**

For the spacing between the two words there are total nine coding. So, the first nine spacing, the code differs as shown in the table. If the tenth spacing occurs then its coding is same as the first gap's coding. If the spacing occurs for the eleventh time, then its code will be same as the second gap's coding and so on.

**Step 3: Coding for numerals and special characters-**

And the coding for numerals and special characters are fixed.

**Table-1 Codes**

S.No	p	q	α	Φ(α)	code	element
1.	36122	10977	7	6	122	A
2.	5847127	7102	17	16	127	B
3.	25267076	7265951	23	22	076	C
4.	115030594	82540623	31	30	594	D
5.	549402765	318409768	41	40	765	E
6.	1197770154	567573781	47	46	154	F
7.	1425293413	1034011446	49	42	413	G
8.	11909181220	4661084743	71	70	220	H
9.	17078425399	658360154	73	72	399	I
10.	26971463650	383385639	79	78	650	J
11.	37381583095	32955248764	89	88	095	K
12.	72796132771	14097411644	97	96	771	L
13.	83381410906	75470616881	103	102	906	M
14.	142813090797	93492240238	113	112	797	N

15.	211287880148	64596368831	119	96	148	O
16.	211645039728	63927374635	119	96	728	P
17.	349313598982	24636557097	127	126	982	Q
18.	508018933237	64096768282	137	136	237	R
19.	846326669600	137825933643	151	150	600	S
20.	992455663399	699334063528	161	132	399	LEF T
21.	1248231429998	701832818903	167	166	998	T
22.	1357860339189	14896011230	161	132	189	U
23.	2633020812647	2472463785016	193	192	647	V
24.	2955446295876	690970326995	191	190	876	W
25.	4106585130110	318875919109	199	198	110	X
26.	5061183535139	4066047018592	217	180	139	Y
27.	5774468358473	1718841553668	217	180	473	Z
28.	5896783404748	4583474883339	223	222	748	I gap
29.	7969657439067	3828187912336	233	232	067	Z
30.	9457594503362	3664931303255	239	238	362	Y
31.	11256711620671	1554263686392	241	240	671	X
32.	14678424856392	10869238132213	263	262	392	W
33.	15080053797729	3600940004896	257	256	729	V
34.	17233562360626	13358880510285	271	270	626	U
35.	23340710700666	22158661563559	287	240	666	T
36.	27715170621699	1758655436960	281	280	699	S
37.	28411930956804	5470803488291	287	240	804	R
38.	34188944592533	83153468716	289	272	533	Q
39.	36486477291096	31004606634557	311	310	096	P
40.	41569375875373	16445165114912	313	312	373	O
41.	49496110896825	46110337885814	329	276	825	N
42.	62834792307128	49972890081859	343	294	128	M
43.	63331442069667	7353977136824	329	276	667	L

44.	66847435 016921	16149839 177458	337	336	921	K
45.	80041396 333160	73133589 792581	359	358	160	J
46.	95395395 736893	82444213 65092	353	352	893	I
47.	11226451 4978846	17718642 669939	367	366	846	H
48.	11443916 2037064	10102727 0008649	383	382	064	G
49.	14779140 5074654	42767590 614533	391	352	654	F
50.	<b>14804709</b> <b>3054154</b>	<b>42305491</b> <b>499025</b>	<b>391</b>	<b>352</b>	<b>154</b>	<b>LEF</b> <b>T</b>
51.	15126123 1332279	99793571 473438	401	400	279	E
52.	<b>17653358</b> <b>1734797</b>	<b>82971167</b> <b>181200</b>	<b>409</b>	<b>408</b>	<b>797</b>	<b>LEF</b> <b>T</b>
53.	24392161 7875078	19611924 3958901	439	438	078	D
54.	26682453 3787439	61701554 227944	433	432	439	C
55.	26725590 5686074	49272041 839013	431	430	074	B
56.	30461911 2260881	24136291 0974654	457	456	881	A
57.	31107481 6938915	10128568 1589164	449	448	915	II gap
58.	32373674 5415068	32039868 2001699	463	462	068	A
59.	48134817 1252751	40142423 9786408	497	420	751	B
60.	533121113 858202	31645542 2593483	503	502	202	C
61.	53937295 1902166	74180232 373759	487	486	166	D
62.	54017775 8592270	11962319 408059	479	478	270	E
63.	62413370 1673136	22570479 9908527	511	432	136	F
64.	64047288 1308809	37640620 834706	497	420	809	G
65.	65724263 3817796	16368859 0122035	511	432	796	H
66.	67318469 5507984	48461485 9627801	527	480	984	I
67.	<b>67364618</b> <b>3056068</b>	<b>48180855</b> <b>8061533</b>	<b>527</b>	<b>480</b>	<b>068</b>	<b>LEF</b> <b>T</b>
68.	69121917 3524177	47276676 0127354	529	506	177	J
69.	69178425 1495945	25659520 2535372	521	520	945	K
70.	97847163 4124603	31833126 0856614	553	468	603	L
71.	99775209 7909913	28221710 0434092	553	468	913	M
72.	10806770 34551013	52245495 9650600	569	568	013	N

73.	12021439 32775549	47400875 7438726	577	576	549	O
74.	12704829 40685529	10713795 34846834	593	592	529	P
75.	14544217 77410850	63669557 8928801	599	598	850	Q
76.	15360871 36216831	52411531 2204042	601	600	831	R
77.	16783940 97892539	84130288 6775792	617	616	539	S
78.	17120473 10240018	10998479 55628157	623	528	018	T
79.	18046984 66208630	13579256 27360167	631	630	630	U
80.	18092230 54142792	78007185 8219393	623	528	792	V
81.	18694473 64081322	17593791 2428087	607	606	322	W
82.	20292120 70401811	11754622 19720860	641	640	811	X
83.	<b>22327650</b> <b>52790166</b>	<b>94674204</b> <b>5314013</b>	<b>647</b>	<b>646</b>	<b>166</b>	<b>LEF</b> <b>T</b>
84.	27842891 95570250	16178044 28064211	679	576	250	Y
85.	29899096 23591451	74248452 3485796	673	672	451	Z
86.	32146890 87278491	18702069 02318238	697	640	491	III gap
87.	321797011 1807879	18578804 93099506	697	640	879	Z
88.	34932480 27147010	28985644 6022699	679	576	010	Y
89.	35062228 83150617	28916066 67913046	713	660	617	X
90.	36617261 74832432	31427523 28044359	719	718	432	W
91.	38403442 86249269	23823792 79002420	721	612	269	V
92.	39783639 57705459	12497535 34923454	713	660	459	U
93.	40140178 58274119	18108718 75460320	721	612	119	T
94.	40530154 84875616	23587215 56789333	727	726	616	S
95.	49098689 08098204	17290139 51216239	743	742	204	R
96.	59759403 67494344	63131730 9010255	751	750	344	Q
97.	61849587 86861760	53726029 31982763	791	672	760	P
98.	64543124 62477149	64527690 0584720	761	760	149	O
99.	65067885 39881443	11158817 13370170	769	768	443	N
100.	<b>70075451</b> <b>16240220</b>	<b>33352443</b> <b>60996219</b>	<b>799</b>	<b>736</b>	<b>220</b>	<b>LEF</b> <b>T</b>
101.	70164964 25522312	33101694 15743479	799	736	312	M

102	72677487 40034046	18094674 04198367	791	672	046	L
103	77554786 32298757	29443534 09572890	809	808	757	K
104	83412151 47363943	60708057 76613752	833	672	943	J
105	83467729 16423211	60358738 10396516	833	672	211	I
106	90251795 49344670	47939619 84038501	839	838	670	H
107	96241179 10674821	81733139 72787704	857	856	821	G
108	98508828 49040276	10900195 33042441	823	822	276	F
109	11912608 88256560 1	59411211 81179162	881	880	601	E
110	11926131 81670869 4	77950041 27776647	887	886	694	D
111	12888341 30968157 3	52652080 65990786	889	756	573	C
112	13013480 27378321 8	11412307 69491487	863	862	218	B
113	<b>13446112</b> <b>14100327</b> <b>0</b>	<b>11737310</b> <b>00833075</b> <b>3</b>	<b>911</b>	<b>910</b>	<b>270</b>	<b>LEF</b> <b>T</b>
114	14127313 76608970 3	29444936 60567580	889	756	703	A
115	16195351 19007450 8	15726385 45877739 7	943	880	508	IV gap
116	16583620 40434447 1	87587824 57612234	937	936	471	A
117	17293518 67677036 9	14250786 77416924 4	953	952	369	B
118	17814876 22508000 7	40333175 66668294	929	928	007	C
119	18252495 01236340 0	17776001 99778291	919	918	400	D
120	19054250 13181842 8	92990077 44887981	959	816	428	E
121	19552118 78516480 2	40533502 37443853	943	880	802	F
122	19767177 18906979 4	10272792 69895716 1	967	966	794	G
123	20044992 00122096 5	74746813 26345548	961	930	965	H

124	21272960 32480274 3	98317717 61549438	977	976	743	I
125	22277676 60872020 8	32612203 66260145	959	816	208	J
126	26777815 80846238 7	24571418 63084557 6	103 3	103 2	387	K
127	26844892 31552778 0	20348157 44185859 3	103 1	103 0	780	L
128	27729312 27403413 4	25799054 16446345	991	990	134	M
129	28128396 80175189 8	66383524 8720377	983	982	898	N
130	<b>28464455</b> <b>54488622</b> <b>0</b>	<b>18605397</b> <b>12213770</b> <b>1</b>	<b>103</b> <b>9</b>	<b>103</b> <b>8</b>	<b>220</b>	<b>LEF</b> <b>T</b>
131	<b>28501588</b> <b>71383364</b> <b>7</b>	<b>56738941</b> <b>13473544</b>	<b>100</b> <b>9</b>	<b>100</b> <b>8</b>	<b>647</b>	<b>LEF</b> <b>T</b>
132	32015961 83608277 2	22434539 22625808 1	106 3	106 2	772	O
133	32083927 23289041 1	17294506 77445006 8	105 7	900	411	P
134	34388112 79328043 5	31291795 67162227 2	108 1	101 2	435	Q
135	37551145 55831785 5	39703404 97588106	104 9	104 8	855	R
136	38389897 43544413 8	17313873 44652497 3	108 7	108 6	138	S
137	<b>39015193</b> <b>43579688</b> <b>1</b>	<b>43115794</b> <b>77146754</b>	<b>105</b> <b>7</b>	<b>900</b>	<b>881</b>	<b>LEF</b> <b>T</b>
138	43526073 48864553 4	35543436 08670811 7	1127	924	534	T
139	<b>43546064</b> <b>72647188</b> <b>1</b>	<b>56379906</b> <b>11907902</b>	<b>108</b> <b>1</b>	<b>101</b> <b>2</b>	<b>881</b>	<b>LEF</b> <b>T</b>
140	43585860 33441859 3	42709077 33890355 6	1129	1128	593	U
141	44043062 25801917 8	13388606 25647878 9	1103	1102	178	V
142	47242237 75149439 1	60721373 83618388	109 7	109 6	391	W
143	49071291 75017568	43748369 74762662	1153	1152	681	X

	1	6				
144	49212144 68745676 8	15770333 69147113 3	1127	924	768	Y
145	51030710 22085658 4	28421414 53701261 5	1151	1150	584	Z
146	52792634 56748598 7	51123789 93727330 0	1169	996	987	V gap
147	64788269 67546561 7	11649768 11732612 0	1169	996	617	Z
148	<b>65857128</b> <b>93453226</b> <b>9</b>	<b>64972049</b> <b>74126925</b> <b>2</b>	<b>121</b> <b>7</b>	<b>121</b> <b>6</b>	<b>269</b>	<b>LEF</b> <b>T</b>
149	<b>67374346</b> <b>09130818</b> <b>9</b>	<b>27623525</b> <b>76815811</b> <b>0</b>	<b>120</b> <b>1</b>	<b>120</b> <b>0</b>	<b>189</b>	<b>LEF</b> <b>T</b>
150	69667598 08319972 6	27404739 50279737 3	120 7	1120	726	Y
151	69770550 04555903 4	27169375 44505892 1	120 7	1120	034	X
152	<b>70731975</b> <b>92138959</b> <b>4</b>	<b>57710053</b> <b>93434597</b> <b>3</b>	<b>123</b> <b>1</b>	<b>123</b> <b>0</b>	<b>594</b>	<b>LEF</b> <b>T</b>
153	74213458 88769928 8	31090540 84518115 7	122 3	122 2	288	W
154	79667010 23953152 5	45693939 41133777 4	124 9	124 8	525	V
155	81687138 02705537 9	18210503 56325294	1193	1192	379	U
156	89027011 23174539 8	59541358 91670812 1	127 9	127 8	398	T
157	89479867 02319787 4	44421341 55692003 3	127 1	120 0	874	S
158	93734863 35453605 9	83706640 91251615 6	129 7	129 6	059	R
159	96773938 97106115 5	47701921 46989813 6	128 9	128 8	155	Q
160	99864397 94179238 1	39801577 56988672	124 1	1152	381	P
161	10009762 85485323 61	37282244 54993860	124 1	1152	361	O
162	10205202 70841957 56	52580724 65286727 1	130 3	130 2	756	N

163	10608189 30661712 21	72458806 13684660 2	132 1	132 0	221	M
164	10952926 78660489 76	70484333 31332530 3	132 7	132 6	976	L
165	110170115 28007133 0	87211817 52580403	127 1	120 0	330	K
166	<b>11434141</b> <b>23790569</b> <b>87</b>	<b>72570726</b> <b>70039247</b> <b>2</b>	<b>133</b> <b>7</b>	<b>1140</b>	<b>987</b>	<b>LEF</b> <b>T</b>
167	11646568 98588502 00	38327301 69779950 9	131 9	131 8	200	J
168	12190802 29961339 19	11521416 26818340 38	136 1	136 0	919	I
169	12225021 27625555 66	72006949 28609579 7	135 1	1152	566	H
170	12577508 17471665 40	60407667 38192183 3	135 1	1152	540	G
171	<b>13828068</b> <b>69359525</b> <b>66</b>	<b>54058292</b> <b>72778389</b> <b>3</b>	<b>136</b> <b>7</b>	<b>136</b> <b>6</b>	<b>566</b>	<b>LEF</b> <b>T</b>
172	14532801 30425501 68	99920334 75320667 5	139 9	139 8	168	F
173	14909031 01236355 37	74827038 38117462	133 7	1140	537	E
174	<b>15183836</b> <b>90338929</b> <b>13</b>	<b>63597022</b> <b>85139175</b> <b>4</b>	<b>139</b> <b>3</b>	<b>1188</b>	<b>913</b>	<b>LEF</b> <b>T</b>
175	<b>15308525</b> <b>88411619</b> <b>15</b>	<b>94629489</b> <b>05229643</b> <b>6</b>	<b>140</b> <b>9</b>	<b>140</b> <b>8</b>	<b>915</b>	<b>LEF</b> <b>T</b>
176	<b>15770829</b> <b>61422417</b> <b>28</b>	<b>24387014</b> <b>65667809</b>	<b>134</b> <b>3</b>	<b>124</b> <b>8</b>	<b>728</b>	<b>LEF</b> <b>T</b>
177	15808595 32023099 72	20501531 86366853	134 3	124 8	972	D
178	15909568 83518205 52	11243387 34067261 61	142 3	142 2	552	C
179	16552350 94123033 40	16233402 55540068 59	143 9	143 8	340	B
180	16787463 90058845 23	33559549 02316217 2	139 3	1188	523	A
181	16978897 59159071 03	96770277 26013400 4	143 3	143 2	103	VI gap
182	18359283 64275518	87771577 76589944	144 7	144 6	856	A

	56	3				
183	18462810 57722970 39	11140738 06909610 96	145 7	138 0	039	B
184	<b>21388349</b> <b>86723052</b> <b>79</b>	<b>86166127</b> <b>57916657</b> <b>8</b>	<b>148</b> <b>1</b>	<b>148</b> <b>0</b>	<b>279</b>	<b>LEF</b> <b>T</b>
185	21880891 19942399 93	19342710 51962855 74	151 3	140 8	993	C
186	21887178 36470775 17	19242804 08365603 38	151 3	140 8	517	D
187	22150901 71423977 41	33576345 55471002 8	145 7	138 0	741	E
188	22477825 22500933 10	47947344 07749353 7	147 1	147 0	310	F
189	24930029 68636481 80	91317138 74035942 1	151 9	126 0	180	G
190	<b>25461559</b> <b>86063613</b> <b>87</b>	<b>31259776</b> <b>05881073</b> <b>0</b>	<b>148</b> <b>9</b>	<b>148</b> <b>8</b>	<b>387</b>	<b>LEF</b> <b>T</b>
191	25930965 96400145 20	57452238 69382338 7	1511 0	151 0	520	H
192	25942363 08733564 82	13072890 86196659 61	154 3	154 2	482	I
193	26197787 71872962 34	19768961 69389972 7	148 7	148 6	234	J
194	<b>26331641</b> <b>39407194</b> <b>59</b>	<b>19571394</b> <b>91227243</b> <b>58</b>	<b>156</b> <b>1</b>	<b>133</b> <b>2</b>	<b>459</b>	<b>LEF</b> <b>T</b>
195	27473699 73413751 56	16947655 63109831 23	156 7	156 6	156	K
196	28025695 57927822 22	25439730 73016308 73	158 3	158 2	222	L
197	28029451 89807626 13	10594396 64130688 84	155 3	155 2	613	M
198	29214878 92197326 45	10083528 83020525 62	156 1	133 2	645	N
199	31248256 79358631 86	20896947 97623751 79	160 7	160 6	186	O
200	31389361 15133390 62	12983445 69362625	151 9	126 0	062	P
201	32311738 65170446 63	17583773 64300307 40	160 9	160 8	663	Q

202	32990198 47276904 46	30980877 09054639 95	163 1	139 2	446	R
203	33477740 03329983 13	27203793 63374328 74	163 3	154 0	313	S
204	35208223 51603048 52	11934147 80243000 9	155 9	155 8	852	T
205	37154264 53827418 05	56975061 58791494 8	160 1	160 0	805	U
206	37933074 34600093 52	24241860 09205335 13	166 3	166 2	352	V
207	38185717 95662722 99	31666056 52312420 54	167 3	142 8	299	W
208	<b>39095492</b> <b>82989241</b> <b>89</b>	<b>17383814</b> <b>90098854</b> <b>82</b>	<b>165</b> <b>7</b>	<b>165</b> <b>6</b>	<b>189</b>	<b>LEF</b> <b>T</b>
209	40322817 85474590 49	25381638 24948734 10	168 1	164 0	049	X
210	42082380 67175428 20	50798874 06076253 3	163 1	139 2	820	Y
211	<b>42367608</b> <b>96474028</b> <b>46</b>	<b>21383034</b> <b>13110073</b> <b>59</b>	<b>168</b> <b>7</b>	<b>144</b> <b>0</b>	<b>846</b>	<b>LEF</b> <b>T</b>
212	42574835 32383946 05	83146594 02367780 6	164 9	153 6	605	Z
213	42658210 98732825 13	81912358 11880714 6	164 9	153 6	513	VII gap
214	43630548 51361797 78	15029306 33914120 61	167 9	158 4	778	0
215	44010602 80233075 67	31240455 24918124 8	163 3	154 0	567	1
216	44256452 72812770 79	20676345 20344709 02	169 7	169 6	079	2
217	46000793 19905262 78	10745616 60597997 45	167 9	158 4	278	3
218	<b>46571233</b> <b>83492164</b> <b>71</b>	<b>26199213</b> <b>96964086</b> <b>52</b>	<b>172</b> <b>1</b>	<b>172</b> <b>0</b>	<b>471</b>	<b>LEF</b> <b>T</b>
219	48807769 13276559 24	44295044 10939830 23	175 1	163 2	924	4
220	48819005 62459870 24	44069410 68912964 75	175 1	163 2	024	5
221	49660145 42881053	38334009 94148177	175 3	175 2	319	6

	19	94				
222	50184001 04360565 26	67421810 58025374 3	168 7	144 0	526	7
223	50902930 74614213 77	28568633 67277243 6	167 3	142 8	377	8
224	58123017 15688311 29	23808274 10109716 32	177 7	177 6	129	9
225	58424922 17153103 30	37466194 22620113 29	179 9	153 6	330	LEF T
226	59117731 32917367 28	24476770 83563401 79	178 3	178 2	728	LEF T
227	62911340 63247214 52	39987077 73420532 61	182 3	182 2	452	VIII gap
228	63614149 79393641 66	45210374 73954577 25	183 1	183 0	166	LEF T
229	64952568 96398939 25	50668443 58647706 78	184 1	157 2	925	.
230	67662031 94904798 92	30994535 75204795 5	175 9	175 8	892	,
231	68427568 31428650 89	21123168 98912580 92	181 7	171 6	089	:
232	69807842 87645528 39	18628629 92012595 86	181 7	171 6	839	;
233	70543904 05248061 51	69668684 54323162 56	187 3	187 2	151	"
234	70797303 28863917 16	57061524 59265293 87	187 1	187 0	716	'
235	71598536 35219390 39	10064193 18924498 68	180 1	180 0	039	LEF T
236	73315257 49825196 91	23149355 01631830 02	184 1	157 2	691	?
237	74334316 84601442 08	24159510 24439114 13	184 7	184 6	208	LEF T
238	74507272 27027015 40	46325922 65439563 29	187 9	187 8	540	LEF T
239	76534049 45615301 70	35460595 68081792 1	179 9	153 6	170	_
240	76915117 09519308 17	57329918 33559583 72	189 7	162 0	817	!

241	83571026 10427604 95	54900322 45372770 72	192 1	179 2	495	(
242	83641081 44041005 31	54564674 36152559 32	192 1	179 2	531	)
243	83877927 03731686 18	62290814 74087828 83	192 7	184 0	618	/
244	85421593 62943171 31	29337666 77599231 68	189 7	162 0	131	=
245	91369803 05602580 25	15418445 05214779 94	188 9	188 8	025	IX gap

### 3.2 Example

Let us encrypt a message:

A 'QWERTY KEYPAD' CONSISTS OF ALL 26 ALPHABETS, DIGITS (0 TO 9), SOME SPECIAL CHARACTERS, AND FUNCTIONAL KEYS.

ELEMENT	OCCURRENCE	CODE
A	I	122
SPACE1	GAP I	748
'	SPECIAL CHARACTER	716
Q	I	982
W	I	876
E	I	765
R	I	237
T	I	998
Y	I	139
SPACE 2	GAP II	915
K	I	095
E	II	279
Y	II	365
P	I	728
A	II	881
D	I	594
'	SPECIAL CHARACTER	716
SPACE 3	GAP III	491
C	I	076
O	I	148
N	I	797
S	I	600
I	I	399
S	II	699
T	II	666
S	III	539
SPACE 4	GAP IV	508
A	III	068
L	I	771
L	II	667
SPACE 5	GAP V	987
2	NUMERAL	079
6	NUMERAL	319
SPACE 6	GAP VI	103

A	IV	703
L	III	603
P	II	096
H	I	220
A	V	471
B	I	127
E	III	270
T	III	018
S	IV	616
,	SPECIAL CHARACTER	892
SPACE 7	GAP VII	513
D	II	078
I	II	893
G	I	413
I	III	984
T	IV	119
S	V	138
SPACE 8	GAP VIII	452
(	SPECIAL CHARACTER	495
0	NUMERAL	778
SPACE 9	GAP IX	025
T	V	534
O	II	373
SPACE 10	GAP X (SIMILAR TO GAP I)	748
9	NUMERAL	129
)	SPECIAL CHARACTER	531
,	SPECIAL CHARACTER	892
SPACE 11	GAP XI (SIMILAR TO GAP II)	915
S	VI	874
O	III	549
M	I	906
E	IV	601
SPACE 12	GAP XII (SIMILAR TO GAP III)	491
S	VII	313
P	III	529
E	V	428
C	II	439
I	IV	211
A	VI	523
L	IV	046
SPACE 13	GAP XIII (SIMILAR TO GAP IV)	508
C	III	202
H	II	846
A	VII	856
R	II	804
A	VIII (SIMILAR TO I)	122
C	IV	573
T	VI	398
E	VI	537

R	III	831
S	VIII (SIMILAR TO I)	600
,	SPECIAL CHARACTER	892
SPACE 14	GAP XIV (SIMILAR TO GAP V)	987
A	IX (SIMILAR TO II)	881
N	II	825
D	III	166
SPACE 15	GAP XV (SIMILAR TO GAP VI)	103
F	I	154
U	I	647
N	III	013
C	V	007
T	VII	852
I	V	743
O	IV	149
N	IV	443
A	X (SIMILAR TO III)	068
L	V	780
SPACE 16	GAP XVI (SIMILAR TO GAP VII)	513
K	II	921
E	VII	741
Y	III	250
S	IX (SIMILAR TO II)	699
.	SPECIAL CHARACTER	925

The encrypted message is a long string of numbers-  
1227487169828767652379981399150952793657288815947  
1649107614879760039969966653950806877166798707931  
91037036030962204711272700186168925130788934139841  
1913845249577802553437374812953189291587454990660  
14913135294284392115230465082028468568041225733985  
3783160089298788182516610315464701300785274314944  
3068780513921741250699925

#### 4 RESULT AND OBSERVATIONS

From the above table we observed that the following relations are true.

$$1) 2p^2 + pq \equiv 0 \pmod{2}$$

$$2) 4p^2 + 2pq \equiv 0 \pmod{4}$$

$$3) 6p^2 + 6pq + 2q^2 \equiv 0 \pmod{2} \text{ or } 2 \pmod{4}$$

$$4) 6p^2 + 2pq \equiv 0 \pmod{2}$$

$$5) 4p^2 + 2pq \equiv 0 \pmod{4}$$



- 6)  $p + q + \alpha \equiv 0 \pmod{2}$
- 7)  $3p + 5q + \alpha \equiv 0 \pmod{2}$
- 8)  $8p^2 + 8pq + 2q^2 \equiv 0 \pmod{4} \text{ or } 2 \pmod{4}$
- 9)  $p^3 + q^3 + 2\alpha \equiv 1 \pmod{4} \text{ or } 3 \pmod{4}$
- 10)  $p^2 + q^2 + 2\phi(\alpha) \equiv 1 \pmod{4}$
- 11)  $p^3 + q^3 + 2\phi(\alpha) \equiv 1 \pmod{4} \text{ or } 3 \pmod{4}$
- 12)  $p + q + \phi(\alpha) \equiv 1 \pmod{2}$
- 13)  $5p + 3q + \phi(\alpha) \equiv 1 \pmod{2}$
- 14)  $p^2 + q^2 - \phi(\alpha) \equiv 1 \pmod{2}$
- 15)  $p^2 + q^2 \pm 2pq\phi(\alpha) \equiv 1 \pmod{4}$
- 16)  $p^2 + q^2 + [\phi(\alpha)]^2 \equiv 1 \pmod{4}$

#### 4 CONCLUSION

We have extended the paper of Darbari and Darbari [1] and proposed a new method of cryptography.

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