AUSTRALASIAN JOURNAL OF COMBINATORICS
Volume **51** (2011), Pages 175–199

All regular graphs of small odd order are vertex-magic

J. S. Kimberley J. A. MacDougall

School of Mathematical and Physical Sciences
The University of Newcastle
NSW 2308
Australia
jason.kimberley@newcastle.edu.au jim.macdougall@newcastle.edu.au

Abstract

This paper deals with vertex-magic total labellings of graphs. Earlier work by many authors has shown many infinite families of graphs to admit such labelings. The fact that many of these graphs are regular led MacDougall to conjecture that all non-trivial regular graphs are vertex-magic. Previously Gray and MacDougall showed that all odd-order r-regular graphs ($r \geq 2$) of order up to $v = 19$ are vertex-magic. In this paper, we report on computations that extend this range, to show that all odd-order r-regular graphs ($r \geq 2$) of order up to $v = 29$ are vertex-magic.

1 Introduction

A *vertex-magic total labeling* (VMTL) on a graph $G(V, E)$ with v vertices and e edges is a one-to-one mapping λ from the vertices and edges onto the integers $1, 2, \ldots, v+e$ so that the sum of the label on a vertex and the labels of its incident edges is constant, independent of the choice of vertex. This sum is called the *magic constant* and varies depending on which labels are assigned to the vertices and which to the edges. The second author has conjectured [4]

Conjecture 1 *With the exception of K_2 and $2K_3$, all regular graphs have at least one VMTL.*

Based on McQuillan's work [6], Gray (in [2]) provided a major step toward the solution of this conjecture. He developed a procedure for beginning with a graph possessing a VMTL and adjoining an arbitrary 2-factor to produce a graph of the same order but larger size which also possesses a VMTL. Using that procedure, Gray and MacDougall showed [3] that for $r \geq 4$ every r-regular graph of odd order $v \leq 17$ possesses a VMTL. In this paper we report the results of computations that extend this result to orders $v \leq 29$.

2 Strong VMTLs

Gray's method applies to those labelings which are *strong*, i.e. have the v largest labels assigned to the vertices (and thus the smallest possible magic constant). In [3] it is shown that the range of feasible values for the magic constant k of an r-regular graph is determined by

$$vr^2 + 2(v+1)(r+1) \;\leq\; 4k \;\leq\; vr^2 + 2(v+1)(r+1) + 2vr$$

and for the labeling to be *strong* we must have $k = \frac{1}{4}(vr^2 + 2(v+1)(r+1))$. This will only be possible if v is odd and r is even, or if v is a multiple of 4 and r is odd. Thus, for example, even cycles do not have strong VMTLs but odd cycles do (the standard caterpillar labeling is an example).

Theorem 1 ([2, Theorem 2.1]) *If G is a graph with a spanning subgraph H which possesses a strong VMTL and $G - E(H)$ is even-regular, then G also possesses a strong VMTL.*

The power of this theorem is illustrated by the case where the starting graph H is an odd cycle. Every odd cycle admits a strong VMTL and adjoining 2-factors repeatedly gives us the following result.

Corollary 1 ([2]) *Every Hamiltonian regular graph of odd order possesses a strong VMTL.*

3 Strong VMTLs of 2-regular Graphs

While it is true that asymptotically almost all regular graphs possess a spanning cycle (so that the corollary above applies), we must consider those that do not. Part of the investigation in [3] depended on the classical result of Petersen that every even-regular graph has a 2-regular spanning subgraph, in other words, is spanned by a disjoint union of cycles. Thus to prove that all even-regular graphs of odd order v are strongly vertex-magic, it is enough to show that all 2-regular graphs of order v have strong VMTLs. Table 1 below shows the number γ of 2-regular graphs for the relevant values of v; these numbers appear as the odd terms in sequence A008483 in Sloane's *On-Line Encyclopedia of Integer Sequences* [9].

Table 1: The number of 2-regular graphs of order v and the strong magic constant k

v	3	5	7	9	11	13	15	17	19	21	23	25	27	29	31	33
k	9	14	19	24	29	34	39	44	49	54	59	64	69	74	79	84
γ	1	1	2	4	6	10	17	25	39	60	88	130	191	273	391	556

Some examples of strong VMTLs for 2-regular graphs are shown in Figures 1 and 2: those in the first figure are disjoint unions of distinct cycles, while the graph in

the second figure has a repeated cycle. Not every odd-order 2-regular graph has a *strong* VMTL. It was noted in [3] that $C_3 \cup C_4$ with order 7, $2C_3 \cup C_5$ with order 11 and $3C_3 \cup C_4$ with order 13 had no strong VMTL. This led the authors of [3] to wonder whether these were the initial examples in two infinite families of such graphs. Constructions by McQuillan [7] and our own computations now suggest that in fact these are the only counterexamples.

Figure 1: Two Examples of Strong VMTLs

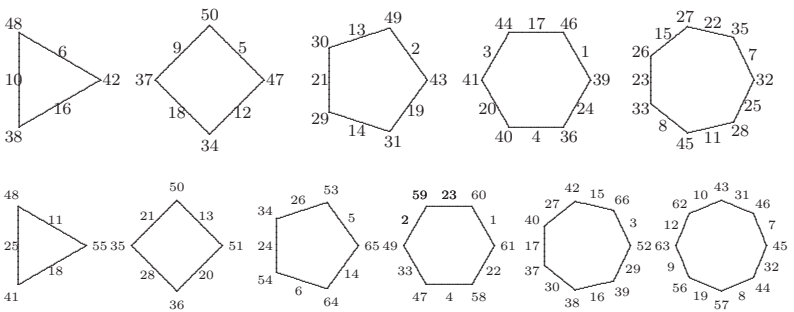
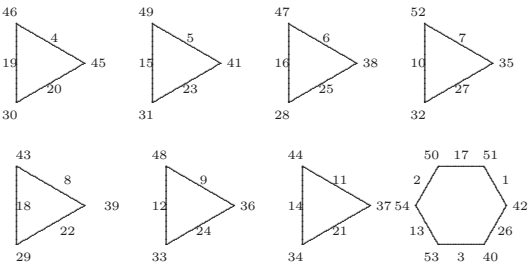


Figure 2: Strong VMTL of $7C_3 \cup C_6$



The tables presented in this paper contain examples of a strong VMTL for *all* the other 2-regular graphs of orders up to 29. These were discovered by extensive computer searches. In all the tables the graphs are listed in reverse lexicographic order on the set of cycle lengths. The examples in these tables thus constitute a proof of the following result:

Theorem 2 *Other than the three graphs, $C_3 \cup C_4$, $2C_3 \cup C_5$ and $3C_3 \cup C_4$, every odd-order 2-regular graph of odd order less than 30 has a strong vertex magic total labelling.*

Proof. Tables 2, 3 and 9 to 22 list the edge label cycles of a strong VMTL for each graph other than the three exceptions. □

Table 2: Strong VMTLs of the 2-regular graphs of odd order ≤ 13

v	k	Graph	Edge Labels
3	9	C_3	$(1,3,2)$
5	14	C_5	$(1,4,2,5,3)$
7	19	C_7	$(1,5,2,6,3,7,4)$
		$C_3 \cup C_4$	no strong VMTL
9	24	C_9	$(1,6,2,4,7,3,9,5,8)$
		$C_3 \cup C_6$	$(1,7,2,8,6,5)(3,9,4)$
		$C_4 \cup C_5$	$(1,7,2,5)(3,8,6,4,9)$
		$3C_3$	$(1,9,5)(2,7,6)(3,8,4)$
11	29	C_{11}	$(1,7,2,5,10,6,11,3,8,4,9)$
		$C_3 \cup C_8$	$(1,9,8)(2,6,7,4,3,11,5,10)$
		$C_4 \cup C_7$	$(1,10,6,7)(2,5,4,11,3,9,8)$
		$C_5 \cup C_6$	$(1,10,7,6,2,8)(3,9,5,11,4)$
		$2C_3 \cup C_5$	no strong VMTL
		$C_3 \cup 2C_4$	$(1,10,3,11)(2,6,4,5)(7,9,8)$
13	34	C_{13}	$(1,8,12,5,13,2,11,3,9,10,6,4,7)$
		$C_3 \cup C_{10}$	$(1,8,2,12,6,13,4,7,9,11)(3,10,5)$
		$C_4 \cup C_9$	$(1,9,8,12)(2,6,13,3,11,7,4,5,10)$
		$C_5 \cup C_8$	$(1,10,8,12,5,9,4,11)(2,7,3,13,6)$
		$C_6 \cup C_7$	$(1,9,8,11,3,10)(2,6,12,4,5,7,13)$
		$2C_3 \cup C_7$	$(1,9,10)(2,7,13)(3,5,8,4,12,6,11)$
		$C_3 \cup C_4 \cup C_6$	$(1,7,10)(2,8,4,5,9,11)(3,12,6,13)$
		$C_3 \cup 2C_5$	$(1,10,4,9,11)(2,7,8)(3,5,12,6,13)$
		$2C_4 \cup C_5$	$(1,11,3,10)(2,6,9,8)(4,12,7,13,5)$
		$3C_3 \cup C_4$	no strong VMTL

As a result of the Theorem we can apply Gray's construction, adjoining whatever 2-factors we like to any of these initial 2-regular graphs. Thus we can prove our main result:

Corollary 2 *Other than the three graphs $C_3 \cup C_4$, $2C_3 \cup C_5$ and $3C_3 \cup C_4$, every odd-order regular graph of order less than* 30 *possesses a strong VMTL.*

It was shown in [3] that other than these three exceptional graphs $C_3 \cup C_4$, $2C_3 \cup C_5$ and $3C_3 \cup C_4$, all even-regular graphs of orders 7, 11 and 13, are vertex-magic. The proof of this relied, in part, on the fact that every quartic graph is spanned by a 2-regular graph other than these three. If we now note that these three exceptions do admit VMTLs (just not strong ones) we obtain the main result of the paper:

Corollary 3 *Every odd-order regular graph of order less than* 30 *is vertex-magic.*

Table 3: Strong VMTLs of the 17 2-regular graphs of order 15

Graph	Edge Labels
C_{15}	$(1,13,9,4,6,14,7,12,11,5,10,2,15,3,8)$
$C_3 \cup C_{12}$	$(1,9,2,12,5,4,8,11,7,15,6,14)(3,10,13)$
$C_4 \cup C_{11}$	$(1,8,14,6,10,5,7,3,15,4,13)(2,9,12,11)$
$C_5 \cup C_{10}$	$(1,14,8,3,7,11,9,5,4,12)(2,10,13,6,15)$
$C_6 \cup C_9$	$(1,12,11,4,10,2,15,7,9)(3,6,14,5,13,8)$
$2C_3 \cup C_9$	$(1,12,11,4,10,8,13,3,9)(2,7,15)(5,14,6)$
$C_7 \cup C_8$	$(1,10,11,9,14,8,2,13)(3,6,7,5,12,4,15)$
$C_3 \cup C_4 \cup C_8$	$(1,10,13)(2,8,14,6,3,15,4,11)(5,12,9,7)$
$C_3 \cup C_5 \cup C_7$	$(1,10,11,2,13)(3,6,4,12,7,5,15)(8,9,14)$
$2C_4 \cup C_7$	$(1,10,12,9,14,2,13)(3,6,11,7)(4,8,5,15)$
$C_3 \cup 2C_6$	$(1,13,5,11,2,9)(3,6,14,7,10,12)(4,8,15)$
$C_4 \cup C_5 \cup C_6$	$(1,11,9,13)(2,8,15,4,14,7)(3,10,6,5,12)$
$3C_3 \cup C_6$	$(1,11,9)(2,7,14)(3,12,10)(4,13,5,6,8,15)$
$3C_5$	$(1,8,15,7,14)(2,10,3,11,9)(4,6,13,5,12)$
$2C_3 \cup C_4 \cup C_5$	$(1,8,14)(2,12,11,9)(3,10,7,5,13)(4,6,15)$
$C_3 \cup 3C_4$	$(1,10,2,13)(3,7,6,15)(4,5,12)(8,11,9,14)$
$5C_3$	$(1,12,11)(2,8,14)(3,6,15)(4,13,7)(5,9,10)$

4 The Number of Strong VMTLs of 2-regular Graphs

Our goal as reported in the last section was to discover a single strong VMTL for each 2-regular graph of odd order. This was enough to prove the existence of a VMTL for every regular graph of odd order $v < 31$. However our computations have also provided more convincing evidence supporting Conjecture 1. It turns out that, apart from the small order graphs, there are very large numbers of VMTLs for almost all graphs under consideration. Tables 4 and 5 below contain the results of counting the number of strong VMTLs for the 2-regular graphs (these numbers appear as sequence A176210 in Sloane's OEIS). We found the exact numbers for $v \leq 19$, but the practical limit of complete counting turned out to be at $v = 19$, so in Tables 5 and 6 we present lower bounds for $v = 21$ and $v = 23$. The counts we found are strong evidence that every 2-regular graph is strongly vertex-magic, and thus that Conjecture 1 is true for even-order graphs. However we still have no good idea how to prove this.

Table 4: The number of strong VMTLs of 2-regular graphs of orders 3 to 17

A176210	A177741
Graph	#sVMTLs
C_3	1
C_5	1
C_7	9
$C_3 \cup C_4$	**0**
C_9	31
$C_3 \cup C_6$	8
$C_4 \cup C_5$	4
$3C_3$	2
C_{11}	308
$C_3 \cup C_8$	81
$C_4 \cup C_7$	100
$C_5 \cup C_6$	70
$2C_3 \cup C_5$	**0**
$C_3 \cup 2C_4$	7
C_{13}	3809
$C_3 \cup C_{10}$	578
$C_4 \cup C_9$	474
$C_5 \cup C_8$	495
$C_6 \cup C_7$	454
$2C_3 \cup C_7$	103
$C_3 \cup C_4 \cup C_6$	181
$C_3 \cup 2C_5$	103
$2C_4 \cup C_5$	97
$3C_3 \cup C_4$	**0**
C_{15}	63995
$C_3 \cup C_{12}$	11703
$C_4 \cup C_{11}$	11655
$C_5 \cup C_{10}$	9472
$C_6 \cup C_9$	9252
$2C_3 \cup C_9$	1151
$C_7 \cup C_8$	8567
$C_3 \cup C_4 \cup C_8$	2297
$C_3 \cup C_5 \cup C_7$	1758
$2C_4 \cup C_7$	1389
$C_3 \cup 2C_6$	1117
$C_4 \cup C_5 \cup C_6$	2023
$3C_3 \cup C_6$	104
$3C_5$	328
$2C_3 \cup C_4 \cup C_5$	210
$C_3 \cup 3C_4$	128
$5C_3$	11

Graph	#sVMTLs
C_{17}	1152784
$C_3 \cup C_{14}$	201685
$C_4 \cup C_{13}$	193899
$C_5 \cup C_{12}$	159485
$C_6 \cup C_{11}$	144516
$2C_3 \cup C_{11}$	19625
$C_7 \cup C_{10}$	137561
$C_3 \cup C_4 \cup C_{10}$	38453
$C_8 \cup C_9$	133174
$C_3 \cup C_5 \cup C_9$	32242
$2C_4 \cup C_9$	18545
$C_3 \cup C_6 \cup C_8$	29515
$C_4 \cup C_5 \cup C_8$	32697
$3C_3 \cup C_8$	980
$C_3 \cup 2C_7$	15499
$C_4 \cup C_6 \cup C_7$	30576
$2C_5 \cup C_7$	13651
$2C_3 \cup C_4 \cup C_7$	3792
$C_5 \cup 2C_6$	13566
$2C_3 \cup C_5 \cup C_6$	3300
$C_3 \cup 2C_4 \cup C_6$	3429
$C_3 \cup C_4 \cup 2C_5$	3542
$3C_4 \cup C_5$	1373
$4C_3 \cup C_5$	**94**
$3C_3 \cup 2C_4$	174

Table 5: The number of strong VMTLs of 2-regular graphs of orders 19 and 21

Graph	#VMTLs
C_{19}	32319312
$C_3 \cup C_{16}$	5654282
$C_4 \cup C_{15}$	5417837
$C_5 \cup C_{14}$	4339306
$C_6 \cup C_{13}$	3945295
$2C_3 \cup C_{13}$	503413
$C_7 \cup C_{12}$	3638562
$C_3 \cup C_4 \cup C_{12}$	985403
$C_8 \cup C_{11}$	3533924
$C_3 \cup C_5 \cup C_{11}$	809230
$2C_4 \cup C_{11}$	492587
$C_9 \cup C_{10}$	3404994
$C_3 \cup C_6 \cup C_{10}$	744237
$C_4 \cup C_5 \cup C_{10}$	788795
$3C_3 \cup C_{10}$	31369
$C_3 \cup C_7 \cup C_9$	705588
$C_4 \cup C_6 \cup C_9$	740368
$2C_5 \cup C_9$	331059
$2C_3 \cup C_4 \cup C_9$	96615
$C_3 \cup 2C_8$	360721
$C_4 \cup C_7 \cup C_8$	725134
$C_5 \cup C_6 \cup C_8$	630100
$2C_3 \cup C_5 \cup C_8$	83476
$C_3 \cup 2C_4 \cup C_8$	102094
$C_5 \cup 2C_7$	305346
$2C_6 \cup C_7$	298900
$2C_3 \cup C_6 \cup C_7$	77161
$C_3 \cup C_4 \cup C_5 \cup C_7$	166608
$3C_4 \cup C_7$	35318
$4C_3 \cup C_7$	1559
$C_3 \cup C_4 \cup 2C_6$	82740
$C_3 \cup 2C_5 \cup C_6$	74490
$2C_4 \cup C_5 \cup C_6$	88441
$3C_3 \cup C_4 \cup C_6$	6432
$C_4 \cup 3C_5$	25734
$3C_3 \cup 2C_5$	3187
$2C_3 \cup 2C_4 \cup C_5$	11174
$C_3 \cup 4C_4$	2389
$5C_3 \cup C_4$	98

Graph	#sVMTLs
C_{21}	$\geq$ 27377353
$C_3 \cup C_{18}$	$\geq$ 4936121
$C_4 \cup C_{17}$	$\geq$ 4402284
$C_5 \cup C_{16}$	$\geq$ 3560381
$C_6 \cup C_{15}$	$\geq$ 3196063
$2C_3 \cup C_{15}$	$\geq$ 451408
$C_7 \cup C_{14}$	$\geq$ 2921701
$C_3 \cup C_4 \cup C_{14}$	$\geq$ 831559
$C_8 \cup C_{13}$	$\geq$ 2755931
$C_3 \cup C_5 \cup C_{13}$	$\geq$ 671181
$2C_4 \cup C_{13}$	$\geq$ 376272
$C_9 \cup C_{12}$	$\geq$ 2673503
$C_3 \cup C_6 \cup C_{12}$	$\geq$ 621505
$C_4 \cup C_5 \cup C_{12}$	$\geq$ 623774
$3C_3 \cup C_{12}$	$\geq$ 27971
$C_{10} \cup C_{11}$	$\geq$ 2606600
$C_3 \cup C_7 \cup C_{11}$	$\geq$ 578169
$C_4 \cup C_6 \cup C_{11}$	$\geq$ 565461
$2C_5 \cup C_{11}$	$\geq$ 255795
$2C_3 \cup C_4 \cup C_{11}$	$\geq$ 81011
$C_3 \cup C_8 \cup C_{10}$	$\geq$ 549727
$C_4 \cup C_7 \cup C_{10}$	$\geq$ 534062
$C_5 \cup C_6 \cup C_{10}$	$\geq$ 476410
$2C_3 \cup C_5 \cup C_{10}$	$\geq$ 64867
$C_3 \cup 2C_4 \cup C_{10}$	$\geq$ 75250
$C_3 \cup 2C_9$	$\geq$ 279738
$C_4 \cup C_8 \cup C_9$	$\geq$ 519379
$C_5 \cup C_7 \cup C_9$	$\geq$ 453412
$2C_6 \cup C_9$	$\geq$ 223923
$2C_3 \cup C_6 \cup C_9$	$\geq$ 64974
$C_3 \cup C_4 \cup C_5 \cup C_9$	$\geq$ 129006
$3C_4 \cup C_9$	$\geq$ 23778
$4C_3 \cup C_9$	$\geq$ 1523
$C_5 \cup 2C_8$	$\geq$ 223829
$C_6 \cup C_7 \cup C_8$	$\geq$ 425393
$2C_3 \cup C_7 \cup C_8$	$\geq$ 59114
$C_3 \cup C_4 \cup C_6 \cup C_8$	$\geq$ 120008
$C_3 \cup 2C_5 \cup C_8$	$\geq$ 53337
$2C_4 \cup C_5 \cup C_8$	$\geq$ 61719
$3C_3 \cup C_4 \cup C_8$	$\geq$ 5488
$3C_7$	$\geq$ 70429
$C_3 \cup C_4 \cup 2C_7$	$\geq$ 59441
$C_3 \cup C_5 \cup C_6 \cup C_7$	$\geq$ 104239
$2C_4 \cup C_6 \cup C_7$	$\geq$ 57074
$C_4 \cup 2C_5 \cup C_7$	$\geq$ 52371
$3C_3 \cup C_5 \cup C_7$	$\geq$ 4458
$2C_3 \cup 2C_4 \cup C_7$	$\geq$ 8365
$C_3 \cup 3C_6$	$\geq$ 17476
$C_4 \cup C_5 \cup 2C_6$	$\geq$ 52295
$3C_3 \cup 2C_6$	$\geq$ 2697
$3C_5 \cup C_6$	$\geq$ 15316
$2C_3 \cup C_4 \cup C_5 \cup C_6$	$\geq$ 14546
$C_3 \cup 3C_4 \cup C_6$	$\geq$ 5218
$5C_3 \cup C_6$	$\geq$ 70
$2C_3 \cup 3C_5$	$\geq$ 2075
$C_3 \cup 2C_4 \cup 2C_5$	$\geq$ 7545
$4C_4 \cup C_5$	$\geq$ 1418
$4C_3 \cup C_4 \cup C_5$	$\geq$ 318
$3C_3 \cup 3C_4$	$\geq$ 268
$7C_3$	$\geq$ 1

Table 6: The number of strong VMTLs of 2-regular graphs of order 23

Graph	#VMTLs
C_{23}	≥ 26357261757
$C_3 \cup C_{20}$	≥ 4448603705
$C_4 \cup C_{19}$	≥ 4246692148
$C_5 \cup C_{18}$	≥ 3305401926
$C_6 \cup C_{17}$	≥ 2974916517
$2C_3 \cup C_{17}$	≥ 379559991
$C_7 \cup C_{16}$	≥ 2704273294
$C_3 \cup C_4 \cup C_{16}$	≥ 742729581
$C_8 \cup C_{15}$	≥ 2526728483
$C_3 \cup C_5 \cup C_{15}$	≥ 580163699
$2C_4 \cup C_{15}$	≥ 359145403
$C_9 \cup C_{14}$	≥ 2407608798
$C_3 \cup C_6 \cup C_{14}$	≥ 530970815
$C_4 \cup C_5 \cup C_{14}$	≥ 565901123
$3C_3 \cup C_{14}$	≥ 21933380
$C_{10} \cup C_{13}$	≥ 2327937652
$C_3 \cup C_7 \cup C_{13}$	≥ 488030011
$C_4 \cup C_6 \cup C_{13}$	≥ 516909029
$2C_5 \cup C_{13}$	≥ 224320262
$2C_3 \cup C_4 \cup C_{13}$	≥ 66525538
$C_{11} \cup C_{12}$	≥ 2297905959
$C_3 \cup C_8 \cup C_{12}$	≥ 464090043
$C_4 \cup C_7 \cup C_{12}$	≥ 479854273
$C_5 \cup C_6 \cup C_{12}$	≥ 414079520
$2C_3 \cup C_5 \cup C_{12}$	≥ 52395655
$C_3 \cup 2C_4 \cup C_{12}$	≥ 66327263
$C_3 \cup C_9 \cup C_{11}$	≥ 449781090
$C_4 \cup C_8 \cup C_{11}$	≥ 459482272
$C_5 \cup C_7 \cup C_{11}$	≥ 386223975
$2C_6 \cup C_{11}$	≥ 192003657
$2C_3 \cup C_6 \cup C_{11}$	≥ 49095941
$C_3 \cup C_4 \cup C_5 \cup C_{11}$	≥ 105760612
$3C_4 \cup C_{11}$	≥ 21929686
$4C_3 \cup C_{11}$	≥ 983805
$C_3 \cup 2C_{10}$	≥ 221878162
$C_4 \cup C_9 \cup C_{10}$	≥ 447724203
$C_5 \cup C_8 \cup C_{10}$	≥ 371268954
$C_6 \cup C_7 \cup C_{10}$	≥ 360490123
$2C_3 \cup C_7 \cup C_{10}$	≥ 45951660
$C_3 \cup C_4 \cup C_6 \cup C_{10}$	≥ 98980991
$C_3 \cup 2C_5 \cup C_{10}$	≥ 42422741
$2C_4 \cup C_5 \cup C_{10}$	≥ 52778689
$3C_3 \cup C_4 \cup C_{10}$	≥ 4131598
$C_5 \cup 2C_9$	≥ 184031336

Graph	#sVMTLs
$C_6 \cup C_8 \cup C_9$	≥ 351538778
$2C_3 \cup C_8 \cup C_9$	≥ 44865023
$2C_7 \cup C_9$	≥ 171643798
$C_3 \cup C_4 \cup C_7 \cup C_9$	≥ 94074872
$C_3 \cup C_5 \cup C_6 \cup C_9$	≥ 80858145
$2C_4 \cup C_6 \cup C_9$	≥ 49741395
$C_4 \cup 2C_5 \cup C_9$	≥ 43259847
$3C_3 \cup C_5 \cup C_9$	≥ 3313463
$2C_3 \cup 2C_4 \cup C_9$	≥ 6444557
$C_7 \cup 2C_8$	≥ 169185964
$C_3 \cup C_4 \cup 2C_8$	≥ 46681533
$C_3 \cup C_5 \cup C_7 \cup C_8$	≥ 77600357
$2C_4 \cup C_7 \cup C_8$	≥ 48191402
$C_3 \cup 2C_6 \cup C_8$	≥ 38849530
$C_4 \cup C_5 \cup C_6 \cup C_8$	≥ 82607864
$3C_3 \cup C_6 \cup C_8$	≥ 3223654
$3C_5 \cup C_8$	≥ 11883659
$2C_3 \cup C_4 \cup C_5 \cup C_8$	≥ 10597864
$C_3 \cup 3C_4 \cup C_8$	≥ 4493631
$5C_3 \cup C_8$	≥ 37176
$C_3 \cup C_6 \cup 2C_7$	≥ 37790794
$C_4 \cup C_5 \cup 2C_7$	≥ 40337251
$3C_3 \cup 2C_7$	≥ 1560680
$C_4 \cup 2C_6 \cup C_7$	≥ 39980575
$2C_5 \cup C_6 \cup C_7$	≥ 34768100
$2C_3 \cup C_4 \cup C_6 \cup C_7$	≥ 10283687
$2C_3 \cup 2C_5 \cup C_7$	≥ 4358242
$C_3 \cup 2C_4 \cup C_5 \cup C_7$	≥ 11103433
$4C_4 \cup C_7$	≥ 1163951
$4C_3 \cup C_4 \cup C_7$	≥ 208467
$C_5 \cup 3C_6$	≥ 11565138
$2C_3 \cup C_5 \cup 2C_6$	≥ 4412305
$C_3 \cup 2C_4 \cup 2C_6$	≥ 5506269
$C_3 \cup C_4 \cup 2C_5 \cup C_6$	≥ 9504325
$3C_4 \cup C_5 \cup C_6$	≥ 3915430
$4C_3 \cup C_5 \cup C_6$	≥ 174271
$3C_3 \cup 2C_4 \cup C_6$	≥ 465251
$C_3 \cup 4C_5$	≥ 670652
$2C_4 \cup 3C_5$	≥ 1699135
$3C_3 \cup C_4 \cup 2C_5$	≥ 391763
$2C_3 \cup 3C_4 \cup C_5$	≥ 509010
$6C_3 \cup C_5$	≥ 1191
$C_3 \cup 5C_4$	≥ 66757
$5C_3 \cup 2C_4$	≥ 5434

There is much stronger evidence for Conjecture 1, however. The data presented in this paper pertains to *strong* labelings, where the magic constant has the smallest feasible value. The very earliest studies of VMTLs of graphs led us to realize that values of the magic constant near the middle of the range of feasible values almost always allowed many more VMTLs than values near the extremes of the range, usually by several orders of magnitude. With a few small exceptions, the magic constant spectrum of a regular graph produces a classical bell-shaped distribution of counts (the symmetry is due to the duality of labelings for regular graphs [5]). We illustrate this with an example. The 3-cube Q_3 is a 3-regular graph of order 8 for which the feasible magic constant k lies in the range $36 \leq k \leq 48$. We counted the number of VMTLs for each value of k and the results are shown in Table 7 below.

Table 7: Distribution of number of VMTLs for Q_3

k	N
36	3048
37	6997
38	30788
39	50765
40	117101
41	132358
42	258575
43	132358
44	117101
45	50765
46	30788
47	6997
48	3048
Σ	940689

Finally we wish to remind the reader how powerful Gray's Theorem is. Using it we have now proved that all regular graphs of odd order less than 30 have strong VMTLs. How many graphs are we talking about? Table 8 tabulates the number of r-regular graphs of odd order n as far as is known at present. For a fixed r the number grows exponentially with n, of course, and the numbers become enormous quickly. The italic entries in the table are new values we have calculated that were not known previously. These were calculated using Markus Meringer's algorithm [8] for fast generation of regular graphs. The numbers in the table are recorded as sequences A008483(n), A033301(n) and A165627(n) in the OEIS.

Table 8: The number of r-regular graphs of order n.

n	$r=2$	$r=4$	$r=6$	$r=8$	$r=10$
3	1				
5	1	1			
7	2	2	1		
9	4	16	4	1	
11	6	266	266	6	1
13	10	10786	367860	10786	10
15	17	805579	1470293676	1470293676	805579
17	25	86223660	*9799685588961*	??	*9799685588961*
19	39	11946592242	??		??
21	60	*2056701139136*			
23	88	??			

The calculations for this paper were done on a cluster of standard Windows PCs in student labs and written using the MAGMA package [1]. The VMTLs were found using branch-and-bound search methods which focussed on the size of the longest cycle in the graph. Several variations of the search procedure were used, depending on the cycle-lengths involved. Finally we remark that searching for a strong VMTL was easier than searching for an arbitrary one because there was only one suitable set of vertex labels, and hence also only one suitable set of edge labels.

Table 9: Strong VMTLs of the 25 2-regular graphs of order 17

Graph	Edge Labels
C_{17}	$(1,13,2,14,10,11,9,17,8,15,3,16,6,4,7,5,12)$
$C_3 \cup C_{14}$	$(1,15,2,9,5,14,12,3,7,6,16,4,8,17)(10,11,13)$
$C_4 \cup C_{13}$	$(1,10,8,5,17,4,11,13,6,14,12,2,15)(3,9,16,7)$
$C_5 \cup C_{12}$	$(1,15,2,12,11,14,7,17,5,13,6,9)(3,10,16,4,8)$
$C_6 \cup C_{11}$	$(1,14,12,10,15,2,11,13,5,7,9)(3,16,4,17,6,8)$
$2C_3 \cup C_{11}$	$(1,14,10)(2,8,6,17,4,16,3,9,7,15,11)(5,13,12)$
$C_7 \cup C_{10}$	$(1,9,8,15,11,14,6,16,5,13)(2,17,7,4,12,3,10)$
$C_3 \cup C_4 \cup C_{10}$	$(1,13,7,17,2,10,3,15,8,9)(4,11,14,12)(5,6,16)$
$C_8 \cup C_9$	$(1,15,11,3,7,13,2,16)(4,8,17,6,5,14,10,12,9)$
$C_3 \cup C_5 \cup C_9$	$(1,15,9,14,12,7,13,2,16)(3,10,11)(4,8,17,5,6)$
$2C_4 \cup C_9$	$(1,16,2,13,6,8,17,5,15)(3,9,4,7)(10,14,12,11)$
$C_3 \cup C_6 \cup C_8$	$(1,9,11,4,8,13)(2,14,12,5,6,16,7,17)(3,10,15)$
$C_4 \cup C_5 \cup C_8$	$(1,13,4,11,9)(2,14,12,6,16,5,7,17)(3,10,15,8)$
$3C_3 \cup C_8$	$(1,13,2,17,6,5,16,9)(3,14,10)(4,8,12)(7,15,11)$
$C_3 \cup 2C_7$	$(1,13,6,17,5,10,16)(2,11,14,7,3,15,9)(4,8,12)$
$C_4 \cup C_6 \cup C_7$	$(1,13,2,8,3,10,16)(4,15,9,12)(5,7,11,14,6,17)$
$2C_5 \cup C_7$	$(1,13,2,10,16)(3,8,11,14,7)(4,12,6,17,5,15,9)$
$2C_3 \cup C_4 \cup C_7$	$(1,16,8,13)(2,10,15,11,9,4,14)(3,12,7)(5,6,17)$
$C_5 \cup 2C_6$	$(1,11,8,7,13,12)(2,14,3,15,9)(4,10,16,5,17,6)$
$2C_3 \cup C_5 \cup C_6$	$(1,12,7,14,11)(2,13,3,15,9,8)(4,10,16)(5,6,17)$
$C_3 \cup 2C_4 \cup C_6$	$(1,11,14,12)(2,16,8,9)(3,13,7)(4,15,6,17,5,10)$
$C_3 \cup C_4 \cup 2C_5$	$(1,15,9,2,11)(3,17,8,7)(4,13,10)(5,14,12,6,16)$
$3C_4 \cup C_5$	$(1,15,2,11)(3,16,8,17)(4,7,14,12,6)(5,9,13,10)$
$4C_3 \cup C_5$	$(1,15,11)(2,13,12)(3,14,7)(4,9,10,8,16)(5,6,17)$
$3C_3 \cup 2C_4$	$(1,17,4,12)(2,13,10)(3,7,15,11)(5,14,6)(8,9,16)$

Table 10: Strong VMTLs of the 39 2-regular graphs of order 19

Graph	Edge Labels
C_{19}	$(1,12,2,17,7,18,3,9,6,5,11,15,13,14,8,10,19,4,16)$
$C_3 \cup C_{16}$	$(1,16,10,19,9,4,17,2,13,11,3,8,14,6,12,15)(5,7,18)$
$C_4 \cup C_{15}$	$(1,11,6,17,3,19,7,18,10,4,15,12,9,2,14)(5,8,16,13)$
$C_5 \cup C_{14}$	$(1,16,7,4,11)(2,12,13,9,17,3,15,6,18,10,19,8,5,14)$
$C_6 \cup C_{13}$	$(1,10,6,18,4,19)(2,15,11,17,12,13,14,7,8,5,9,3,16)$
$2C_3 \cup C_{13}$	$(1,19,4,18,6,15,11,17,12,2,16,9,10)(3,14,13)(5,8,7)$
$C_7 \cup C_{12}$	$(1,13,15,14,4,17,2,9,7,10,16,11)(3,12,8,5,18,6,19)$
$C_3 \cup C_4 \cup C_{12}$	$(1,13,3,19,6,18,5,15,14,12,16,11)(2,9,4,17)(7,10,8)$
$C_8 \cup C_{11}$	$(1,10,19,2,16,11,4,8,18,7,12)(3,13,15,9,5,17,6,14)$
$C_3 \cup C_5 \cup C_{11}$	$(1,10,19,2,16,6,14,3,13,15,12)(4,11,8)(5,9,17,7,18)$
$2C_4 \cup C_{11}$	$(1,10,19,2,16,4,15,11,17,5,12)(3,9,14,13)(6,8,7,18)$
$C_9 \cup C_{10}$	$(1,16,13,2,10,17,3,15,6,18)(4,12,11,14,8,5,9,19,7)$
$C_3 \cup C_6 \cup C_{10}$	$(1,16,11,2,10,8,15,14,6,18)(3,12,13)(4,17,5,9,19,7)$
$C_4 \cup C_5 \cup C_{10}$	$(1,18,6,16)(2,13,5,8,15,14,11,3,17,10)(4,12,9,19,7)$
$3C_3 \cup C_{10}$	$(1,18,2,10,5,9,19,7,6,16)(3,8,15)(4,17,12)(11,14,13)$
$C_3 \cup C_7 \cup C_9$	$(1,19,6,5,11,2,13)(3,15,8,4,18,9,17,12,16)(7,10,14)$
$C_4 \cup C_6 \cup C_9$	$(1,13,15,3,16,10,5,6,19)(2,14,7,17,12,11)(4,8,9,18)$
$2C_5 \cup C_9$	$(1,19,6,15,13)(2,10,5,14,3,8,16,7,11)(4,18,9,17,12)$
$2C_3 \cup C_4 \cup C_9$	$(1,13,10,16,8,7,5,6,19)(2,11,17)(3,15,14)(4,12,9,18)$
$C_3 \cup 2C_8$	$(1,12,16,13,6,15,10,17)(2,18,4,11,3,8,9,14)(5,19,7)$
$C_4 \cup C_7 \cup C_8$	$(1,12,2,18,4,8,17)(3,13,15,14)(5,19,7,16,11,10,9,6)$
$C_5 \cup C_6 \cup C_8$	$(1,17,10,5,19,7,16,12)(2,9,8,4,18)(3,13,6,15,14,11)$
$2C_3 \cup C_5 \cup C_8$	$(1,17,2,18,4,8,3,12)(5,19,7,16,9)(6,11,10)(13,15,14)$
$C_3 \cup 2C_4 \cup C_8$	$(1,12,11,17)(2,18,4,10,6,15,14,13)(3,8,9,16)(5,19,7)$
$C_5 \cup 2C_7$	$(1,15,9,2,13)(3,17,4,8,18,5,14)(6,7,11,16,12,10,19)$
$2C_6 \cup C_7$	$(1,15,4,9,2,13)(3,14,8,18,5,7,17)(6,12,16,11,10,19)$
$2C_3 \cup C_6 \cup C_7$	$(1,15,9,3,17,2,13)(4,14,7)(5,8,18)(6,11,16,12,10,19)$
$C_3 \cup C_4 \cup C_5 \cup C_7$	$(1,15,13)(2,16,11,9)(3,14,10,19,6,7,12)(4,8,18,5,17)$
$3C_4 \cup C_7$	$(1,15,2,13)(3,8,18,5,17,4,9)(6,14,10,19)(7,12,16,11)$
$4C_3 \cup C_7$	$(1,15,13)(2,16,10,17,4,18,11)(3,9,14)(5,19,6)(7,12,8)$
$C_3 \cup C_4 \cup 2C_6$	$(1,17,11,14)(2,10,12,8,6,15)(3,16,13)(4,9,18,5,19,7)$
$C_3 \cup 2C_5 \cup C_6$	$(1,17,4,12,11,14)(2,15,9,18,10)(3,16,13,7,19)(5,8,6)$
$2C_4 \cup C_5 \cup C_6$	$(1,17,8,6,14)(2,15,12,10)(3,16,5,18,11,13)(4,9,19,7)$
$3C_3 \cup C_4 \cup C_6$	$(1,17,8,14)(2,10,19,7,13,15)(3,16,11)(4,12,9)(5,18,6)$
$C_4 \cup 3C_5$	$(1,11,16,6,14)(2,17,9,4,12)(3,15,13,8)(5,18,7,10,19)$
$3C_3 \cup 2C_5$	$(1,11,12,2,14)(3,10,19,6,16)(4,7,17)(5,15,13)(8,9,18)$
$2C_3 \cup 2C_4 \cup C_5$	$(1,11,9,4,14)(2,15,12)(3,13,8,16)(5,6,17)(7,18,10,19)$
$C_3 \cup 4C_4$	$(1,10,3,18)(2,12,8,16)(4,11,6,19)(5,17,9,7)(13,15,14)$
$5C_3 \cup C_4$	$(1,10,15)(2,11,16)(3,17,12)(4,13,9,19)(5,14,7)(6,18,8)$

Table 11: Strong VMTLs of the 60 2-regular graphs of order 21

Graph	Edge Labels
C_{21}	(1, 18, 14, 13, 3, 15, 7, 17, 4, 11, 9, 5, 8, 21, 2, 10, 20, 6, 19, 12, 16)
$C_3 \cup C_{18}$	(1, 13, 17, 11, 8, 4, 12, 3, 21, 10, 19, 7, 6, 16, 2, 15, 5, 20)(9, 18, 14)
$C_4 \cup C_{17}$	(1, 16, 9, 15, 6, 14, 4, 11, 5, 7, 20, 3, 19, 13, 17, 2, 12)(8, 18, 10, 21)
$C_5 \cup C_{16}$	(1, 18, 5, 19, 8, 21, 7, 11, 3, 9, 17, 4, 13, 2, 20, 12)(6, 14, 16, 15, 10)
$C_6 \cup C_{15}$	(1, 11, 20, 12, 4, 14, 10, 15, 2, 13, 16, 6, 17, 3, 18)(5, 8, 19, 7, 21, 9)
$2C_3 \cup C_{15}$	(1, 18, 3, 17, 15, 2, 13, 14, 12, 6, 16, 8, 5, 20, 11)(4, 10, 19)(7, 21, 9)
$C_7 \cup C_{14}$	(1, 18, 2, 14, 16, 10, 5, 12, 19, 13, 8, 6, 17, 11)(3, 21, 4, 9, 20, 7, 15)
$C_3 \cup C_4 \cup C_{14}$	(1, 18, 2, 14, 17, 15, 3, 21, 4, 9, 13, 10, 19, 11)(5, 16, 12)(6, 20, 7, 8)
$C_8 \cup C_{13}$	(1, 12, 11, 15, 16, 4, 13, 5, 19, 10, 20, 7, 21)(2, 17, 8, 6, 9, 3, 18, 14)
$C_3 \cup C_5 \cup C_{13}$	(1, 21, 7, 20, 10, 19, 13, 4, 8, 16, 9, 6, 12)(2, 17, 14)(3, 11, 15, 5, 18)
$2C_4 \cup C_{13}$	(1, 12, 5, 19, 13, 8, 18, 11, 4, 10, 20, 7, 21)(2, 17, 6, 14)(3, 9, 16, 15)
$C_9 \cup C_{12}$	(1, 18, 14, 4, 17, 13, 9, 20, 11)(2, 12, 16, 7, 8, 19, 6, 10, 3, 21, 5, 15)
$C_3 \cup C_6 \cup C_{12}$	(1, 11, 20, 9, 6, 19, 8, 14, 4, 12, 2, 18)(3, 21, 5, 16, 7, 10)(13, 17, 15)
$C_4 \cup C_5 \cup C_{12}$	(1, 11, 20, 9, 6, 19, 8, 10, 3, 21, 5, 18)(2, 12, 16, 14)(4, 17, 15, 7, 13)
$3C_3 \cup C_{12}$	(1, 18, 14, 2, 10, 5, 21, 3, 15, 7, 16, 12)(4, 13, 17)(6, 8, 19)(9, 20, 11)
$C_{10} \cup C_{11}$	(1, 21, 8, 20, 3, 9, 5, 14, 13, 17, 15)(2, 19, 12, 6, 18, 7, 10, 16, 4, 11)
$C_3 \cup C_7 \cup C_{11}$	(1, 21, 8, 20, 3, 17, 15)(2, 11, 14, 16, 10, 4, 13, 5, 7, 12, 19)(6, 9, 18)
$C_4 \cup C_6 \cup C_{11}$	(1, 21, 8, 20, 3, 10, 7, 5, 9, 17, 15)(2, 13, 6, 18, 12, 19)(4, 14, 11, 16)
$2C_5 \cup C_{11}$	(1, 21, 8, 20, 3, 11, 16, 10, 7, 5, 15)(2, 17, 13, 12, 19)(4, 9, 6, 18, 14)
$2C_3 \cup C_4 \cup C_{11}$	(1, 21, 8, 20, 3, 10, 16, 4, 13, 17, 15)(2, 12, 19)(5, 14, 11, 7)(6, 9, 18)
$C_3 \cup C_8 \cup C_{10}$	(1, 21, 10, 8, 7, 19, 6, 15, 2, 12)(3, 13, 17, 11, 16, 4, 20, 9)(5, 18, 14)
$C_4 \cup C_7 \cup C_{10}$	(1, 21, 10, 5, 16, 2, 12)(3, 13, 6, 14)(4, 20, 9, 18, 7, 19, 11, 17, 15, 8)
$C_5 \cup C_6 \cup C_{10}$	(1, 12, 2, 10, 21)(3, 13, 5, 15, 8, 19, 7, 18, 14, 16)(4, 20, 9, 6, 11, 17)
$2C_3 \cup C_5 \cup C_{10}$	(1, 12, 2, 10, 21)(3, 18, 14, 16, 9, 20, 4, 15, 5, 13)(6, 11, 17)(7, 8, 19)
$C_3 \cup 2C_4 \cup C_{10}$	(1, 21, 10, 18, 14, 13, 3, 16, 2, 12)(4, 20, 9, 17)(5, 15, 8, 7)(6, 19, 11)
$C_3 \cup 2C_9$	(1, 20, 5, 14, 2, 11, 6, 18, 13)(3, 9, 21, 7, 8, 10, 16, 4, 19)(12, 17, 15)
$C_4 \cup C_8 \cup C_9$	(1, 13, 4, 15, 16, 10, 5, 20)(2, 11, 18, 14)(3, 19, 8, 12, 6, 17, 7, 21, 9)
$C_5 \cup C_7 \cup C_9$	(1, 20, 5, 18, 6, 11, 2, 14, 13)(3, 19, 12, 17, 15)(4, 8, 7, 21, 9, 10, 16)
$2C_6 \cup C_9$	(1, 13, 16, 10, 5, 20)(2, 11, 6, 17, 7, 21, 9, 18, 14)(3, 15, 4, 8, 12, 19)
$2C_3 \cup C_6 \cup C_9$	(1, 13, 2, 11, 5, 20)(3, 19, 8, 18, 14, 10, 7, 21, 9)(4, 15, 16)(6, 17, 12)
$C_3 \cup C_4 \cup C_5 \cup C_9$	(1, 13, 5, 20)(2, 11, 18, 6, 14)(3, 19, 12)(4, 8, 9, 21, 7, 16, 10, 17, 15)
$3C_4 \cup C_9$	(1, 20, 5, 13)(2, 18, 14, 17, 7, 21, 9, 6, 11)(3, 19, 10, 16)(4, 8, 15, 12)
$4C_3 \cup C_9$	(1, 20, 5, 19, 8, 4, 18, 2, 13)(3, 10, 16)(6, 12, 11)(7, 21, 9)(14, 17, 15)
$C_5 \cup 2C_8$	(1, 20, 7, 16, 6, 14, 2, 12)(3, 9, 10, 5, 19, 11, 17, 15)(4, 21, 8, 18, 13)
$C_6 \cup C_7 \cup C_8$	(1, 12, 2, 14, 16, 7, 20)(3, 9, 17, 15, 5, 19)(4, 11, 6, 13, 18, 10, 8, 21)
$2C_3 \cup C_7 \cup C_8$	(1, 20, 7, 11, 3, 19, 5, 12)(2, 18, 14)(4, 21, 8)(6, 17, 13, 15, 16, 10, 9)
$C_3 \cup C_4 \cup C_6 \cup C_8$	(1, 12, 7, 20)(2, 15, 16, 10, 18, 14)(3, 19, 5, 13, 17, 6, 9, 11)(4, 21, 8)
$C_3 \cup 2C_5 \cup C_8$	(1, 20, 7, 16, 10, 9, 6, 12)(2, 15, 13, 18, 14)(3, 11, 19, 5, 17)(4, 21, 8)
$2C_4 \cup C_5 \cup C_8$	(1, 12, 5, 19, 3, 11, 7, 20)(2, 10, 18, 14)(4, 21, 8, 15, 16)(6, 13, 17, 9)
$3C_3 \cup C_4 \cup C_8$	(1, 20, 7, 12)(2, 16, 14)(3, 11, 6, 9, 17, 15, 5, 19)(4, 21, 8)(10, 18, 13)
$3C_7$	(1, 11, 12, 19, 13, 7, 15)(2, 16, 14, 3, 18, 10, 17)(4, 20, 9, 6, 8, 5, 21)
$C_3 \cup C_4 \cup 2C_7$	(1, 11, 20, 4, 21, 5, 15)(2, 16, 12, 10, 19, 13, 17)(3, 14, 9, 18)(6, 8, 7)
$C_3 \cup C_5 \cup C_6 \cup C_7$	(1, 11, 6, 7, 13, 8, 15)(2, 17, 10, 18, 14, 16)(3, 19, 12)(4, 21, 5, 9, 20)
$2C_4 \cup C_6 \cup C_7$	(1, 11, 12, 15)(2, 16, 14, 17)(3, 19, 13, 7, 10, 18)(4, 20, 9, 6, 8, 5, 21)
$C_4 \cup 2C_5 \cup C_7$	(1, 11, 6, 7, 8, 12, 15)(2, 16, 14, 17)(3, 19, 13, 10, 18)(4, 21, 5, 9, 20)
$3C_3 \cup C_5 \cup C_7$	(1, 11, 20, 4, 21, 5, 15)(2, 12, 16)(3, 10, 19)(6, 17, 13)(7, 8, 9, 18, 14)
$2C_3 \cup 2C_4 \cup C_7$	(1, 11, 17, 15)(2, 16, 3, 18)(4, 21, 5, 12, 19, 10, 20)(6, 8, 7)(9, 14, 13)
$C_3 \cup 3C_6$	(1, 20, 8, 5, 7, 16)(2, 17, 3, 15, 12, 14)(4, 10, 21)(6, 18, 11, 19, 13, 9)
$C_4 \cup C_5 \cup 2C_6$	(1, 16, 7, 5, 8, 20)(2, 17, 9, 6, 18)(3, 11, 19, 13, 14, 15)(4, 12, 10, 21)
$3C_3 \cup 2C_6$	(1, 16, 3, 19, 8, 20)(2, 13, 5, 7, 6, 14)(4, 10, 21)(9, 17, 15)(11, 18, 12)
$3C_5 \cup C_6$	(1, 20, 8, 6, 7, 16)(2, 17, 15, 5, 13)(3, 19, 11, 18, 9)(4, 12, 14, 10, 21)
$2C_3 \cup C_4 \cup C_5 \cup C_6$	(1, 16, 6, 7, 8, 20)(2, 17, 12, 14)(3, 9, 18, 5, 15)(4, 10, 21)(11, 19, 13)
$C_3 \cup 3C_4 \cup C_6$	(1, 16, 11, 15, 8, 20)(2, 17, 12, 18)(3, 19, 13)(4, 14, 10, 21)(5, 9, 6, 7)
$5C_3 \cup C_6$	(1, 20, 9, 3, 12, 16)(2, 18, 14)(4, 10, 21)(5, 8, 19)(6, 13, 17)(7, 11, 15)
$2C_3 \cup 3C_5$	(1, 16, 5, 15, 13)(2, 21, 8, 10, 17)(3, 9, 7, 6, 19)(4, 20, 11)(12, 18, 14)
$C_3 \cup 2C_4 \cup 2C_5$	(1, 16, 14, 13)(2, 17, 15, 5, 21)(3, 19, 12)(4, 9, 20, 8)(6, 18, 7, 11, 10)
$4C_4 \cup C_5$	(1, 13, 5, 16)(2, 21, 7, 17)(3, 19, 11, 20, 12)(4, 9, 18, 8)(6, 14, 15, 10)
$4C_3 \cup C_4 \cup C_5$	(1, 13, 16)(2, 21, 11, 17)(3, 9, 15)(4, 18, 8, 19, 12)(5, 10, 20)(6, 14, 7)
$3C_3 \cup 3C_4$	(1, 15, 8, 20)(2, 13, 17)(3, 11, 18, 14)(4, 9, 16)(5, 19, 7)(6, 12, 10, 21)
$7C_3$	(1, 18, 14)(2, 15, 16)(3, 13, 17)(4, 21, 8)(5, 19, 9)(6, 20, 7)(10, 11, 12)

Table 12: Strong VMTLs of the first 50 2-regular graphs of order 23

Graph	Edge Labels
C_{23}	$(1, 17, 2, 12, 19, 4, 20, 15, 5, 21, 7, 18, 9, 8, 13, 3, 10, 22, 11, 23, 6, 16, 14)$
$C_3 \cup C_{20}$	$(1, 16, 13, 7, 9, 23, 3, 15, 19, 4, 18, 6, 22, 5, 8, 17, 2, 12, 21, 14)(10, 11, 20)$
$C_4 \cup C_{19}$	$(1, 23, 6, 9, 5, 15, 17, 10, 20, 8, 18, 3, 22, 11, 2, 14, 4, 13, 21)(7, 12, 19, 16)$
$C_5 \cup C_{18}$	$(1, 13, 2, 16, 15, 9, 8, 19, 7, 23, 6, 22, 11, 21, 14, 20, 5, 18)(3, 17, 4, 12, 10)$
$C_6 \cup C_{17}$	$(1, 21, 9, 23, 5, 19, 16, 18, 11, 20, 13, 7, 14, 2, 15, 4, 22)(3, 12, 6, 8, 17, 10)$
$2C_3 \cup C_{17}$	$(1, 21, 9, 23, 5, 14, 2, 15, 19, 16, 11, 20, 13, 8, 10, 4, 22)(3, 12, 17)(6, 7, 18)$
$C_7 \cup C_{16}$	$(1, 15, 3, 14, 10, 20, 11, 8, 7, 13, 19, 2, 12, 23, 6, 22)(4, 21, 5, 17, 16, 18, 9)$
$C_3 \cup C_4 \cup C_{16}$	$(1, 15, 16, 18, 14, 4, 21, 5, 10, 3, 19, 2, 12, 23, 6, 22)(7, 17, 13, 20)(8, 9, 11)$
$C_8 \cup C_{15}$	$(1, 17, 16, 7, 6, 23, 8, 19)(2, 20, 15, 9, 21, 4, 22, 12, 5, 14, 18, 10, 11, 3, 13)$
$C_3 \cup C_5 \cup C_{15}$	$(1, 17, 11, 16, 7, 10, 3, 13, 2, 20, 15, 18, 14, 5, 19)(4, 22, 12, 9, 21)(6, 23, 8)$
$2C_4 \cup C_{15}$	$(1, 19, 8, 23, 6, 11, 5, 9, 21, 4, 22, 12, 7, 16, 17)(2, 20, 15, 13)(3, 10, 14, 18)$
$C_9 \cup C_{14}$	$(1, 12, 2, 20, 15, 17, 14, 9, 7, 8, 10, 23, 4, 16)(3, 22, 6, 13, 21, 5, 19, 11, 18)$
$C_3 \cup C_6 \cup C_{14}$	$(1, 12, 2, 20, 15, 9, 7, 8, 11, 19, 10, 23, 4, 16)(3, 22, 6, 17, 14, 18)(5, 13, 21)$
$C_4 \cup C_5 \cup C_{14}$	$(1, 12, 2, 20, 15, 19, 13, 17, 14, 9, 10, 23, 4, 16)(3, 22, 6, 18)(5, 11, 7, 8, 21)$
$3C_3 \cup C_{14}$	$(1, 16, 4, 23, 10, 5, 19, 15, 3, 22, 6, 20, 2, 12)(7, 9, 14)(8, 11, 21)(13, 18, 17)$
$C_{10} \cup C_{13}$	$(1, 20, 15, 2, 16, 9, 21, 13, 18, 14, 8, 7, 12)(3, 11, 5, 19, 10, 23, 4, 22, 6, 17)$
$C_3 \cup C_7 \cup C_{13}$	$(1, 20, 15, 17, 7, 8, 6, 22, 4, 23, 10, 19, 12)(2, 16, 3, 14, 11, 5, 18)(9, 21, 13)$
$C_4 \cup C_6 \cup C_{13}$	$(1, 20, 15, 2, 16, 3, 11, 13, 21, 9, 7, 8, 12)(4, 22, 6, 19, 10, 23)(5, 17, 14, 18)$
$2C_5 \cup C_{13}$	$(1, 20, 15, 2, 16, 3, 17, 14, 8, 7, 18, 11, 12)(4, 22, 6, 10, 23)(5, 19, 13, 21, 9)$
$2C_3 \cup C_4 \cup C_{13}$	$(1, 20, 15, 16, 3, 19, 10, 23, 4, 22, 6, 11, 12)(2, 18, 14)(5, 13, 21, 9)(7, 17, 8)$
$C_{11} \cup C_{12}$	$(1, 22, 7, 12, 23, 3, 13, 21, 6, 16, 2, 19)(4, 10, 20, 5, 8, 9, 15, 18, 14, 17, 11)$
$C_3 \cup C_8 \cup C_{12}$	$(1, 19, 2, 16, 14, 17, 15, 10, 9, 5, 11, 22)(3, 12, 23)(4, 18, 6, 7, 20, 8, 21, 13)$
$C_4 \cup C_7 \cup C_{12}$	$(1, 22, 12, 23, 3, 13, 15, 18, 6, 16, 2, 19)(4, 11, 21, 9, 20, 7, 10)(5, 8, 17, 14)$
$C_5 \cup C_6 \cup C_{12}$	$(1, 22, 6, 16, 2, 19)(3, 13, 21, 9, 8, 5, 14, 17, 7, 20, 12, 23)(4, 10, 15, 18, 11)$
$2C_3 \cup C_5 \cup C_{12}$	$(1, 22, 6, 10, 15, 14, 20, 7, 17, 16, 2, 19)(3, 12, 23)(4, 13, 18)(5, 8, 11, 21, 9)$
$C_3 \cup 2C_4 \cup C_{12}$	$(1, 19, 2, 16, 9, 5, 14, 20, 11, 21, 8, 22)(3, 12, 23)(4, 18, 15, 13)(6, 7, 17, 10)$
$C_3 \cup C_9 \cup C_{11}$	$(1, 17, 12, 23, 3, 20, 11, 4, 16)(2, 22, 10, 6, 8, 5, 14, 13, 21, 9, 19)(7, 18, 15)$
$C_4 \cup C_8 \cup C_{11}$	$(1, 16, 4, 11, 5, 9, 18, 15, 14, 8, 17)(2, 19, 12, 23, 3, 20, 10, 22)(6, 13, 21, 7)$
$C_5 \cup C_7 \cup C_{11}$	$(1, 16, 4, 11, 17)(2, 22, 10, 6, 21, 9, 5, 8, 14, 15, 19)(3, 20, 13, 18, 7, 12, 23)$
$2C_6 \cup C_{11}$	$(1, 17, 14, 15, 4, 16)(2, 22, 10, 5, 11, 19)(3, 20, 8, 6, 7, 18, 9, 13, 21, 12, 23)$
$2C_3 \cup C_6 \cup C_{11}$	$(1, 16, 4, 18, 13, 15, 19, 2, 22, 10, 17)(3, 20, 9, 21, 12, 23)(5, 14, 11)(6, 8, 7)$
$C_3 \cup C_4 \cup C_5 \cup C_{11}$	$(1, 16, 4, 11, 17)(2, 19, 12, 23, 3, 20, 14, 13, 6, 10, 22)(5, 8, 21, 9)(7, 18, 15)$
$3C_4 \cup C_{11}$	$(1, 17, 14, 16)(2, 22, 10, 19)(3, 20, 8, 6, 7, 18, 9, 13, 21, 12, 23)(4, 11, 5, 15)$
$4C_3 \cup C_{11}$	$(1, 17, 16)(2, 22, 10, 20, 11, 5, 14, 15, 8, 6, 19)(3, 12, 23)(4, 18, 9)(7, 21, 13)$
$C_3 \cup 2C_{10}$	$(1, 23, 10, 4, 12, 5, 15, 19, 11, 17)(2, 13, 22, 9, 16, 3, 18, 14, 8, 21)(6, 7, 20)$
$C_4 \cup C_9 \cup C_{10}$	$(1, 23, 10, 20, 7, 19, 6, 15, 17)(2, 13, 22, 9, 11, 3, 14, 5, 8, 21)(4, 18, 16, 12)$
$C_5 \cup C_8 \cup C_{10}$	$(1, 23, 10, 15, 17)(2, 13, 22, 9, 19, 11, 3, 18, 8, 21)(4, 12, 5, 14, 20, 7, 6, 16)$
$C_6 \cup C_7 \cup C_{10}$	$(1, 23, 10, 18, 3, 14, 11, 19, 15, 17)(2, 13, 22, 9, 5, 8, 21)(4, 12, 7, 20, 6, 16)$
$2C_3 \cup C_7 \cup C_{10}$	$(1, 23, 10, 4, 12, 14, 8, 5, 15, 17)(2, 13, 22, 9, 20, 7, 21)(3, 18, 16)(6, 11, 19)$
$C_3 \cup C_4 \cup C_6 \cup C_{10}$	$(1, 23, 10, 20, 5, 17)(2, 13, 22, 9, 18, 14, 3, 11, 8, 21)(4, 12, 16)(6, 15, 19, 7)$
$C_3 \cup 2C_5 \cup C_{10}$	$(1, 23, 10, 3, 17)(2, 13, 22, 9, 19, 15, 11, 6, 8, 21)(4, 12, 20, 7, 18)(5, 16, 14)$
$2C_4 \cup C_5 \cup C_{10}$	$(1, 23, 10, 4, 17)(2, 13, 22, 9, 19, 15, 11, 5, 8, 21)(3, 14, 6, 16)(7, 18, 12, 20)$
$3C_3 \cup C_4 \cup C_{10}$	$(1, 23, 10, 17)(2, 15, 4, 16, 13, 22, 9, 5, 11, 21)(3, 12, 18)(6, 7, 19)(8, 20, 14)$
$C_5 \cup 2C_9$	$(1, 19, 8, 15, 3, 23, 11, 2, 20)(4, 10, 5, 12, 21)(6, 13, 16, 14, 18, 17, 7, 9, 22)$
$C_6 \cup C_8 \cup C_9$	$(1, 19, 16, 3, 23, 11, 2, 20)(4, 14, 15, 12, 21, 7, 8, 17, 13)(5, 18, 6, 10, 22, 9)$
$2C_3 \cup C_8 \cup C_9$	$(1, 20, 2, 11, 23, 3, 13, 19)(4, 15, 10, 7, 8, 21, 12, 16, 14)(5, 22, 9)(6, 18, 17)$
$2C_7 \cup C_9$	$(1, 19, 13, 15, 3, 23, 11, 2, 20)(4, 10, 6, 18, 17, 12, 21)(5, 22, 9, 8, 7, 16, 14)$
$C_3 \cup C_4 \cup C_7 \cup C_9$	$(1, 19, 4, 15, 3, 23, 11, 2, 20)(5, 12, 21, 7, 9, 22, 10)(6, 18, 17, 8)(13, 16, 14)$
$C_3 \cup C_5 \cup C_6 \cup C_9$	$(1, 20, 2, 11, 23, 3, 15, 13, 19)(4, 12, 21, 8, 7, 10)(5, 22, 9, 16, 14)(6, 18, 17)$
$2C_4 \cup C_6 \cup C_9$	$(1, 19, 4, 15, 3, 23, 11, 2, 20)(5, 12, 21, 10)(6, 22, 7, 9, 16, 8)(13, 14, 18, 17)$

Table 13: Strong VMTLs of the remaining 38 2-regular graphs of order 23

Graph	Edge Labels
$C_4 \cup 2C_5 \cup C_9$	$(1,19,16,13,3,23,11,2,20)(4,14,18,10,15)(5,22,9,21,12)(6,8,7,17)$
$3C_3 \cup C_5 \cup C_9$	$(1,19,16,15,3,23,11,2,20)(4,12,21)(5,9,8,7,22)(6,17,13)(10,14,18)$
$2C_3 \cup 2C_4 \cup C_9$	$(1,19,16,14,3,23,11,2,20)(4,12,21)(5,13,18)(6,8,7,22)(9,15,17,10)$
$C_7 \cup 2C_8$	$(1,14,7,21,8,18,16,15)(2,20,3,11,9,4,13,17)(5,19,6,12,23,10,22)$
$C_3 \cup C_4 \cup 2C_8$	$(1,14,7,17,2,20,3,15)(4,16,12,23,10,22,5,9)(6,11,19)(8,18,13,21)$
$C_3 \cup C_5 \cup C_7 \cup C_8$	$(1,15,3,20,2,17,14)(4,9,16)(5,12,23,10,22)(6,8,13,21,7,19,11,18)$
$2C_4 \cup C_7 \cup C_8$	$(1,14,16,18,6,7,11,15)(2,20,3,17)(4,13,8,21)(5,9,19,12,23,10,22)$
$C_3 \cup 2C_6 \cup C_8$	$(1,14,12,23,10,22,5,15)(2,20,3,21,4,17)(6,7,11,19,9,8)(13,18,16)$
$C_4 \cup C_5 \cup C_6 \cup C_8$	$(1,15,16,9,4,14)(2,20,3,17)(5,12,23,10,22)(6,8,13,21,7,19,11,18)$
$3C_3 \cup C_6 \cup C_8$	$(1,14,20,2,17,13,5,15)(3,11,18)(4,19,12,23,10,22)(6,21,7)(8,9,16)$
$3C_5 \cup C_8$	$(1,14,11,3,15)(2,20,6,7,17)(4,19,9,21,8,13,18,16)(5,12,23,10,22)$
$2C_3 \cup C_4 \cup C_5 \cup C_8$	$(1,15,16,14)(2,17,3,11,7,18,6,20)(4,19,9)(5,12,23,10,22)(8,13,21)$
$C_3 \cup 3C_4 \cup C_8$	$(1,15,16,14)(2,18,6,17)(3,19,7,11)(4,13,21)(5,8,20,9,12,23,10,22)$
$5C_3 \cup C_8$	$(1,15,14)(2,21,4,16,18,3,11,17)(5,13,19)(6,7,20)(8,22,9)(10,12,23)$
$C_3 \cup C_6 \cup 2C_7$	$(1,23,8,15,17,2,14)(3,19,16,4,10,18)(5,21,9,20,13,12,22)(6,11,7)$
$C_4 \cup C_5 \cup 2C_7$	$(1,23,8,18,17,2,14)(3,19,4,10,15)(5,16,12,22)(6,11,21,9,20,13,7)$
$3C_3 \cup 2C_7$	$(1,23,8,18,17,2,14)(3,19,15)(4,9,21,6,22,11,10)(5,12,20)(7,16,13)$
$C_4 \cup 2C_6 \cup C_7$	$(1,23,8,17,2,14)(3,18,15,19)(4,10,13,22,5,12,16)(6,7,11,21,9,20)$
$2C_5 \cup C_6 \cup C_7$	$(1,23,8,17,2,14)(3,18,16,13,19)(4,10,7,21,9)(5,22,11,12,6,20,15)$
$2C_3 \cup C_4 \cup C_6 \cup C_7$	$(1,23,8,17,2,14)(3,19,15,13,22,5,18)(4,10,16)(6,11,7)(9,20,12,21)$
$2C_3 \cup 2C_5 \cup C_7$	$(1,23,8,6,17,2,14)(3,19,10)(4,22,12,5,16)(7,11,21,9,18)(13,20,15)$
$C_3 \cup 2C_4 \cup C_5 \cup C_7$	$(1,23,8,6,17,2,14)(3,19,10)(4,13,5,16)(7,18,9,21)(11,22,12,20,15)$
$4C_4 \cup C_7$	$(1,23,8,5,17,2,14)(3,15,11,18)(4,16,7,10)(6,21,9,19)(12,20,13,22)$
$4C_3 \cup C_4 \cup C_7$	$(1,23,8,10,17,2,14)(3,18,15,11)(4,19,16)(5,12,20)(6,22,7)(9,13,21)$
$C_5 \cup 3C_6$	$(1,18,12,23,4,22)(2,16,6,8,13,11)(3,14,19,15,17)(5,10,21,7,9,20)$
$2C_3 \cup C_5 \cup 2C_6$	$(1,18,12,23,4,22)(2,11,3,13,8,16)(5,15,17)(6,9,20,14,19)(7,10,21)$
$C_3 \cup 2C_4 \cup 2C_6$	$(1,18,12,23,4,22)(2,16,13,20,5,11)(3,19,15,17)(6,8,9)(7,21,10,14)$
$C_3 \cup C_4 \cup 2C_5 \cup C_6$	$(1,18,12,23,4,22)(2,19,6,11)(3,17,15)(5,9,7,21,10)(8,16,13,20,14)$
$3C_4 \cup C_5 \cup C_6$	$(1,18,12,23,4,22)(2,15,3,11)(5,17,16,8,20)(6,14,7,9)(10,19,13,21)$
$4C_3 \cup C_5 \cup C_6$	$(1,22,6,16,18)(2,13,11)(3,17,15)(4,12,23)(5,9,8,21,10,20)(7,14,19)$
$3C_3 \cup 2C_4 \cup C_6$	$(1,22,7,18)(2,19,3,11)(4,12,23)(5,13,21)(6,14,10,20,8,9)(15,17,16)$
$C_3 \cup 4C_5$	$(1,12,4,13,22)(2,17,14,6,16)(3,11,21,8,18)(5,10,23,7,20)(9,15,19)$
$2C_4 \cup 3C_5$	$(1,12,4,13,22)(2,17,5,16)(3,11,20,8,21)(6,14,18,9)(7,23,10,15,19)$
$3C_3 \cup C_4 \cup 2C_5$	$(1,12,13,22)(2,17,14)(3,11,21,6,15)(4,18,16)(5,10,23,7,19)(8,9,20)$
$2C_3 \cup 3C_4 \cup C_5$	$(1,12,19,13,22)(2,15,14)(3,16,18)(4,20,6,21)(5,9,11,17)(7,23,10,8)$
$6C_3 \cup C_5$	$(1,22,12)(2,17,14)(3,11,21,4,18)(5,15,13)(6,9,20)(7,23,10)(8,19,16)$
$C_3 \cup 5C_4$	$(1,22,6,12)(2,19,13,14)(3,23,8,11)(4,21,9,20)(5,10,7,15)(16,18,17)$
$5C_3 \cup 2C_4$	$(1,12,22)(2,19,14)(3,11,21)(4,13,5,15)(6,20,9,16)(7,23,8)(10,18,17)$

Table 14: Strong VMTLs of the first 65 2-regular graphs of order 25

Graph	Edge Labels
C_{25}	(1, 24, 3, 17, 18, 8, 14, 2, 16, 21, 12, 22, 7, 10, 4, 19, 13, 6, 9, 15, 23, 5, 25, 11, 20)
$C_3 \cup C_{22}$	(1, 21, 10, 25, 2, 16, 22, 11, 18, 3, 20, 6, 8, 17, 13, 4, 24, 12, 7, 9, 23, 14)(5, 15, 19)
$C_4 \cup C_{21}$	(1, 22, 15, 6, 10, 7, 11, 25, 2, 23, 3, 12, 19, 5, 14, 24, 8, 20, 9, 21, 13)(4, 18, 17, 16)
$C_5 \cup C_{20}$	(1, 23, 2, 19, 15)(3, 20, 18, 8, 6, 11, 25, 5, 10, 22, 9, 13, 7, 12, 17, 16, 21, 14, 4, 24)
$C_6 \cup C_{19}$	(1, 19, 9, 10, 22, 2, 25, 13, 4, 14, 7, 23, 8, 21, 5, 11, 3, 12, 24)(6, 16, 18, 15, 20, 17)
$2C_3 \cup C_{19}$	(1, 24, 12, 3, 11, 7, 23, 8, 14, 20, 9, 10, 6, 22, 2, 25, 13, 4, 19)(5, 21, 16)(15, 18, 17)
$C_7 \cup C_{18}$	(1, 15, 2, 22, 3, 17, 18, 16, 6, 13, 23, 5, 9, 21, 10, 19, 7, 20)(4, 14, 24, 8, 25, 12, 11)
$C_3 \cup C_4 \cup C_{18}$	(1, 15, 2, 22, 3, 17, 18, 4, 14, 24, 8, 25, 12, 7, 19, 11, 16, 20)(5, 9, 6, 23)(10, 21, 13)
$C_8 \cup C_{17}$	(1, 13, 24, 6, 23, 8, 12, 4, 18, 3, 14, 20, 15, 21, 17, 2, 25)(5, 19, 9, 16, 7, 11, 22, 10)
$C_3 \cup C_5 \cup C_{17}$	(1, 25, 2, 17, 19, 15, 9, 11, 21, 14, 3, 18, 4, 12, 6, 24, 13)(5, 20, 8, 23, 10)(7, 16, 22)
$2C_4 \cup C_{17}$	(1, 25, 2, 17, 19, 4, 12, 23, 8, 10, 5, 15, 9, 16, 6, 24, 13)(3, 14, 20, 18)(7, 22, 11, 21)
$C_9 \cup C_{16}$	(1, 20, 14, 12, 8, 23, 13, 2, 16, 22, 15, 17, 6, 21, 4, 18)(3, 11, 24, 9, 7, 10, 19, 5, 25)
$C_3 \cup C_6 \cup C_{16}$	(1, 20, 7, 19, 4, 18)(2, 13, 23, 8, 21, 17, 15, 22, 12, 5, 25, 3, 11, 24, 9, 16)(6, 14, 10)
$C_4 \cup C_5 \cup C_{16}$	(1, 18, 4, 21, 17, 10, 6, 14, 9, 24, 11, 3, 25, 5, 12, 20)(2, 16, 8, 23, 13)(7, 22, 15, 19)
$3C_3 \cup C_{16}$	(1, 20, 18)(2, 16, 6, 19, 4, 12, 8, 23, 9, 24, 11, 3, 25, 5, 21, 13)(7, 17, 10)(14, 22, 15)
$C_{10} \cup C_{15}$	(1, 20, 16, 2, 21, 13, 9, 17, 11, 19)(3, 14, 5, 10, 22, 15, 23, 12, 4, 25, 8, 6, 18, 7, 24)
$C_3 \cup C_7 \cup C_{15}$	(1, 20, 14, 3, 24, 7, 18, 6, 22, 10, 5, 9, 13, 17, 19)(2, 21, 16)(4, 25, 8, 11, 15, 23, 12)
$C_4 \cup C_6 \cup C_{15}$	(1, 20, 17, 19)(2, 16, 22, 8, 25, 4, 12, 23, 9, 5, 10, 18, 6, 13, 21)(3, 24, 7, 15, 11, 14)
$2C_5 \cup C_{15}$	(1, 20, 18, 8, 25, 4, 12, 23, 7, 24, 3, 14, 11, 17, 19)(2, 16, 6, 13, 21)(5, 9, 15, 22, 10)
$2C_3 \cup C_4 \cup C_{15}$	(1, 20, 6, 19)(2, 16, 22, 15, 17, 18, 12, 4, 25, 8, 14, 3, 24, 7, 21)(5, 10, 9)(11, 13, 23)
$C_{11} \cup C_{14}$	(1, 22, 7, 23, 3, 12, 25, 13, 5, 11, 9, 24, 4, 18)(2, 19, 6, 8, 16, 20, 14, 21, 10, 17, 15)
$C_3 \cup C_8 \cup C_{14}$	(1, 22, 10, 17, 5, 11, 7, 18)(2, 19, 15)(3, 12, 25, 13, 16, 20, 4, 24, 9, 21, 14, 6, 8, 23)
$C_4 \cup C_7 \cup C_{14}$	(1, 18, 4, 24, 9, 16, 15, 2, 19, 17, 7, 20, 10, 22)(3, 12, 25, 13, 5, 11, 23)(6, 14, 21, 8)
$C_5 \cup C_6 \cup C_{14}$	(1, 22, 5, 11, 7, 17, 15, 2, 19, 16, 9, 24, 4, 18)(3, 12, 25, 13, 23)(6, 14, 20, 10, 21, 8)
$2C_3 \cup C_5 \cup C_{14}$	(1, 18, 7, 11, 5, 17, 15, 2, 19, 16, 4, 24, 9, 22)(3, 12, 25, 13, 23)(6, 21, 8)(10, 20, 14)
$C_3 \cup 2C_4 \cup C_{14}$	(1, 22, 10, 20, 16, 9, 24, 4, 23, 3, 12, 25, 13, 18)(2, 19, 15)(5, 17, 7, 11)(6, 14, 21, 8)
$C_{12} \cup C_{13}$	(1, 17, 15, 21, 5, 16, 7, 23, 6, 10, 12, 2, 18)(3, 22, 9, 19, 8, 25, 13, 24, 11, 4, 20, 14)
$C_3 \cup C_9 \cup C_{13}$	(1, 17, 5, 16, 10, 19, 12, 2, 18)(3, 22, 6, 21, 15, 8, 25, 13, 24, 11, 4, 20, 14)(7, 23, 9)
$C_4 \cup C_8 \cup C_{13}$	(1, 17, 6, 10, 16, 5, 23, 14, 3, 22, 12, 2, 18)(4, 20, 9, 21, 15, 7, 24, 11)(8, 25, 13, 19)
$C_5 \cup C_7 \cup C_{13}$	(1, 17, 5, 16, 7, 23, 9, 22, 3, 14, 12, 2, 18)(4, 20, 8, 25, 13, 24, 11)(6, 10, 19, 15, 21)
$2C_6 \cup C_{13}$	(1, 17, 6, 10, 21, 9, 23, 14, 3, 22, 12, 2, 18)(4, 20, 16, 5, 24, 11)(7, 19, 8, 25, 13, 15)
$2C_3 \cup C_6 \cup C_{13}$	(1, 17, 10, 6, 23, 7, 24, 11, 4, 20, 12, 2, 18)(3, 14, 22)(5, 16, 21)(8, 25, 13, 9, 19, 15)
$C_3 \cup C_4 \cup C_5 \cup C_{13}$	(1, 18, 2, 12, 17)(3, 22, 10, 6, 24, 11, 4, 20, 7, 15, 19, 9, 14)(5, 21, 16)(8, 25, 13, 23)
$3C_4 \cup C_{13}$	(1, 17, 14, 3, 22, 8, 25, 13, 24, 11, 12, 2, 18)(4, 23, 9, 20)(5, 10, 6, 16)(7, 19, 15, 21)
$4C_3 \cup C_{13}$	(1, 17, 6, 9, 23, 4, 20, 10, 21, 16, 12, 2, 18)(3, 14, 22)(5, 24, 11)(7, 15, 19)(8, 25, 13)
$C_3 \cup C_{10} \cup C_{12}$	(1, 17, 11, 25, 9, 18, 4, 12, 2, 19)(3, 22, 15, 23, 8, 24, 5, 10, 7, 16, 14, 21)(6, 13, 20)
$C_4 \cup C_9 \cup C_{12}$	(1, 17, 13, 20, 7, 16, 10, 18, 4, 12, 2, 19)(3, 22, 15, 23, 8, 24, 5, 14, 21)(6, 11, 25, 9)
$C_5 \cup C_8 \cup C_{12}$	(1, 19, 2, 12, 16, 14, 9, 25, 11, 4, 18, 17)(3, 22, 15, 23, 8, 24, 5, 21)(6, 13, 20, 7, 10)
$C_6 \cup C_7 \cup C_{12}$	(1, 19, 2, 12, 16, 11, 25, 9, 22, 3, 21, 17)(4, 13, 10, 6, 20, 15, 18)(5, 24, 8, 7, 23, 14)
$2C_3 \cup C_7 \cup C_{12}$	(1, 17, 6, 21, 9, 25, 11, 15, 16, 12, 2, 19)(3, 13, 22)(4, 20, 18)(5, 14, 23, 10, 7, 8, 24)
$C_3 \cup C_4 \cup C_6 \cup C_{12}$	(1, 17, 14, 12, 2, 19)(3, 21, 16, 22)(4, 18, 5, 24, 8, 11, 25, 9, 6, 10, 7, 23)(13, 20, 15)
$C_3 \cup 2C_5 \cup C_{12}$	(1, 17, 10, 7, 9, 25, 11, 22, 3, 12, 2, 19)(4, 18, 13, 6, 20)(5, 24, 8, 15, 23)(14, 16, 21)
$2C_4 \cup C_5 \cup C_{12}$	(1, 19, 2, 12, 4, 18, 15, 13, 22, 3, 21, 17)(5, 24, 8, 23, 14)(6, 11, 25, 9)(7, 16, 10, 20)
$3C_3 \cup C_4 \cup C_{12}$	(1, 17, 5, 24, 8, 7, 9, 25, 11, 12, 2, 19)(3, 16, 14)(4, 23, 10, 21)(6, 20, 18)(13, 22, 15)
$C_3 \cup 2C_{11}$	(1, 13, 24)(2, 22, 6, 12, 3, 16, 5, 25, 4, 18, 14)(7, 20, 15, 8, 9, 11, 23, 10, 21, 17, 19)
$C_4 \cup C_{10} \cup C_{11}$	(1, 24, 10, 21, 6, 15, 23, 14, 2, 22, 13)(3, 12, 20, 8, 9, 11, 7, 19, 17, 16)(4, 18, 5, 25)
$C_5 \cup C_9 \cup C_{11}$	(1, 24, 10, 21, 7, 11, 9, 8, 13)(2, 22, 5, 25, 4, 19, 17, 18, 15, 23, 14)(3, 12, 20, 6, 16)
$C_6 \cup C_8 \cup C_{11}$	(1, 24, 10, 11, 21, 7, 20, 13)(2, 22, 9, 8, 18, 4, 25, 5, 15, 23, 14)(3, 12, 6, 17, 19, 16)
$2C_3 \cup C_8 \cup C_{11}$	(1, 13, 24)(2, 22, 14)(3, 12, 6, 17, 15, 20, 18, 4, 25, 5, 16)(7, 21, 10, 23, 11, 9, 8, 19)
$2C_7 \cup C_{11}$	(1, 24, 10, 21, 11, 7, 13)(2, 22, 5, 25, 4, 19, 17, 18, 15, 23, 14)(3, 16, 6, 20, 8, 9, 12)
$C_3 \cup C_4 \cup C_7 \cup C_{11}$	(1, 13, 24)(2, 22, 6, 14)(3, 16, 5, 25, 4, 18, 9, 8, 15, 20, 12)(7, 11, 23, 10, 21, 17, 19)
$C_3 \cup C_5 \cup C_6 \cup C_{11}$	(1, 13, 24)(2, 22, 11, 20, 14)(3, 16, 7, 10, 8, 12)(4, 25, 5, 21, 6, 15, 23, 9, 19, 17, 18)
$2C_4 \cup C_6 \cup C_{11}$	(1, 24, 9, 11, 21, 13)(2, 14, 23, 8, 20, 15, 6, 12, 3, 16, 22)(4, 18, 5, 25)(7, 19, 17, 10)
$C_4 \cup 2C_5 \cup C_{11}$	(1, 13, 21, 7, 24)(2, 22, 5, 25, 4, 19, 17, 18, 15, 23, 14)(3, 12, 20, 6, 16)(8, 9, 11, 10)
$3C_3 \cup C_5 \cup C_{11}$	(1, 13, 24)(2, 22, 14)(3, 16, 5, 25, 4, 18, 8, 20, 15, 19, 12)(6, 21, 17)(7, 10, 23, 9, 11)
$2C_3 \cup 2C_4 \cup C_{11}$	(1, 13, 24)(2, 22, 6, 15, 20, 16, 3, 12, 21, 17, 14)(4, 18, 5, 25)(7, 10, 8, 19)(9, 11, 23)
$C_5 \cup 2C_{10}$	(1, 16, 15, 7, 12, 6, 8, 19, 2, 14)(3, 22, 4, 20, 17)(5, 18, 11, 21, 9, 24, 10, 25, 13, 23)
$C_6 \cup C_9 \cup C_{10}$	(1, 14, 2, 19, 17, 3, 22, 15, 16)(4, 18, 12, 11, 7, 20)(5, 23, 9, 24, 10, 25, 13, 6, 8, 21)
$2C_3 \cup C_9 \cup C_{10}$	(1, 14, 2, 19, 11, 17, 6, 18, 4, 16)(3, 22, 15)(5, 9, 24, 10, 25, 13, 23, 8, 21)(7, 12, 20)
$C_7 \cup C_8 \cup C_{10}$	(1, 14, 2, 19, 18, 5, 23, 4, 20, 16)(3, 22, 9, 24, 10, 25, 13, 17)(6, 12, 7, 15, 11, 21, 8)
$C_3 \cup C_4 \cup C_8 \cup C_{10}$	(1, 16, 6, 8, 18, 19, 2, 14)(3, 17, 7, 22)(4, 15, 21, 9, 24, 10, 25, 13, 5, 23)(11, 12, 20)
$C_3 \cup C_5 \cup C_7 \cup C_{10}$	(1, 14, 2, 19, 9, 24, 10, 25, 13, 16)(3, 22, 5, 18, 4, 20, 17)(6, 12, 7, 23, 8)(11, 21, 15)
$2C_4 \cup C_7 \cup C_{10}$	(1, 14, 2, 19, 4, 18, 12, 15, 21, 16)(3, 22, 7, 17)(5, 23, 9, 24, 10, 25, 13)(6, 8, 11, 20)
$C_3 \cup 2C_6 \cup C_{10}$	(1, 14, 2, 19, 8, 18, 4, 15, 21, 16)(3, 22, 6, 23, 7, 17)(5, 9, 24, 10, 25, 13)(11, 12, 20)
$C_4 \cup C_5 \cup C_6 \cup C_{10}$	(1, 16, 21, 7, 11, 18, 12, 19, 2, 14)(3, 22, 5, 17)(4, 20, 6, 8, 15)(9, 24, 10, 25, 13, 23)

Table 15: Strong VMTLs of the remaining 65 2-regular graphs of order 25.

Graph	Edge Labels
$3C_3 \cup C_6 \cup C_{10}$	(1, 14, 2, 19, 4, 23, 9, 11, 20, 16)(3, 22, 15)(5, 24, 10, 25, 13, 17)(6, 8, 18)(7, 21, 12)
$3C_5 \cup C_{10}$	(1, 16, 21, 15, 4, 18, 12, 19, 2, 14)(3, 23, 9, 11, 22)(5, 24, 10, 25, 13)(6, 17, 7, 20, 8)
$2C_3 \cup C_4 \cup C_5 \cup C_{10}$	(1, 14, 2, 19, 17, 20, 4, 22, 3, 16)(5, 18, 12, 15)(6, 23, 8)(7, 21, 11)(9, 24, 10, 25, 13)
$C_3 \cup 3C_4 \cup C_{10}$	(1, 14, 2, 19, 12, 6, 21, 8, 20, 16)(3, 11, 22)(4, 18, 5, 15)(7, 23, 9, 17)(10, 25, 13, 24)
$5C_3 \cup C_{10}$	(1, 16, 14)(2, 24, 10, 25, 13, 3, 18, 6, 17, 20)(4, 15, 21)(5, 23, 9)(7, 22, 11)(8, 19, 12)
$C_7 \cup 2C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 22, 9, 23, 14, 19, 7, 20)(6, 10, 13, 8, 21, 17, 18)
$C_3 \cup C_4 \cup 2C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 22, 9, 23, 6, 10, 13, 20)(7, 14, 21, 17)(8, 19, 18)
$2C_8 \cup C_9$	(1, 16, 3, 15, 5, 25, 4, 24)(2, 20, 7, 8, 18, 6, 10, 11, 12)(9, 22, 13, 21, 17, 19, 14, 23)
$C_3 \cup C_5 \cup C_8 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 22, 7, 19, 8, 13, 20)(6, 10, 21, 17, 18)(9, 14, 23)
$2C_4 \cup C_8 \cup C_9$	(1, 16, 3, 15, 5, 25, 4, 24)(2, 20, 18, 19, 8, 13, 22, 14, 12)(6, 9, 7, 17)(10, 21, 11, 23)
$C_3 \cup C_6 \cup C_7 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 20)(6, 18, 19, 8, 23, 10)(7, 22, 13, 21, 17, 9, 14)
$C_4 \cup C_5 \cup C_7 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 22, 7, 20)(6, 10, 23, 8, 13, 19, 18)(9, 14, 21, 17)
$3C_3 \cup C_7 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 20)(6, 23, 10)(7, 14, 9, 22, 13, 21, 17)(8, 18, 19)
$C_4 \cup 2C_6 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 20, 7, 9, 22, 12)(6, 23, 10, 14, 21, 17)(8, 18, 19, 13)
$2C_5 \cup C_6 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 22, 10, 13, 20)(6, 18, 19, 8, 23)(7, 14, 21, 17, 9)
$2C_3 \cup C_4 \cup C_6 \cup C_9$	(1, 16, 3, 15, 5, 25, 11, 4, 24)(2, 12, 23, 10, 14, 20)(6, 21, 17)(7, 9, 22)(8, 13, 19, 18)
$2C_3 \cup 2C_5 \cup C_9$	(1, 16, 3, 15, 23, 9, 22, 4, 24)(2, 12, 21, 14, 20)(5, 25, 11)(6, 17, 10, 19, 18)(7, 13, 8)
$C_3 \cup 2C_4 \cup C_5 \cup C_9$	(1, 16, 3, 15, 12, 2, 20, 4, 24)(5, 10, 23, 11, 25)(6, 14, 21, 17)(7, 22, 9)(8, 13, 19, 18)
$4C_4 \cup C_9$	(1, 16, 3, 15, 5, 25, 13, 8, 24)(2, 20, 4, 12)(6, 9, 18, 17)(7, 21, 10, 19)(11, 22, 14, 23)
$4C_3 \cup C_4 \cup C_9$	(1, 16, 3, 24)(2, 12, 8, 13, 10, 25, 5, 11, 20)(4, 14, 22)(6, 23, 9)(7, 21, 17)(15, 19, 18)
$C_3 \cup C_6 \cup 2C_8$	(1, 17, 19, 4, 12, 22, 3, 16)(2, 24, 13, 9, 5, 25)(6, 14, 10, 11, 21, 7, 8, 23)(15, 20, 18)
$C_4 \cup C_5 \cup 2C_8$	(1, 16, 3, 22, 14, 20, 18, 17)(2, 24, 13, 7, 9, 19, 5, 25)(4, 11, 21, 12, 10)(6, 15, 8, 23)
$3C_3 \cup 2C_8$	(1, 16, 17)(2, 24, 13, 22, 3, 19, 5, 25)(4, 10, 6, 23, 8, 7, 21, 15)(9, 11, 12)(14, 20, 18)
$C_3 \cup 2C_7 \cup C_8$	(1, 16, 3, 22, 14, 7, 17)(2, 25, 5, 11, 21, 13, 24)(4, 19, 9, 6, 23, 8, 12, 10)(15, 20, 18)
$C_4 \cup C_6 \cup C_7 \cup C_8$	(1, 16, 3, 22, 12, 20, 18, 17)(2, 24, 13, 9, 11, 5, 25)(4, 19, 14, 10)(6, 15, 21, 7, 8, 23)
$2C_5 \cup C_7 \cup C_8$	(1, 16, 3, 19, 17)(2, 24, 13, 7, 9, 5, 25)(4, 11, 10, 14, 21)(6, 22, 12, 20, 18, 15, 8, 23)
$2C_3 \cup C_4 \cup C_7 \cup C_8$	(1, 17, 3, 16)(2, 24, 13, 19, 15, 10, 5, 25)(4, 20, 18)(6, 8, 23)(7, 21, 14, 22, 11, 12, 9)
$C_5 \cup 2C_6 \cup C_8$	(1, 16, 3, 22, 10, 4, 19, 17)(2, 24, 13, 11, 5, 25)(6, 23, 8, 12, 9)(7, 21, 14, 20, 18, 15)
$2C_3 \cup C_5 \cup C_6 \cup C_8$	(1, 16, 20, 14, 21, 17)(2, 24, 13, 7, 9, 19, 5, 25)(3, 12, 11, 10, 22)(4, 15, 18)(6, 23, 8)
$C_3 \cup 2C_4 \cup C_6 \cup C_8$	(1, 17, 3, 16)(2, 24, 13, 11, 22, 10, 5, 25)(4, 12, 9, 19)(6, 23, 8)(7, 15, 21, 14, 20, 18)
$C_3 \cup C_4 \cup 2C_5 \cup C_8$	(1, 17, 3, 16)(2, 24, 13, 9, 14, 19, 5, 25)(4, 12, 22, 10, 11)(6, 8, 23)(7, 21, 15, 20, 18)
$3C_4 \cup C_5 \cup C_8$	(1, 17, 19, 16)(2, 24, 13, 21, 7, 9, 5, 25)(3, 12, 11, 10, 22)(4, 20, 18, 15)(6, 14, 8, 23)
$4C_3 \cup C_5 \cup C_8$	(1, 16, 17)(2, 24, 13, 7, 9, 19, 5, 25)(3, 20, 18)(4, 15, 21, 14, 11)(6, 8, 23)(10, 12, 22)
$3C_3 \cup 2C_4 \cup C_8$	(1, 16, 17)(2, 24, 13, 23, 8, 14, 5, 25)(3, 12, 22)(4, 10, 19)(6, 15, 20, 18)(7, 9, 11, 21)
$C_4 \cup 3C_7$	(1, 17, 18, 6, 16, 4, 24)(2, 19, 14, 13)(3, 11, 25, 7, 9, 10, 20)(5, 12, 22, 15, 23, 8, 21)
$C_5 \cup C_6 \cup 2C_7$	(1, 17, 18, 16, 4, 24)(2, 19, 14, 12, 5, 9, 13)(3, 21, 6, 10, 20)(7, 22, 15, 23, 8, 11, 25)
$2C_3 \cup C_5 \cup 2C_7$	(1, 17, 16, 4, 24)(2, 13, 22, 15, 23, 8, 19)(3, 14, 20)(5, 9, 21)(6, 18, 11, 25, 7, 12, 10)
$C_3 \cup 2C_4 \cup 2C_7$	(1, 17, 10, 6, 18, 4, 24)(2, 19, 16, 13)(3, 14, 20)(5, 9, 11, 25, 7, 12, 21)(8, 22, 15, 23)
$3C_6 \cup C_7$	(1, 17, 3, 20, 4, 24)(2, 19, 14, 21, 6, 16, 13)(5, 11, 25, 7, 10, 9)(8, 18, 12, 22, 15, 23)
$2C_3 \cup 2C_6 \cup C_7$	(1, 24, 4, 12, 10, 17)(2, 19, 11, 25, 7, 22, 13)(3, 21, 16)(5, 18, 15, 23, 8, 9)(6, 14, 20)
$C_3 \cup C_4 \cup C_5 \cup C_6 \cup C_7$	(1, 17, 3, 20, 4, 24)(2, 13, 21, 14, 19)(5, 9, 18, 12)(6, 10, 16)(7, 22, 15, 23, 8, 11, 25)
$3C_4 \cup C_6 \cup C_7$	(1, 17, 12, 10, 4, 24)(2, 19, 16, 3, 14, 20, 13)(5, 21, 6, 18)(7, 9, 11, 25)(8, 22, 15, 23)
$4C_3 \cup C_6 \cup C_7$	(1, 24, 4, 11, 25, 7, 17)(2, 19, 16, 6, 8, 18)(3, 13, 20)(5, 12, 22)(9, 10, 21)(14, 15, 23)
$C_3 \cup 3C_5 \cup C_7$	(1, 17, 10, 4, 24)(2, 19, 18, 5, 21, 3, 13)(6, 16, 14)(7, 12, 22, 11, 25)(8, 9, 20, 15, 23)
$2C_4 \cup 2C_5 \cup C_7$	(1, 17, 10, 4, 24)(2, 19, 3, 16, 13)(5, 12, 21, 14, 20, 6, 18)(7, 9, 11, 25)(8, 22, 15, 23)
$3C_3 \cup C_4 \cup C_5 \cup C_7$	(1, 24, 4, 18, 17)(2, 19, 14, 13)(3, 21, 16)(5, 12, 22, 7, 25, 11, 9)(6, 10, 20)(8, 15, 23)
$2C_3 \cup 3C_4 \cup C_7$	(1, 17, 5, 14, 10, 4, 24)(2, 19, 18)(3, 12, 21, 13)(6, 20, 15, 23)(7, 16, 11, 25)(8, 22, 9)
$6C_3 \cup C_7$	(1, 17, 19)(2, 13, 22)(3, 14, 20)(4, 24, 5, 25, 6, 8, 18)(7, 12, 9)(10, 15, 23)(11, 21, 16)
$C_3 \cup C_4 \cup 3C_6$	(1, 16, 22)(2, 20, 4, 15, 11, 23)(3, 18, 17, 10, 5, 13)(6, 8, 21, 9, 19, 14)(7, 24, 12, 25)
$C_3 \cup 2C_5 \cup 2C_6$	(1, 22, 14, 19, 16)(2, 23, 5, 9, 20)(3, 18, 6, 21, 17, 13)(4, 15, 11)(7, 24, 10, 8, 12, 25)
$2C_4 \cup C_5 \cup 2C_6$	(1, 16, 18, 3, 13, 22)(2, 20, 8, 6, 23)(4, 14, 19, 11, 9, 15)(5, 21, 17, 10)(7, 24, 12, 25)
$3C_3 \cup C_4 \cup 2C_6$	(1, 16, 22)(2, 20, 6, 8, 10, 23)(3, 21, 13)(4, 11, 19, 9, 18, 17)(5, 15, 14)(7, 24, 12, 25)
$C_4 \cup 3C_5 \cup C_6$	(1, 22, 8, 10, 16)(2, 20, 15, 4, 23)(3, 13, 21, 17, 11, 18)(5, 9, 6, 14, 19)(7, 24, 12, 25)
$3C_3 \cup 2C_5 \cup C_6$	(1, 16, 22)(2, 20, 15, 5, 23)(3, 21, 13)(4, 14, 19, 17, 10)(6, 24, 7, 25, 12, 9)(8, 11, 18)
$2C_3 \cup 2C_4 \cup C_5 \cup C_6$	(1, 16, 22)(2, 23, 5, 10, 20)(3, 18, 17, 9, 11, 13)(4, 15, 19, 14)(6, 21, 8)(7, 24, 12, 25)
$C_3 \cup 4C_4 \cup C_6$	(1, 22, 8, 11, 18, 16)(2, 20, 15, 23)(3, 21, 5, 13)(4, 10, 17)(6, 9, 19, 14)(7, 24, 12, 25)
$5C_3 \cup C_4 \cup C_6$	(1, 16, 22)(2, 23, 4, 11, 18, 17)(3, 19, 15)(5, 21, 9)(6, 14, 10)(7, 24, 12, 25)(8, 13, 20)
$5C_5$	(1, 16, 6, 25, 13)(2, 22, 3, 23, 14)(4, 24, 8, 10, 11)(5, 18, 17, 19, 15)(7, 12, 21, 9, 20)
$2C_3 \cup C_4 \cup 3C_5$	(1, 16, 6, 25, 13)(2, 21, 12, 18, 17)(3, 22, 14, 23)(4, 24, 8, 10, 11)(5, 15, 19)(7, 9, 20)
$C_3 \cup 3C_4 \cup 2C_5$	(1, 16, 6, 25, 13)(2, 19, 17)(3, 21, 14, 23)(4, 24, 8, 22, 12)(5, 18, 15, 10)(7, 20, 9, 11)
$5C_3 \cup 2C_5$	(1, 16, 6, 25, 13)(2, 19, 14)(3, 22, 15)(4, 23, 11)(5, 18, 17, 7, 21)(8, 12, 24)(9, 10, 20)
$5C_4 \cup C_5$	(1, 16, 6, 25, 13)(2, 21, 3, 18)(4, 11, 14, 12)(5, 22, 7, 23)(8, 10, 9, 24)(15, 19, 17, 20)
$4C_3 \cup 2C_4 \cup C_5$	(1, 16, 6, 25, 13)(2, 19, 17)(3, 12, 23)(4, 21, 8, 24)(5, 22, 15, 18)(7, 9, 11)(10, 20, 14)
$3C_3 \cup 4C_4$	(1, 20, 17)(2, 18, 12)(3, 16, 13, 14)(4, 21, 5, 19)(6, 22, 10)(7, 15, 23, 8)(9, 24, 11, 25)
$7C_3 \cup C_4$	(1, 20, 5, 17)(2, 12, 21)(3, 14, 24)(4, 22, 15)(6, 10, 18)(7, 23, 8)(9, 11, 25)(13, 19, 16)

Table 16: Strong VMTLs of the first 70 two-regular graphs of order 27.

Graph	Edge Labels
C_{27}	(1, 21, 4, 23, 8, 13, 24, 14, 25, 10, 5, 27, 3, 20, 16, 17, 12, 6, 11, 9, 7, 19, 15, 26, 2, 22, 18)
$C_3 \cup C_{24}$	(1, 22, 18, 21, 5, 10, 12, 7, 11, 17, 3, 13, 20, 16, 25, 2, 27, 4, 26, 9, 8, 24, 14, 23)(6, 15, 19)
$C_4 \cup C_{23}$	(1, 20, 8, 12, 5, 10, 22, 15, 19, 11, 27, 9, 13, 3, 16, 25, 14, 4, 21, 2, 24, 7, 26)(6, 18, 17, 23)
$C_5 \cup C_{22}$	(1, 24, 15, 26, 5, 23, 4, 16, 10, 25, 7, 14, 20, 13, 3, 27, 2, 22, 18, 19, 17, 21)(6, 12, 11, 8, 9)
$C_6 \cup C_{21}$	(1, 17, 13, 19, 5, 11, 9, 6, 27, 10, 25, 15, 26, 2, 21, 8, 18, 4, 23, 16, 20)(3, 22, 12, 7, 24, 14)
$2C_3 \cup C_{21}$	(1, 20, 16, 13, 6, 27, 10, 25, 15, 26, 2, 21, 5, 19, 8, 7, 24, 14, 3, 22, 17)(4, 12, 18)(9, 23, 11)
$C_7 \cup C_{20}$	(1, 20, 11, 6, 16, 4, 15, 17, 7, 23, 3, 12, 26, 2, 14, 25, 10, 27, 9, 24)(5, 13, 21, 8, 19, 22, 18)
$C_3 \cup C_4 \cup C_{20}$	(1, 20, 7, 17, 15, 4, 16, 6, 11, 23, 3, 12, 26, 2, 14, 25, 10, 27, 9, 24)(5, 13, 18)(8, 21, 19, 22)
$C_8 \cup C_{19}$	(1, 15, 23, 12, 27, 14, 20, 9, 21, 6, 17, 19, 2, 22, 3, 16, 24, 8, 25)(4, 11, 26, 5, 13, 7, 10, 18)
$C_3 \cup C_5 \cup C_{19}$	(1, 15, 25)(2, 22, 10, 8, 19)(3, 20, 18, 17, 16, 6, 9, 11, 26, 5, 24, 4, 21, 13, 23, 7, 12, 27, 14)
$2C_4 \cup C_{19}$	(1, 15, 23, 11, 26, 5, 10, 18, 17, 19, 2, 22, 7, 20, 3, 16, 24, 8, 25)(4, 13, 9, 21)(6, 12, 27, 14)
$C_9 \cup C_{18}$	(1, 18, 19, 15, 26, 7, 25, 11, 24, 14, 8, 22, 6, 9, 12, 27, 2, 16)(3, 17, 23, 4, 20, 5, 21, 10, 13)
$C_3 \cup C_6 \cup C_{18}$	(1, 16, 2, 27, 12, 18)(3, 17, 19, 21, 5, 20, 4, 23, 8, 14, 9, 6, 22, 15, 26, 7, 25, 13)(10, 24, 11)
$C_4 \cup C_5 \cup C_{18}$	(1, 18, 8, 14, 24, 6, 9, 22, 15, 26, 7, 25, 10, 11, 12, 27, 2, 16)(3, 13, 21, 19, 17)(4, 20, 5, 23)
$3C_3 \cup C_{18}$	(1, 18, 5, 23, 15, 26, 7, 25, 10, 24, 13, 3, 17, 9, 12, 27, 2, 16)(4, 11, 20)(6, 21, 19)(8, 14, 22)
$C_{10} \cup C_{17}$	(1, 15, 19, 18, 21, 10, 9, 23, 3, 24)(2, 13, 5, 12, 26, 14, 6, 27, 8, 22, 7, 16, 25, 11, 17, 4, 20)
$C_3 \cup C_7 \cup C_{17}$	(1, 15, 5, 12, 26, 14, 22, 17, 4, 20, 2, 13, 21, 9, 23, 3, 24)(6, 27, 8, 11, 7, 16, 25)(10, 19, 18)
$C_4 \cup C_6 \cup C_{17}$	(1, 15, 5, 18, 16, 25, 6, 27, 8, 10, 9, 12, 26, 14, 23, 3, 24)(2, 20, 4, 13)(7, 21, 11, 19, 17, 22)
$2C_5 \cup C_{17}$	(1, 15, 19, 18, 14, 26, 12, 5, 16, 25, 4, 20, 2, 13, 23, 3, 24)(6, 17, 22, 8, 27)(7, 11, 9, 10, 21)
$2C_3 \cup C_4 \cup C_{17}$	(1, 24, 3, 23, 7, 21, 11, 9, 10, 8, 27, 6, 25, 12, 26, 14, 15)(2, 20, 4, 13)(5, 18, 16)(17, 19, 22)
$C_{11} \cup C_{16}$	(1, 19, 13, 25, 3, 22, 2, 24, 9, 6, 16)(4, 17, 23, 7, 12, 15, 20, 11, 5, 18, 21, 8, 26, 10, 27, 14)
$C_3 \cup C_8 \cup C_{16}$	(1, 16, 7, 23, 8, 26, 10, 27, 14, 4, 17, 5, 11, 18, 21, 19)(2, 24, 9, 6, 13, 25, 3, 22)(12, 20, 15)
$C_4 \cup C_7 \cup C_{16}$	(1, 19, 21, 18, 5, 11, 16)(2, 24, 9, 6, 23, 8, 26, 10, 27, 14, 4, 17, 13, 25, 3, 22)(7, 12, 20, 15)
$C_5 \cup C_6 \cup C_{16}$	(1, 19, 21, 18, 15, 16)(2, 22, 3, 25, 13, 8, 26, 10, 27, 14, 4, 11, 5, 17, 6, 24)(7, 12, 23, 9, 20)
$2C_3 \cup C_5 \cup C_{16}$	(1, 19, 20, 13, 16)(2, 22, 3, 25, 15, 23, 8, 26, 10, 27, 14, 4, 11, 21, 6, 24)(5, 18, 17)(7, 9, 12)
$C_3 \cup 2C_4 \cup C_{16}$	(1, 16, 24, 2, 22, 3, 25, 8, 26, 10, 27, 14, 4, 17, 12, 19)(5, 11, 21, 18)(6, 9, 13)(7, 20, 15, 23)
$C_{12} \cup C_{15}$	(1, 23, 3, 24, 5, 14, 7, 9, 8, 26, 6, 22, 11, 4, 19)(2, 16, 25, 15, 21, 10, 27, 12, 13, 17, 18, 20)
$C_3 \cup C_9 \cup C_{15}$	(1, 23, 3, 24, 14, 5, 11, 4, 19)(2, 16, 9, 12, 27, 10, 7, 22, 6, 26, 8, 25, 15, 21, 20)(13, 18, 17)
$C_4 \cup C_8 \cup C_{15}$	(1, 23, 3, 24, 5, 11, 4, 19)(2, 16, 25, 15, 6, 26, 8, 9, 10, 27, 12, 21, 7, 18, 20)(13, 22, 14, 17)
$C_5 \cup C_7 \cup C_{15}$	(1, 23, 3, 24, 11, 4, 19)(2, 16, 25, 15, 18, 13, 17, 21, 8, 26, 6, 22, 14, 5, 20)(7, 9, 12, 27, 10)
$2C_6 \cup C_{15}$	(1, 19, 4, 11, 14, 5, 16, 2, 20, 18, 13, 17, 24, 3, 23)(6, 22, 7, 9, 8, 26)(10, 25, 15, 21, 12, 27)
$2C_3 \cup C_6 \cup C_{15}$	(1, 19, 4, 11, 5, 12, 27, 10, 9, 21, 14, 17, 24, 3, 23)(2, 20, 16)(6, 15, 13, 25, 8, 26)(7, 18, 22)
$C_3 \cup C_4 \cup C_5 \cup C_{15}$	(1, 19, 4, 11, 8, 26, 6, 15, 10, 27, 12, 5, 24, 3, 23)(2, 16, 25, 13, 20)(7, 21, 9)(14, 17, 18, 22)
$3C_4 \cup C_{15}$	(1, 19, 4, 15, 20, 2, 16, 25, 13, 17, 11, 5, 24, 3, 23)(6, 9, 8, 26)(7, 14, 22, 18)(10, 21, 12, 27)
$4C_3 \cup C_{15}$	(1, 23, 3, 24, 4, 11, 5, 14, 21, 17, 13, 10, 27, 12, 19)(2, 20, 16)(6, 15, 26)(7, 18, 22)(8, 9, 25)
$C_{13} \cup C_{14}$	(1, 22, 17, 23, 2, 18, 16, 25, 5, 26, 3, 19, 14)(4, 13, 8, 24, 11, 27, 10, 9, 15, 21, 7, 20, 6, 12)
$C_3 \cup C_{10} \cup C_{14}$	(1, 14, 22)(2, 18, 21, 6, 20, 8, 13, 4, 12, 23)(3, 19, 15, 17, 7, 11, 27, 10, 9, 24, 16, 25, 5, 26)
$C_4 \cup C_9 \cup C_{14}$	(1, 22, 17, 7, 21, 15, 6, 20, 14)(2, 18, 9, 24, 16, 25, 5, 26, 3, 19, 13, 4, 12, 23)(8, 11, 27, 10)
$C_5 \cup C_8 \cup C_{14}$	(1, 22, 18, 2, 23, 16, 25, 5, 26, 3, 19, 15, 21, 14)(4, 12, 9, 24, 8, 20, 6, 13)(7, 11, 27, 10, 17)
$C_6 \cup C_7 \cup C_{14}$	(1, 14, 20, 7, 17, 23, 2, 18, 8, 13, 4, 12, 6, 22)(3, 19, 16, 25, 5, 26)(9, 10, 27, 11, 21, 15, 24)
$2C_3 \cup C_7 \cup C_{14}$	(1, 14, 22)(2, 23, 16, 25, 5, 26, 3, 19, 21, 13, 15, 20, 6, 18)(4, 17, 10, 27, 11, 7, 12)(8, 9, 24)
$C_3 \cup C_4 \cup C_6 \cup C_{14}$	(1, 22, 18, 2, 23, 16, 25, 5, 26, 3, 19, 15, 21, 14)(4, 13, 6, 12)(7, 17, 9, 24, 8, 20)(10, 11, 27)
$C_3 \cup 2C_5 \cup C_{14}$	(1, 14, 22)(2, 23, 17, 16, 25, 5, 26, 3, 19, 20, 6, 15, 9, 18)(4, 12, 7, 21, 13)(8, 10, 27, 11, 24)
$2C_4 \cup C_5 \cup C_{14}$	(1, 22, 12, 4, 14)(2, 23, 9, 18)(3, 19, 21, 15, 24, 11, 27, 10, 7, 17, 16, 25, 5, 26)(6, 20, 8, 13)
$3C_3 \cup C_4 \cup C_{14}$	(1, 14, 22)(2, 18, 17, 23)(3, 19, 20, 6, 24, 9, 8, 16, 25, 7, 21, 13, 5, 26)(4, 12, 15)(10, 11, 27)
$C_3 \cup C_{11} \cup C_{13}$	(1, 16, 4, 14, 24, 15, 18, 6, 25, 9, 27)(2, 21, 20, 12, 7, 19, 3, 26, 11, 5, 10, 17, 23)(8, 13, 22)
$C_4 \cup C_{10} \cup C_{13}$	(1, 27, 9, 25, 6, 24, 15, 12, 4, 16)(2, 21, 20, 18, 8, 11, 26, 3, 19, 14, 7, 17, 23)(5, 13, 22, 10)
$C_5 \cup C_9 \cup C_{13}$	(1, 27, 9, 25, 6, 10, 5, 13, 8, 24, 15, 4, 16)(2, 21, 14, 12, 18, 20, 7, 17, 23)(3, 19, 22, 11, 26)
$C_6 \cup C_8 \cup C_{13}$	(1, 27, 9, 25, 6, 12, 4, 16)(2, 21, 20, 18, 15, 24, 11, 26, 3, 19, 7, 17, 23)(5, 10, 22, 8, 13, 14)
$2C_3 \cup C_8 \cup C_{13}$	(1, 16, 4, 12, 6, 25, 9, 27)(2, 23, 17, 24, 15, 18, 20, 7, 19, 3, 26, 11, 21)(5, 10, 14)(8, 13, 22)
$2C_7 \cup C_{13}$	(1, 16, 4, 17, 23, 2, 21, 20, 10, 6, 25, 9, 27)(3, 19, 5, 13, 22, 11, 26)(7, 8, 18, 14, 24, 15, 12)
$C_3 \cup C_4 \cup C_7 \cup C_{13}$	(1, 27, 9, 25, 6, 21, 2, 23, 7, 14, 12, 4, 16)(3, 26, 11, 8, 10, 5, 19)(13, 20, 18, 22)(15, 17, 24)
$C_3 \cup C_5 \cup C_6 \cup C_{13}$	(1, 16, 4, 12, 15, 20, 13, 8, 24, 6, 25, 9, 27)(2, 21, 17, 22, 18, 23)(3, 26, 11, 7, 19)(5, 10, 14)
$2C_4 \cup C_6 \cup C_{13}$	(1, 16, 23, 2, 21, 5, 15, 4, 12, 6, 25, 9, 27)(3, 26, 11, 19)(7, 14, 10, 17, 24, 8)(13, 20, 18, 22)
$C_4 \cup 2C_5 \cup C_{13}$	(1, 16, 4, 12, 23, 2, 21, 20, 13, 6, 25, 9, 27)(3, 26, 11, 19)(5, 10, 8, 18, 22)(7, 17, 15, 24, 14)
$3C_3 \cup C_5 \cup C_{13}$	(1, 16, 24, 15, 23, 2, 21, 12, 20, 6, 25, 9, 27)(3, 26, 11, 7, 13)(4, 18, 17)(5, 10, 14)(8, 19, 22)
$2C_3 \cup 2C_4 \cup C_{13}$	(1, 16, 5, 21, 2, 23, 4, 14, 10, 6, 25, 9, 27)(3, 26, 11, 19)(7, 8, 12)(13, 20, 18, 22)(15, 17, 24)
$C_3 \cup 2C_{12}$	(1, 21, 3, 23, 2, 13, 8, 22, 9, 25, 15, 26)(4, 16, 7, 11, 6, 10, 19, 14, 5, 27, 12, 24)(17, 20, 18)
$C_4 \cup C_{11} \cup C_{12}$	(1, 21, 3, 23, 2, 13, 22, 9, 25, 15, 26)(4, 17, 6, 10, 7, 11, 8, 20, 18, 19, 14, 16)(5, 27, 12, 24)
$C_5 \cup C_{10} \cup C_{12}$	(1, 21, 3, 23, 2, 13, 7, 22, 9, 25, 15, 26)(4, 19, 18, 17, 16, 5, 27, 12, 24, 14)(6, 10, 20, 8, 11)
$C_6 \cup C_9 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 20, 8, 9, 25, 15, 26)(4, 14, 5, 27, 12, 24, 7, 22, 16)(6, 10, 11, 19, 18, 17)
$2C_3 \cup C_9 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 22, 14, 9, 25, 15, 26)(4, 17, 16)(5, 27, 12)(6, 24, 7, 11, 8, 20, 18, 19, 10)
$C_7 \cup C_8 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 8, 22, 9, 25, 15, 26)(4, 16, 19, 14, 5, 27, 12, 24)(6, 17, 20, 18, 11, 7, 10)
$C_3 \cup C_4 \cup C_8 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 8, 10, 9, 25, 15, 26)(4, 16, 14, 19)(5, 27, 12, 24, 7, 22, 6, 11)(17, 20, 18)
$C_3 \cup C_5 \cup C_7 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 24, 7, 9, 25, 15, 26)(4, 17, 6, 22, 14, 19, 16)(5, 27, 12)(8, 11, 18, 20, 10)
$2C_4 \cup C_7 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 7, 22, 9, 25, 15, 26)(4, 17, 20, 16, 19, 14, 24)(5, 27, 12, 18)(6, 10, 8, 11)
$C_3 \cup 2C_6 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 6, 14, 4, 25, 15, 26)(5, 27, 12, 11, 22, 16)(7, 9, 8, 20, 10, 24)(17, 19, 18)
$C_4 \cup C_5 \cup C_6 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 20, 8, 9, 25, 15, 26)(4, 14, 22, 16)(5, 27, 12, 7, 24)(6, 10, 11, 19, 18, 17)
$3C_3 \cup C_6 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 20, 10, 6, 25, 15, 26)(4, 14, 24)(5, 27, 12, 22, 7, 16)(8, 9, 11)(17, 18, 19)
$3C_5 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 5, 27, 12, 25, 15, 26)(4, 16, 20, 18, 17)(6, 10, 24, 7, 22)(8, 9, 14, 19, 11)

Table 17: Strong VMTLs of the next 70 two-regular graphs of order 27.

Graph	Edge Labels
$2C_3 \cup C_4 \cup C_5 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 24, 7, 9, 25, 15, 26)(4, 19, 16, 17)(5, 27, 12)(6, 14, 22)(8, 11, 18, 20, 10)
$C_3 \cup 3C_4 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 8, 20, 17, 19, 15, 26)(4, 14, 6, 25)(5, 27, 12, 18)(7, 10, 9)(11, 22, 16, 24)
$5C_3 \cup C_{12}$	(1, 21, 3, 23, 2, 13, 5, 27, 12, 4, 15, 26)(6, 14, 22)(7, 16, 24)(8, 9, 25)(10, 11, 19)(17, 20, 18)
$C_5 \cup 2C_{11}$	(1, 25, 3, 21, 20)(2, 15, 10, 12, 7, 23, 4, 19, 17, 22, 16)(5, 26, 8, 27, 13, 24, 9, 6, 14, 18, 11)
$C_6 \cup C_{10} \cup C_{11}$	(1, 25, 3, 17, 22, 16, 2, 15, 21, 20)(4, 23, 7, 12, 10, 19)(5, 26, 8, 27, 13, 24, 9, 6, 18, 14, 11)
$2C_3 \cup C_{10} \cup C_{11}$	(1, 20, 16, 2, 15, 12, 7, 22, 3, 25)(4, 11, 19)(5, 17, 21, 18, 23, 9, 24, 13, 27, 8, 26)(6, 10, 14)
$C_7 \cup C_9 \cup C_{11}$	(1, 25, 3, 12, 18, 21, 20)(2, 15, 7, 17, 19, 4, 23, 6, 10, 22, 16)(5, 26, 8, 27, 13, 24, 9, 11, 14)
$C_3 \cup C_4 \cup C_9 \cup C_{11}$	(1, 20, 3, 25)(2, 15, 12, 4, 11, 21, 17, 22, 14, 6, 16)(5, 26, 8, 27, 13, 24, 9, 10, 19)(7, 18, 23)
$2C_8 \cup C_{11}$	(1, 20, 19, 4, 12, 17, 3, 25)(2, 16, 22, 14, 11, 21, 6, 18, 23, 7, 15)(5, 26, 8, 27, 13, 24, 9, 10)
$C_3 \cup C_5 \cup C_8 \cup C_{11}$	(1, 20, 12, 3, 25)(2, 16, 6, 21, 17, 22, 14, 10, 19, 4, 15)(5, 26, 8, 27, 13, 24, 9, 11)(7, 18, 23)
$2C_4 \cup C_8 \cup C_{11}$	(1, 20, 3, 25)(2, 15, 23, 16)(4, 21, 11, 19, 22, 14, 6, 18)(5, 26, 8, 27, 13, 24, 9, 7, 12, 17, 10)
$C_3 \cup C_6 \cup C_7 \cup C_{11}$	(1, 20, 12, 17, 21, 3, 25)(2, 15, 7, 18, 23, 16)(4, 11, 19)(5, 26, 8, 27, 13, 24, 9, 10, 6, 14, 22)
$C_4 \cup C_5 \cup C_7 \cup C_{11}$	(1, 20, 3, 25)(2, 15, 14, 6, 18, 23, 16)(4, 11, 19, 17, 21)(5, 26, 8, 27, 13, 24, 9, 7, 12, 10, 22)
$3C_3 \cup C_7 \cup C_{11}$	(1, 20, 19, 4, 12, 3, 25)(2, 15, 21, 17, 24, 13, 27, 8, 26, 5, 22)(6, 16, 14)(7, 11, 18)(9, 10, 23)
$C_4 \cup 2C_6 \cup C_{11}$	(1, 20, 3, 25)(2, 15, 23, 6, 14, 16)(4, 11, 5, 26, 8, 27, 13, 24, 9, 18, 21)(7, 17, 19, 22, 10, 12)
$2C_5 \cup C_6 \cup C_{11}$	(1, 20, 12, 3, 25)(2, 15, 4, 23, 7, 16)(5, 26, 8, 27, 13, 24, 9, 11, 18, 21, 17)(6, 19, 22, 14, 10)
$2C_3 \cup C_4 \cup C_6 \cup C_{11}$	(1, 20, 2, 15, 3, 25)(4, 11, 5, 26, 8, 27, 13, 24, 9, 23, 16)(6, 17, 21)(7, 18, 12)(10, 19, 22, 14)
$2C_3 \cup 2C_5 \cup C_{11}$	(1, 20, 12, 3, 25)(2, 17, 5, 26, 8, 27, 13, 24, 9, 21, 15)(4, 19, 22, 16, 23)(6, 10, 14)(7, 11, 18)
$C_3 \cup 2C_4 \cup C_5 \cup C_{11}$	(1, 20, 3, 25)(2, 15, 23, 16)(4, 11, 21)(5, 26, 8, 27, 13, 24, 9, 18, 12, 7, 17)(6, 10, 19, 22, 14)
$4C_4 \cup C_{11}$	(1, 20, 3, 25)(2, 14, 10, 15)(4, 18, 23, 16)(5, 26, 8, 27, 13, 24, 9, 6, 12, 7, 22)(11, 19, 17, 21)
$4C_3 \cup C_4 \cup C_{11}$	(1, 20, 7, 25)(2, 23, 15)(3, 16, 21)(4, 14, 6, 10, 5, 26, 8, 27, 13, 9, 24)(11, 18, 12)(17, 19, 22)
$C_7 \cup 2C_{10}$	(1, 23, 2, 24, 15, 26, 14, 22, 16, 19)(3, 20, 11, 17, 10, 8, 21, 13, 4, 18)(5, 25, 12, 7, 9, 6, 27)
$C_3 \cup C_4 \cup 2C_{10}$	(1, 23, 2, 24, 13, 4, 18, 3, 20, 19)(5, 27, 6, 10, 17, 12, 16, 22, 9, 25)(7, 11, 8)(14, 21, 15, 26)
$C_8 \cup C_9 \cup C_{10}$	(1, 23, 2, 24, 15, 26, 14, 21, 17, 19)(3, 20, 8, 7, 11, 16, 13, 4, 18)(5, 25, 12, 22, 9, 10, 6, 27)
$C_3 \cup C_5 \cup C_9 \cup C_{10}$	(1, 19, 17, 22, 16, 11, 24, 2, 23)(3, 20, 8, 7, 9, 10, 21, 13, 4, 18)(5, 27, 6, 12, 25)(14, 15, 26)
$2C_4 \cup C_9 \cup C_{10}$	(1, 23, 2, 24, 11, 4, 18, 3, 20, 19)(5, 25, 6, 27)(7, 12, 16, 13, 21, 17, 10, 8, 9)(14, 22, 15, 26)
$C_3 \cup C_6 \cup C_8 \cup C_{10}$	(1, 23, 2, 24, 12, 19)(3, 20, 8, 9, 7, 11, 4, 18)(5, 25, 10, 17, 22, 16, 21, 13, 6, 27)(14, 15, 26)
$C_4 \cup C_5 \cup C_8 \cup C_{10}$	(1, 19, 10, 8, 9, 7, 12, 24, 2, 23)(3, 20, 17, 22, 16, 11, 4, 18)(5, 25, 6, 27)(13, 15, 26, 14, 21)
$3C_3 \cup C_8 \cup C_{10}$	(1, 19, 17, 22, 13, 21, 7, 24, 2, 23)(3, 18, 20)(4, 11, 16, 6, 27, 5, 25, 12)(8, 9, 10)(14, 15, 26)
$C_3 \cup 2C_7 \cup C_{10}$	(1, 19, 10, 21, 17, 22, 13, 24, 2, 23)(3, 18, 4, 15, 26, 14, 20)(5, 25, 11, 16, 12, 6, 27)(7, 9, 8)
$C_4 \cup C_6 \cup C_7 \cup C_{10}$	(1, 23, 2, 24, 15, 26, 14, 21, 17, 19)(3, 18, 4, 13, 16, 11, 20)(5, 25, 12, 22, 6, 27)(7, 9, 10, 8)
$2C_5 \cup C_7 \cup C_{10}$	(1, 23, 2, 24, 10, 8, 9, 7, 12, 19)(3, 20, 17, 21, 18)(4, 11, 16, 6, 27, 5, 25)(13, 15, 26, 14, 22)
$2C_3 \cup C_4 \cup C_7 \cup C_{10}$	(1, 23, 2, 24, 12, 4, 18, 3, 20, 19)(5, 27, 6, 13, 22, 9, 25)(7, 10, 8)(11, 16, 21, 17)(14, 15, 26)
$C_5 \cup 2C_6 \cup C_{10}$	(1, 23, 2, 24, 11, 7, 8, 9, 10, 19)(3, 20, 16, 12, 4, 18)(5, 25, 13, 21, 6, 27)(14, 17, 22, 15, 26)
$2C_3 \cup C_5 \cup C_6 \cup C_{10}$	(1, 19, 17, 10, 12, 4, 13, 24, 2, 23)(3, 15, 26, 14, 21, 18)(5, 27, 6, 9, 25)(7, 16, 22)(8, 20, 11)
$C_3 \cup 2C_4 \cup C_6 \cup C_{10}$	(1, 23, 2, 24, 12, 4, 18, 3, 20, 19)(5, 25, 6, 27)(7, 11, 17, 10, 9, 8)(13, 22, 16, 21)(14, 15, 26)
$C_3 \cup C_4 \cup 2C_5 \cup C_{10}$	(1, 19, 4, 12, 15, 26, 14, 24, 2, 23)(3, 18, 16)(5, 25, 11, 6, 27)(7, 21, 10, 8)(9, 20, 17, 22, 13)
$3C_4 \cup C_5 \cup C_{10}$	(1, 23, 2, 24, 13, 4, 18, 3, 20, 19)(5, 25, 6, 27)(7, 9, 10, 8)(11, 17, 12, 22, 16)(14, 21, 15, 26)
$4C_3 \cup C_5 \cup C_{10}$	(1, 23, 2, 24, 6, 27, 5, 11, 20, 19)(3, 25, 12)(4, 18, 17)(7, 16, 22)(8, 9, 10)(13, 21, 15, 26, 14)
$3C_3 \cup 2C_4 \cup C_{10}$	(1, 19, 9, 22, 5, 27, 6, 24, 2, 23)(3, 13, 16)(4, 17, 21, 18)(7, 10, 8)(11, 12, 25)(14, 20, 15, 26)
$3C_9$	(1, 18, 3, 12, 21, 15, 20, 4, 22)(2, 26, 5, 17, 24, 16, 9, 25, 14)(6, 11, 27, 10, 8, 19, 13, 7, 23)
$C_3 \cup C_6 \cup 2C_9$	(1, 22, 11, 27, 10, 8, 12, 3, 18)(2, 14, 25, 9, 16, 6, 24, 5, 26)(4, 13, 19, 7, 17, 23)(15, 21, 20)
$C_4 \cup C_5 \cup 2C_9$	(1, 22, 13, 17, 23, 6, 12, 3, 18)(2, 26, 5, 19, 8, 24, 9, 25, 14)(4, 21, 20, 16)(7, 15, 11, 27, 10)
$3C_3 \cup 2C_9$	(1, 18, 22)(2, 26, 5, 12, 3, 24, 9, 25, 14)(4, 17, 15, 11, 27, 10, 8, 21, 20)(6, 19, 16)(7, 13, 23)
$C_3 \cup C_7 \cup C_8 \cup C_9$	(1, 18, 3, 12, 8, 24, 16, 19, 22)(2, 14, 25, 9, 17, 5, 26)(4, 13, 20)(6, 23, 7, 11, 27, 10, 15, 21)
$C_4 \cup C_6 \cup C_8 \cup C_9$	(1, 22, 4, 20, 13, 12, 3, 18)(2, 14, 25, 9, 23, 7, 15, 5, 26)(6, 11, 27, 10, 8, 21)(16, 19, 17, 24)
$2C_5 \cup C_8 \cup C_9$	(1, 18, 3, 12, 8, 24, 16, 19, 22)(2, 14, 25, 9, 17, 13, 5, 26)(4, 21, 15, 7, 20)(6, 11, 27, 10, 23)
$2C_3 \cup C_4 \cup C_8 \cup C_9$	(1, 18, 3, 12, 8, 10, 27, 11, 22)(2, 26, 5, 21, 20, 9, 25, 14)(4, 13, 23)(6, 19, 16, 24)(7, 17, 15)
$C_4 \cup 2C_7 \cup C_9$	(1, 18, 3, 12, 23, 4, 22)(2, 14, 25, 9, 15, 5, 26)(6, 16, 24, 8, 21, 20, 13, 17, 19)(7, 11, 27, 10)
$C_5 \cup C_6 \cup C_7 \cup C_9$	(1, 22, 8, 12, 3, 18)(2, 14, 25, 9, 13, 5, 26)(4, 21, 15, 17, 24, 16, 19, 7, 20)(6, 11, 27, 10, 23)
$2C_3 \cup C_5 \cup C_7 \cup C_9$	(1, 18, 22)(2, 14, 25, 9, 24, 5, 26)(3, 19, 8, 16, 10, 27, 11, 6, 12)(4, 21, 20, 15, 17)(7, 13, 23)
$C_3 \cup 2C_4 \cup C_7 \cup C_9$	(1, 22, 18)(2, 14, 25, 9, 24, 5, 26)(3, 12, 10, 27, 11, 6, 21, 20, 15)(4, 16, 8, 17)(7, 19, 13, 23)
$3C_6 \cup C_9$	(1, 22, 8, 12, 3, 18)(2, 26, 5, 19, 16, 24, 9, 25, 14)(4, 21, 20, 6, 23, 13)(7, 11, 27, 10, 17, 15)
$2C_3 \cup 2C_6 \cup C_9$	(1, 18, 22)(2, 14, 25, 9, 15, 3, 12, 5, 26)(4, 21, 20, 6, 16, 17)(7, 13, 23)(8, 24, 11, 27, 10, 19)
$C_3 \cup C_4 \cup C_5 \cup C_6 \cup C_9$	(1, 22, 8, 12, 3, 18)(2, 14, 25, 9, 23, 6, 21, 5, 26)(4, 13, 20)(7, 11, 27, 10, 15)(16, 19, 17, 24)
$3C_4 \cup C_6 \cup C_9$	(1, 18, 17, 23, 4, 22)(2, 14, 25, 9, 24, 6, 15, 5, 26)(3, 19, 13, 12)(7, 11, 27, 10)(8, 21, 20, 16)
$4C_3 \cup C_6 \cup C_9$	(1, 18, 22)(2, 14, 25, 10, 27, 11, 16, 5, 26)(3, 17, 13, 23, 6, 12)(4, 21, 20)(7, 19, 15)(8, 9, 24)
$C_3 \cup 3C_5 \cup C_9$	(1, 18, 23, 13, 22)(2, 14, 25, 9, 8, 21, 19, 5, 26)(3, 24, 6, 20, 12)(4, 17, 16)(7, 11, 27, 10, 15)
$2C_4 \cup 2C_5 \cup C_9$	(1, 22, 7, 18)(2, 26, 5, 21, 19, 8, 9, 25, 14)(3, 12, 20, 15)(4, 17, 24, 6, 16)(10, 27, 11, 13, 23)
$3C_3 \cup C_4 \cup C_5 \cup C_9$	(1, 18, 22)(2, 14, 25, 9, 12, 3, 19, 5, 26)(4, 13, 16)(6, 20, 15, 21)(7, 11, 27, 10, 23)(8, 17, 24)
$2C_3 \cup 3C_4 \cup C_9$	(1, 22, 4, 18)(2, 14, 25, 9, 16, 20, 15, 5, 26)(3, 21, 12)(6, 23, 17, 24)(7, 11, 27, 10)(8, 19, 13)
$6C_3 \cup C_9$	(1, 18, 16)(2, 26, 5, 15, 3, 24, 12, 4, 21)(6, 9, 20)(7, 17, 23)(8, 14, 25)(10, 27, 11)(13, 19, 22)
$C_3 \cup 3C_8$	(1, 19, 18, 21, 17, 24, 8, 27)(2, 25, 15, 9, 12, 22, 3, 20)(4, 11, 5, 26, 7, 10, 16, 14)(6, 13, 23)
$C_4 \cup C_7 \cup 2C_8$	(1, 19, 7, 26, 5, 24, 8, 27)(2, 20, 3, 22, 17, 21, 15, 25)(4, 13, 11, 10, 9, 6, 12)(14, 16, 18, 23)
$C_5 \cup C_6 \cup 2C_8$	(1, 19, 13, 4, 14, 16, 8, 27)(2, 20, 3, 22, 15, 25)(5, 26, 7, 12, 24)(6, 9, 17, 21, 18, 23, 11, 10)
$2C_3 \cup C_5 \cup 2C_8$	(1, 19, 7, 26, 5, 10, 8, 27)(2, 20, 3, 22, 14, 24, 15, 25)(4, 12, 17)(6, 13, 11)(9, 21, 16, 18, 23)
$C_3 \cup 2C_4 \cup 2C_8$	(1, 19, 7, 26, 5, 24, 8, 27)(2, 20, 3, 22, 17, 21, 15, 25)(4, 13, 11)(6, 10, 9, 12)(14, 16, 18, 23)
$C_5 \cup 2C_7 \cup C_8$	(1, 19, 13, 4, 11, 8, 27)(2, 20, 3, 22, 14, 23, 15, 25)(5, 26, 7, 17, 24)(6, 12, 9, 21, 18, 16, 10)
$2C_6 \cup C_7 \cup C_8$	(1, 19, 11, 13, 24, 8, 27)(2, 20, 3, 22, 17, 21, 15, 25)(4, 14, 7, 26, 5, 12)(6, 9, 10, 16, 18, 23)
$2C_3 \cup C_6 \cup C_7 \cup C_8$	(1, 19, 13, 4, 11, 8, 27)(2, 20, 3, 22, 15, 25)(5, 26, 7, 14, 10, 6, 12, 24)(9, 17, 21)(16, 18, 23)

Table 18: Strong VMTLs of the remaining 51 two-regular graphs of order 27.

Graph	Edge Labels
$C_3 \cup C_4 \cup C_5 \cup C_7 \cup C_8$	(1, 19, 17, 9, 21, 8, 27)(2, 20, 3, 22, 10, 6, 15, 25)(4, 14, 24, 13, 11)(5, 12, 7, 26)(16, 18, 23)
$3C_4 \cup C_7 \cup C_8$	(1, 19, 13, 6, 9, 8, 27)(2, 20, 3, 22, 4, 17, 12, 25)(5, 26, 7, 11)(10, 14, 16, 24)(15, 21, 18, 23)
$4C_3 \cup C_7 \cup C_8$	(1, 19, 11, 5, 10, 8, 27)(2, 20, 3, 22, 4, 13, 6, 25)(7, 26, 14)(9, 15, 23)(12, 17, 24)(16, 21, 18)
$C_3 \cup C_4 \cup 2C_6 \cup C_8$	(1, 19, 11, 21, 18, 16, 8, 27)(2, 20, 3, 22, 15, 25)(4, 12, 9, 17, 24, 14)(5, 10, 7, 26)(6, 13, 23)
$C_3 \cup 2C_5 \cup C_6 \cup C_8$	(1, 19, 10, 8, 27)(2, 20, 3, 22, 15, 25)(4, 13, 11, 21, 17)(5, 26, 7, 9, 6, 24, 12, 14)(16, 18, 23)
$2C_4 \cup C_5 \cup C_6 \cup C_8$	(1, 19, 11, 8, 27)(2, 20, 3, 22, 17, 21, 15, 25)(4, 14, 7, 26, 5, 12)(6, 18, 23, 9)(10, 16, 13, 24)
$3C_3 \cup C_4 \cup C_6 \cup C_8$	(1, 19, 10, 6, 12, 24, 8, 27)(2, 20, 3, 22, 15, 25)(4, 13, 11)(5, 26, 7, 14)(9, 17, 21)(16, 18, 23)
$C_4 \cup 3C_5 \cup C_8$	(1, 19, 13, 8, 27)(2, 20, 3, 22, 14, 23, 15, 25)(4, 11, 6, 12)(5, 26, 7, 17, 24)(9, 21, 18, 16, 10)
$3C_3 \cup 2C_5 \cup C_8$	(1, 19, 22, 8, 27)(2, 25, 13, 11, 4, 14, 3, 20)(5, 24, 12, 7, 26)(6, 10, 15)(9, 17, 23)(16, 21, 18)
$2C_3 \cup 2C_4 \cup C_5 \cup C_8$	(1, 19, 15, 21, 4, 13, 8, 27)(2, 25, 12, 3, 20)(5, 11, 7, 26)(6, 18, 23)(9, 17, 22, 10)(14, 16, 24)
$C_3 \cup 4C_4 \cup C_8$	(1, 19, 4, 12, 5, 21, 8, 27)(2, 20, 16, 25)(3, 18, 22)(6, 9, 10, 24)(7, 26, 13, 11)(14, 17, 15, 23)
$5C_3 \cup C_4 \cup C_8$	(1, 27, 8, 11, 25, 2, 20, 19)(3, 18, 22)(4, 14, 12)(5, 10, 7, 26)(6, 17, 24)(9, 15, 23)(13, 16, 21)
$C_6 \cup 3C_7$	(1, 20, 3, 22, 7, 27)(2, 13, 17, 15, 26, 12, 24)(4, 14, 23, 10, 25, 6, 16)(5, 11, 8, 9, 18, 21, 19)
$2C_3 \cup 3C_7$	(1, 27, 7, 17, 22, 3, 20)(2, 13, 23, 10, 9, 8, 24)(4, 14, 6, 25, 5, 11, 18)(12, 15, 26)(16, 21, 19)
$C_3 \cup C_4 \cup C_6 \cup 2C_7$	(1, 20, 3, 22, 7, 27)(2, 13, 24)(4, 15, 26, 12, 10, 8, 16)(5, 11, 6, 25)(9, 18, 21, 14, 19, 17, 23)
$C_3 \cup 2C_5 \cup 2C_7$	(1, 27, 7, 11, 22, 3, 20)(2, 24, 8, 9, 13)(4, 16, 23)(5, 25, 6, 10, 14)(12, 17, 18, 19, 21, 15, 26)
$2C_4 \cup C_5 \cup 2C_7$	(1, 20, 3, 22, 10, 7, 27)(2, 13, 9, 24)(4, 23, 14, 16)(5, 11, 8, 21, 18, 17, 19)(6, 25, 15, 26, 12)
$3C_3 \cup C_4 \cup 2C_7$	(1, 20, 3, 16, 23, 7, 27)(2, 13, 24)(4, 14, 18)(5, 22, 11, 9, 15, 26, 12)(6, 10, 25)(8, 21, 19, 17)
$C_3 \cup C_5 \cup 2C_6 \cup C_7$	(1, 20, 3, 22, 7, 27)(2, 24, 8, 9, 13)(4, 14, 5, 11, 19, 16)(6, 18, 21, 15, 26, 12, 25)(10, 17, 23)
$2C_4 \cup 2C_6 \cup C_7$	(1, 20, 3, 22, 7, 27)(2, 13, 14, 23, 9, 24)(4, 15, 26, 12, 10, 8, 16)(5, 25, 6, 11)(17, 18, 21, 19)
$C_4 \cup 2C_5 \cup C_6 \cup C_7$	(1, 20, 3, 22, 7, 27)(2, 24, 6, 25, 11, 5, 13)(4, 16, 21, 18)(8, 9, 10, 14, 19)(12, 23, 17, 15, 26)
$3C_3 \cup C_5 \cup C_6 \cup C_7$	(1, 20, 3, 22, 7, 27)(2, 13, 24)(4, 14, 16)(5, 19, 17)(6, 25, 15, 26, 12, 23, 10)(8, 11, 21, 18, 9)
$2C_3 \cup 2C_4 \cup C_6 \cup C_7$	(1, 20, 3, 22, 7, 27)(2, 13, 24)(4, 16, 19, 11, 5, 17, 23)(6, 25, 14, 18)(8, 9, 10)(12, 21, 15, 26)
$4C_5 \cup C_7$	(1, 20, 3, 17, 23, 7, 27)(2, 13, 22, 5, 24)(4, 14, 25, 11, 21)(6, 10, 9, 8, 16)(12, 19, 18, 15, 26)
$2C_3 \cup C_4 \cup 2C_5 \cup C_7$	(1, 20, 3, 21, 18, 7, 27)(2, 13, 24)(4, 25, 6, 16)(5, 11, 19, 14, 22)(8, 9, 10)(12, 23, 17, 15, 26)
$C_3 \cup 3C_4 \cup C_5 \cup C_7$	(1, 20, 3, 21, 18, 7, 27)(2, 24, 11, 5, 13)(4, 25, 6, 16)(8, 9, 10, 22)(12, 15, 26)(14, 19, 17, 23)
$5C_3 \cup C_5 \cup C_7$	(1, 20, 3, 19, 10, 7, 27)(2, 13, 24)(4, 16, 25, 8, 23)(5, 11, 14)(6, 26, 12)(9, 21, 15)(17, 18, 22)
$5C_4 \cup C_7$	(1, 27, 7, 18, 19, 3, 20)(2, 24, 5, 13)(4, 15, 26, 12)(6, 21, 9, 11)(8, 16, 17, 23)(10, 22, 14, 25)
$4C_3 \cup 2C_4 \cup C_7$	(1, 20, 3, 16, 9, 7, 27)(2, 13, 24)(4, 18, 6, 23)(5, 15, 26, 12)(8, 10, 25)(11, 21, 19)(14, 17, 22)
$C_3 \cup 4C_6$	(1, 20, 14, 24, 3, 15)(2, 27, 12, 5, 10, 21)(4, 22, 6, 16, 9, 26)(7, 13, 19, 18, 23, 17)(8, 25, 11)
$C_4 \cup C_5 \cup 3C_6$	(1, 15, 3, 24, 14, 20)(2, 27, 12, 5, 10, 21)(4, 22, 6, 16, 9, 26)(7, 13, 11, 8, 25)(17, 19, 18, 23)
$3C_3 \cup 3C_6$	(1, 20, 17, 24, 3, 15)(2, 27, 12, 23, 10, 21)(4, 26, 14, 5, 19, 13)(6, 16, 22)(7, 18, 8)(9, 25, 11)
$3C_5 \cup 2C_6$	(1, 20, 16, 24, 3, 15)(2, 27, 12, 8, 11, 21)(4, 13, 25, 9, 26)(5, 10, 23, 14, 17)(6, 18, 7, 19, 22)
$2C_3 \cup C_4 \cup C_5 \cup 2C_6$	(1, 20, 17, 24, 3, 15)(2, 21, 19, 12, 27)(4, 13, 23, 11, 9, 26)(5, 10, 14)(6, 16, 22)(7, 18, 8, 25)
$C_3 \cup 3C_4 \cup 2C_6$	(1, 15, 3, 24, 8, 20)(2, 27, 12, 21)(4, 11, 9, 26)(5, 19, 22, 14, 23, 17)(6, 25, 13)(7, 18, 16, 10)
$5C_3 \cup 2C_6$	(1, 20, 15)(2, 27, 12, 5, 10, 21)(3, 17, 24)(4, 26, 14)(6, 16, 22)(7, 18, 19)(8, 11, 13, 23, 9, 25)
$2C_3 \cup 3C_5 \cup C_6$	(1, 20, 13, 24, 3, 15)(2, 21, 7, 12, 27)(4, 26, 14, 6, 11)(5, 19, 17)(8, 18, 23)(9, 16, 22, 10, 25)
$C_3 \cup 2C_4 \cup 2C_5 \cup C_6$	(1, 20, 17, 24, 3, 15)(2, 27, 12, 21)(4, 16, 9, 26)(5, 14, 8, 7, 19)(6, 25, 13, 23, 11)(10, 18, 22)
$4C_4 \cup C_5 \cup C_6$	(1, 20, 17, 24, 3, 15)(2, 27, 12, 21)(4, 13, 9, 26)(5, 19, 6, 14)(7, 25, 11, 23, 8)(10, 18, 22, 16)
$4C_3 \cup C_4 \cup C_5 \cup C_6$	(1, 15, 3, 24, 14, 20)(2, 27, 12, 21)(4, 26, 11)(5, 19, 17)(6, 13, 7, 18, 22)(8, 23, 9)(10, 16, 25)
$3C_3 \cup 3C_4 \cup C_6$	(1, 20, 18, 10, 5, 15)(2, 27, 12, 21)(3, 24, 13, 22)(4, 26, 14)(6, 16, 25)(7, 19, 17)(8, 9, 23, 11)
$7C_3 \cup C_6$	(1, 17, 2, 13, 3, 26)(4, 19, 20)(11, 14, 21)(9, 12, 24)(6, 16, 25)(5, 15, 23)(7, 10, 27)(8, 18, 22)
$C_3 \cup C_4 \cup 4C_5$	(1, 21, 15, 18, 14)(2, 16, 25, 5, 24)(3, 17, 23, 4, 20)(6, 22, 12, 19)(7, 10, 9)(8, 27, 11, 26, 13)
$3C_4 \cup 3C_5$	(1, 21, 19, 17, 14)(2, 16, 25, 5, 18)(3, 22, 6, 23)(4, 15, 12, 20)(7, 10, 24, 9)(8, 27, 11, 26, 13)
$4C_3 \cup 3C_5$	(1, 21, 3, 17, 14)(2, 16, 25)(4, 19, 15)(5, 23, 9, 24, 12)(6, 10, 20)(7, 18, 22)(8, 27, 11, 26, 13)
$3C_3 \cup 2C_4 \cup 2C_5$	(1, 21, 3, 14)(2, 16, 24)(4, 25, 5, 15)(6, 19, 17)(7, 20, 12, 22, 9)(8, 27, 11, 26, 13)(10, 18, 23)
$2C_3 \cup 4C_4 \cup C_5$	(1, 21, 19, 14)(2, 18, 16)(3, 22, 4, 20)(5, 23, 6, 25)(7, 10, 9)(8, 27, 11, 26, 13)(12, 15, 17, 24)
$6C_3 \cup C_4 \cup C_5$	(1, 21, 20, 3, 14)(2, 18, 22)(4, 24, 12, 25)(5, 26, 13)(6, 19, 15)(7, 9, 23)(8, 27, 11)(10, 17, 16)
$C_3 \cup 6C_4$	(1, 18, 22, 17)(2, 24, 9, 15)(3, 25, 12, 26)(4, 19, 8, 27)(5, 10, 6, 16)(7, 13, 23)(11, 21, 20, 14)
$5C_3 \cup 3C_4$	(1, 18, 22, 17)(2, 19, 15)(3, 26, 12)(4, 24, 8, 27)(5, 25, 11)(6, 21, 20)(7, 13, 9, 16)(10, 14, 23)
$9C_3$	(1, 15, 26)(2, 27, 13)(3, 16, 23)(4, 18, 20)(5, 25, 12)(6, 19, 17)(7, 21, 14)(8, 24, 10)(9, 22, 11)

Table 19: Strong VMTLs of the first 70 2-regular graphs of order 29.

Graph	Edge Labels
C_{29}	(1, 23, 17, 21, 2, 16, 27, 4, 18, 9, 24, 11, 28, 14, 5, 12, 22, 19, 6, 20, 10, 26, 3, 25, 7, 13, 8, 29, 15)
$C_3 \cup C_{26}$	(1, 28, 8, 27, 11, 5, 16, 3, 29, 10, 12, 21, 9, 25, 6, 17, 26, 14, 4, 22, 2, 15, 13, 7, 20, 24)(18, 23, 19)
$C_4 \cup C_{25}$	(1, 16, 24, 15, 12, 9, 29, 4, 22, 2, 20, 3, 26, 11, 21, 10, 6, 14, 5, 13, 17, 8, 28, 7, 27)(18, 23, 19, 25)
$C_5 \cup C_{24}$	(1, 19, 2, 29, 10, 13, 9, 7, 11, 6, 28, 8, 24, 4, 25, 15, 22, 20, 5, 14, 12, 23, 18, 26)(3, 21, 17, 16, 27)
$C_6 \cup C_{23}$	(1, 20, 13, 9, 19, 25, 5, 22, 18, 24, 17, 14, 12, 26, 8, 28, 11, 7, 10, 27, 16, 4, 15)(2, 21, 3, 29, 6, 23)
$2C_3 \cup C_{23}$	(1, 20, 24, 9, 8, 28, 11, 23, 2, 21, 3, 29, 6, 12, 26, 14, 13, 18, 10, 27, 16, 4, 15)(5, 25, 17)(7, 19, 22)
$C_7 \cup C_{22}$	(1, 19, 6, 26, 11, 16, 22)(2, 20, 4, 25, 15, 27, 8, 18, 10, 29, 14, 3, 28, 5, 13, 21, 23, 7, 9, 12, 24, 17)
$C_3 \cup C_4 \cup C_{22}$	(1, 22, 16, 11, 26, 6, 20, 2, 17, 24, 4, 25, 15, 27, 8, 10, 29, 14, 3, 28, 5, 19)(7, 18, 12, 9)(13, 21, 23)
$C_8 \cup C_{21}$	(1, 22, 2, 26, 5, 11, 29, 3, 27, 12, 6, 14, 7, 28, 10, 15, 21, 13, 9, 8, 18)(4, 25, 16, 17, 20, 24, 19, 23)
$C_3 \cup C_5 \cup C_{21}$	(1, 22, 2, 26, 5, 11, 29, 3, 27, 12, 6, 14, 23, 4, 25, 17, 16, 10, 28, 7, 18)(8, 13, 9)(15, 21, 20, 24, 19)
$2C_4 \cup C_{21}$	(1, 22, 2, 26, 5, 11, 29, 3, 27, 12, 13, 7, 28, 10, 8, 9, 17, 25, 4, 23, 18)(6, 15, 21, 16)(14, 20, 24, 19)
$C_9 \cup C_{20}$	(1, 21, 13, 17, 27, 11, 24, 2, 19)(3, 16, 26, 5, 12, 15, 28, 9, 14, 4, 20, 8, 25, 7, 29, 10, 6, 23, 18, 22)
$C_3 \cup C_6 \cup C_{20}$	(1, 21, 6, 24, 2, 19)(3, 16, 26, 5, 13, 10, 29, 7, 25, 8, 9, 28, 15, 14, 20, 4, 12, 23, 18, 22)(11, 17, 27)
$C_4 \cup C_5 \cup C_{20}$	(1, 21, 9, 28, 15, 13, 14, 20, 4, 12, 23, 18, 22, 3, 16, 26, 5, 24, 2, 19)(6, 17, 27, 11)(7, 29, 10, 8, 25)
$3C_3 \cup C_{20}$	(1, 21, 20, 4, 15, 28, 9, 25, 8, 22, 3, 13, 14, 18, 5, 26, 16, 24, 2, 19)(6, 23, 12)(7, 10, 29)(11, 17, 27)
$C_{10} \cup C_{19}$	(1, 25, 6, 21, 20, 23, 5, 17, 4, 19)(2, 14, 18, 7, 22, 13, 11, 29, 15, 3, 16, 26, 8, 9, 24, 12, 27, 10, 28)
$C_3 \cup C_7 \cup C_{19}$	(1, 25, 6, 23, 13, 22, 19)(2, 14, 28)(3, 16, 27, 5, 18, 21, 7, 20, 4, 17, 8, 9, 24, 10, 12, 26, 11, 29, 15)
$C_4 \cup C_6 \cup C_{19}$	(1, 19, 4, 17, 5, 23, 20, 21, 13, 22, 7, 18, 9, 8, 24, 12, 27, 6, 25)(2, 28, 10, 14)(3, 16, 26, 11, 29, 15)
$2C_5 \cup C_{19}$	(1, 25, 6, 18, 11, 29, 15, 3, 16, 26, 8, 27, 12, 13, 23, 5, 17, 4, 19)(2, 14, 24, 9, 28)(7, 10, 22, 21, 20)
$2C_3 \cup C_4 \cup C_{19}$	(1, 19, 22, 7, 10, 26, 12, 23, 11, 29, 15, 3, 16, 27, 5, 18, 21, 6, 25)(2, 14, 28)(4, 20, 8, 17)(9, 13, 24)
$C_{11} \cup C_{18}$	(1, 26, 4, 17, 5, 21, 23, 9, 25, 8, 27, 15, 3, 28, 10, 14, 2, 18)(6, 22, 7, 16, 20, 19, 24, 13, 12, 29, 11)
$C_3 \cup C_8 \cup C_{18}$	(1, 26, 4, 17, 5, 21, 13, 24, 12, 29, 11, 22, 6, 19, 25, 14, 2, 18)(3, 28, 10, 7, 16, 8, 27, 15)(9, 20, 23)
$C_4 \cup C_7 \cup C_{18}$	(1, 26, 10, 28, 3, 15, 27, 8, 16, 7, 19, 20, 12, 29, 11, 14, 2, 18)(4, 17, 5, 25, 9, 24, 13)(6, 22, 21, 23)
$C_5 \cup C_6 \cup C_{18}$	(1, 26, 13, 23, 20, 24, 9, 16, 21, 8, 27, 15, 3, 28, 10, 14, 2, 18)(4, 17, 5, 25, 7, 19)(6, 22, 12, 29, 11)
$2C_3 \cup C_5 \cup C_{18}$	(1, 26, 4, 17, 5, 21, 13, 24, 9, 8, 27, 15, 3, 28, 10, 14, 2, 18)(6, 19, 25, 7, 22)(11, 29, 12)(16, 23, 20)
$C_3 \cup 2C_4 \cup C_{18}$	(1, 26, 13, 4, 17, 5, 25, 9, 24, 8, 27, 15, 3, 28, 10, 14, 2, 18)(6, 19, 7, 22)(11, 29, 12)(16, 21, 23, 20)
$C_{12} \cup C_{17}$	(1, 16, 4, 22, 17, 21, 19, 24, 3, 18, 6, 26, 10, 13, 12, 29, 15)(2, 27, 8, 25, 9, 28, 14, 5, 23, 7, 11, 20)
$C_3 \cup C_9 \cup C_{17}$	(1, 16, 4, 22, 11, 7, 12, 29, 15)(2, 20, 23, 5, 19, 21, 18, 3, 24, 10, 26, 6, 25, 13, 17, 8, 27)(9, 28, 14)
$C_4 \cup C_8 \cup C_{17}$	(1, 16, 4, 22, 21, 7, 24, 3, 18, 20, 2, 27, 8, 11, 12, 29, 15)(5, 13, 17, 23, 10, 26, 6, 19)(9, 28, 14, 25)
$C_5 \cup C_7 \cup C_{17}$	(1, 16, 4, 22, 17, 6, 26, 10, 23, 7, 21, 19, 5, 13, 12, 29, 15)(2, 27, 8, 11, 20)(3, 18, 25, 9, 28, 14, 24)
$2C_6 \cup C_{17}$	(1, 16, 4, 22, 17, 7, 18, 3, 24, 14, 28, 9, 19, 21, 12, 29, 15)(2, 27, 8, 11, 23, 20)(5, 25, 6, 26, 10, 13)
$2C_3 \cup C_6 \cup C_{17}$	(1, 16, 4, 22, 17, 7, 24, 3, 18, 10, 26, 6, 19, 21, 12, 29, 15)(2, 27, 8, 11, 23, 20)(5, 25, 13)(9, 14, 28)
$C_3 \cup C_4 \cup C_5 \cup C_{17}$	(1, 16, 4, 22, 9, 28, 14, 11, 23, 10, 26, 6, 17, 7, 12, 29, 15)(2, 20, 8, 27)(3, 18, 21, 19, 24)(5, 25, 13)
$3C_4 \cup C_{17}$	(1, 16, 4, 22, 21, 17, 23, 10, 26, 6, 13, 5, 19, 11, 12, 29, 15)(2, 20, 8, 27)(3, 24, 7, 18)(9, 28, 14, 25)
$4C_3 \cup C_{17}$	(1, 16, 4, 22, 18, 3, 25, 8, 27, 2, 20, 5, 19, 24, 12, 29, 15)(6, 13, 26)(7, 23, 11)(9, 14, 28)(10, 21, 17)
$C_{13} \cup C_{16}$	(1, 18, 9, 11, 5, 24, 13, 12, 28, 15, 2, 22, 20, 21, 17, 27)(3, 19, 4, 14, 7, 23, 16, 10, 26, 8, 25, 6, 29)
$C_3 \cup C_{10} \cup C_{16}$	(1, 18, 23, 8, 13, 7, 20, 6, 29, 3, 19, 4, 14, 25, 17, 27)(2, 15, 28, 12, 26, 10, 24, 5, 11, 22)(9, 16, 21)
$C_4 \cup C_9 \cup C_{16}$	(1, 18, 24, 5, 11, 26, 10, 17, 27)(2, 22, 16, 9, 25, 14, 4, 19, 3, 29, 6, 20, 21, 12, 28, 15)(7, 23, 8, 13)
$C_5 \cup C_8 \cup C_{16}$	(1, 18, 23, 16, 9, 21, 17, 27)(2, 15, 28, 12, 14, 4, 19, 3, 29, 6, 25, 8, 13, 7, 20, 22)(5, 11, 26, 10, 24)
$C_6 \cup C_7 \cup C_{16}$	(1, 18, 8, 25, 17, 27)(2, 15, 28, 12, 9, 16, 22)(3, 29, 6, 21, 20, 10, 26, 13, 7, 24, 5, 11, 23, 14, 4, 19)
$2C_3 \cup C_7 \cup C_{16}$	(1, 18, 5, 20, 21, 17, 27)(2, 15, 28, 12, 9, 7, 13, 24, 6, 29, 3, 19, 8, 23, 11, 22)(4, 25, 14)(10, 16, 26)
$C_3 \cup C_4 \cup C_6 \cup C_{16}$	(1, 18, 23, 11, 14, 4, 19, 3, 29, 6, 10, 26, 13, 25, 17, 27)(2, 15, 28, 12, 8, 22)(5, 21, 16)(7, 24, 9, 20)
$C_3 \cup 2C_5 \cup C_{16}$	(1, 18, 24, 17, 27)(2, 22, 7, 20, 6, 29, 3, 19, 4, 14, 25, 13, 8, 12, 28, 15)(5, 11, 23, 10, 26)(9, 16, 21)
$2C_4 \cup C_5 \cup C_{16}$	(1, 18, 23, 7, 20, 6, 29, 3, 19, 4, 14, 25, 13, 8, 17, 27)(2, 15, 28, 12, 22)(5, 24, 9, 11)(10, 21, 16, 26)
$3C_3 \cup C_4 \cup C_{16}$	(1, 18, 19, 3, 29, 6, 20, 22, 2, 15, 28, 12, 8, 21, 17, 27)(4, 14, 11, 23)(5, 16, 25)(7, 24, 9)(10, 13, 26)
$C_{14} \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 20, 24, 9, 11, 15, 21, 18, 16)(2, 22, 3, 19, 23, 17, 4, 25, 13, 10, 6, 12, 7, 28)
$C_3 \cup C_{11} \cup C_{15}$	(1, 16, 20, 6, 12, 8, 29, 14, 27, 5, 26)(2, 22, 3, 19, 4, 25, 13, 21, 23, 17, 11, 10, 9, 7, 28)(15, 24, 18)
$C_4 \cup C_{10} \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 20, 24, 18, 21, 13, 25, 4, 16)(2, 22, 3, 19, 17, 23, 10, 9, 7, 28)(6, 12, 11, 15)
$C_5 \cup C_9 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 18, 16)(2, 22, 3, 19, 23, 17, 4, 25, 13, 20, 24, 15, 21, 7, 28)(6, 12, 11, 9, 10)
$C_6 \cup C_8 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 10, 6, 17, 23, 11, 9, 12, 16)(2, 22, 3, 19, 7, 28)(4, 25, 13, 20, 24, 18, 21, 15)
$2C_3 \cup C_8 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 20, 18, 21, 23, 17, 25, 4, 16)(2, 28, 7, 11, 15, 19, 3, 22)(6, 10, 13)(9, 24, 12)
$2C_7 \cup C_{15}$	(1, 16, 4, 25, 17, 23, 15, 21, 18, 8, 29, 14, 27, 5, 26)(2, 22, 3, 19, 9, 7, 28)(6, 13, 20, 24, 10, 11, 12)
$C_3 \cup C_4 \cup C_7 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 12, 6, 20, 24, 18, 21, 17, 16)(2, 22, 3, 19, 9, 7, 28)(4, 15, 25)(10, 13, 23, 11)
$C_3 \cup C_5 \cup C_6 \cup C_{15}$	(1, 16, 20, 13, 6, 15, 24, 18, 10, 8, 29, 14, 27, 5, 26)(2, 22, 3, 19, 7, 28)(4, 12, 11, 9, 25)(17, 21, 23)
$2C_4 \cup C_6 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 11, 9, 20, 24, 18, 10, 23, 16)(2, 22, 3, 19, 7, 28)(4, 17, 6, 12)(13, 21, 15, 25)
$C_4 \cup 2C_5 \cup C_{15}$	(1, 26, 5, 27, 14, 29, 8, 13, 10, 9, 7, 28, 2, 22, 16)(3, 17, 11, 23, 19)(4, 21, 18, 15, 25)(6, 20, 24, 12)
$3C_3 \cup C_5 \cup C_{15}$	(1, 26, 16)(2, 28, 7, 13, 5, 27, 14, 29, 8, 17, 4, 12, 11, 18, 22)(3, 25, 6, 20, 19)(9, 24, 10)(15, 21, 23)
$2C_3 \cup 2C_4 \cup C_{15}$	(1, 16, 23, 11, 25, 15, 6, 13, 10, 8, 29, 14, 27, 5, 26)(2, 22, 7, 28)(3, 17, 9, 19)(4, 12, 21)(18, 20, 24)
$C_3 \cup C_{12} \cup C_{14}$	(1, 27, 2, 21, 19, 5, 25, 7, 12, 24, 13, 3, 22, 16)(4, 18, 9, 11, 28, 14, 20, 6, 29, 15, 26, 17)(8, 23, 10)
$C_4 \cup C_{11} \cup C_{14}$	(1, 16, 20, 6, 29, 15, 26, 17, 21, 2, 27)(3, 13, 24, 7, 25, 5, 19, 14, 28, 11, 23, 4, 18, 22)(8, 10, 9, 12)
$C_5 \cup C_{10} \cup C_{14}$	(1, 27, 2, 21, 19, 5, 25, 7, 12, 10, 8, 18, 20, 16)(3, 13, 24, 9, 22)(4, 23, 11, 28, 14, 6, 29, 15, 26, 17)
$C_6 \cup C_9 \cup C_{14}$	(1, 16, 4, 18, 20, 6, 29, 15, 26, 17, 19, 21, 2, 27)(3, 13, 24, 9, 12, 7, 25, 5, 22)(8, 10, 14, 28, 11, 23)
$2C_3 \cup C_9 \cup C_{14}$	(1, 27, 2, 21, 6, 29, 15, 26, 4, 22, 3, 13, 24, 16)(5, 19, 17)(7, 14, 28, 11, 9, 25, 18, 20, 12)(8, 23, 10)
$C_7 \cup C_8 \cup C_{14}$	(1, 27, 2, 21, 19, 8, 16)(3, 13, 5, 25, 7, 12, 24, 10, 23, 14, 28, 11, 9, 22)(4, 20, 6, 29, 15, 26, 17)
$C_3 \cup C_4 \cup C_8 \cup C_{14}$	(1, 16, 24, 9, 10, 21, 2, 27)(3, 13, 8, 12, 6, 29, 15, 26, 17, 19, 7, 25, 5, 22)(4, 20, 18)(11, 23, 14, 28)
$C_3 \cup C_5 \cup C_7 \cup C_{14}$	(1, 27, 2, 21, 19, 12, 8, 14, 28, 11, 7, 25, 5, 16)(3, 13, 23, 4, 22)(6, 29, 15, 26, 17, 20, 18)(9, 24, 10)
$2C_4 \cup C_7 \cup C_{14}$	(1, 16, 6, 29, 15, 26, 17, 4, 20, 18, 19, 21, 2, 27)(3, 22, 5, 13)(7, 23, 8, 25)(9, 10, 24, 12, 14, 28, 11)
$C_3 \cup 2C_6 \cup C_{14}$	(1, 16, 5, 21, 2, 27)(3, 13, 25, 6, 29, 15, 26, 17, 23, 7, 11, 28, 14, 22)(4, 20, 12, 8, 19, 18)(9, 24, 10)
$C_4 \cup C_5 \cup C_6 \cup C_{14}$	(1, 27, 2, 21, 16)(3, 13, 20, 18, 4, 22)(5, 25, 7, 11, 28, 14, 6, 29, 15, 26, 17, 23, 8, 19)(9, 12, 24, 10)
$3C_3 \cup C_6 \cup C_{14}$	(1, 27, 2, 21, 19, 7, 11, 28, 14, 23, 10, 9, 25, 16)(3, 13, 17, 26, 5, 22)(4, 20, 18)(6, 29, 15)(8, 24, 12)

Table 20: Strong VMTLs of the second 70 2-regular graphs of order 29.

Graph	Edge Labels
$3C_5 \cup C_{14}$	(1, 16, 21, 2, 27)(3, 13, 20, 18, 22)(4, 14, 28, 11, 25, 6, 29, 15, 26, 17, 5, 19, 7, 23)(8, 24, 10, 9, 12)
$2C_3 \cup C_4 \cup C_5 \cup C_{14}$	(1, 16, 21, 2, 27)(3, 22, 5, 13)(4, 20, 18)(6, 29, 15, 26, 17, 23, 7, 19, 14, 28, 11, 10, 9, 25)(8, 24, 12)
$C_3 \cup 3C_4 \cup C_{14}$	(1, 16, 4, 23, 10, 20, 18, 22, 3, 13, 5, 21, 2, 27)(6, 29, 15, 26)(7, 24, 19, 17)(8, 11, 28, 14)(9, 25, 12)
$5C_3 \cup C_{14}$	(1, 16, 11, 28, 14, 5, 25, 18, 20, 4, 12, 21, 2, 27)(3, 19, 22)(6, 29, 15)(7, 13, 24)(8, 26, 10)(9, 17, 23)
$C_3 \cup 2C_{13}$	(1, 20, 9, 23, 11, 14, 5, 18, 22, 4, 26, 2, 15)(3, 17, 25, 13, 28, 16, 8, 27, 10, 29, 7, 24, 19)(6, 12, 21)
$C_4 \cup C_{12} \cup C_{13}$	(1, 15, 2, 26, 4, 14, 11, 8, 27, 10, 29, 7, 20)(3, 17, 25, 13, 28, 16, 6, 18, 5, 24, 9, 23)(12, 22, 21, 19)
$C_5 \cup C_{11} \cup C_{13}$	(1, 15, 2, 26, 4, 21, 22, 11, 23, 9, 20)(3, 17, 25, 13, 28, 16, 24, 7, 29, 10, 27, 8, 19)(5, 14, 12, 6, 18)
$C_6 \cup C_{10} \cup C_{13}$	(1, 20, 11, 12, 22, 21, 19, 5, 14, 4, 26, 2, 15)(3, 17, 25, 13, 28, 16, 6, 23, 9, 24)(7, 18, 8, 27, 10, 29)
$2C_3 \cup C_{10} \cup C_{13}$	(1, 20, 11, 14, 5, 19, 4, 26, 2, 15)(3, 17, 23)(6, 12, 22, 21, 8, 27, 10, 29, 7, 25, 13, 28, 16)(9, 18, 24)
$C_7 \cup C_9 \cup C_{13}$	(1, 20, 23, 11, 21, 5, 24, 9, 14, 4, 26, 2, 15)(3, 17, 25, 13, 28, 16, 6, 18, 22)(7, 12, 19, 8, 27, 10, 29)
$C_3 \cup C_4 \cup C_9 \cup C_{13}$	(1, 20, 5, 14, 17, 3, 19, 21, 22, 4, 26, 2, 15)(6, 23, 11, 12)(7, 25, 13, 28, 16, 8, 27, 10, 29)(9, 18, 24)
$2C_8 \cup C_{13}$	(1, 20, 12, 7, 29, 10, 27, 8, 14, 4, 26, 2, 15)(3, 17, 25, 13, 28, 16, 11, 23)(5, 24, 9, 22, 21, 19, 6, 18)
$C_3 \cup C_5 \cup C_8 \cup C_{13}$	(1, 20, 9, 14, 4, 26, 2, 15)(3, 17, 23)(5, 19, 24, 18, 7, 29, 10, 27, 8, 11, 21, 12, 22)(6, 25, 13, 28, 16)
$2C_4 \cup C_8 \cup C_{13}$	(1, 15, 2, 26, 4, 14, 5, 20)(3, 24, 9, 17)(6, 18, 22, 21, 8, 27, 10, 29, 7, 25, 13, 28, 16)(11, 23, 19, 12)
$C_3 \cup C_6 \cup C_7 \cup C_{13}$	(1, 15, 2, 26, 4, 20)(3, 17, 25, 13, 28, 16, 7, 29, 10, 27, 8, 24, 19)(5, 14, 11, 23, 6, 12, 21)(9, 18, 22)
$C_4 \cup C_5 \cup C_7 \cup C_{13}$	(1, 15, 2, 26, 4, 23, 20)(3, 19, 12, 6, 17)(5, 14, 11, 21)(7, 22, 18, 24, 9, 25, 13, 28, 16, 8, 27, 10, 29)
$3C_3 \cup C_7 \cup C_{13}$	(1, 15, 2, 26, 4, 23, 20)(3, 21, 19)(5, 14, 24)(6, 12, 13, 28, 16, 18, 8, 27, 10, 29, 7, 25, 17)(9, 11, 22)
$C_4 \cup 2C_6 \cup C_{13}$	(1, 20, 4, 26, 2, 15)(3, 17, 25, 13, 28, 16)(5, 18, 7, 29, 10, 27, 8, 14, 12, 6, 21, 19, 24)(9, 23, 11, 22)
$2C_5 \cup C_6 \cup C_{13}$	(1, 20, 14, 9, 23, 3, 17, 12, 21, 4, 26, 2, 15)(5, 19, 24, 18, 22)(6, 25, 13, 28, 16)(7, 29, 10, 27, 8, 11)
$2C_3 \cup C_4 \cup C_6 \cup C_{13}$	(1, 20, 4, 26, 2, 15)(3, 17, 23)(5, 14, 24, 18)(6, 12, 19)(7, 29, 10, 27, 8, 25, 9, 13, 28, 16, 11, 21, 22)
$2C_3 \cup 2C_5 \cup C_{13}$	(1, 20, 7, 29, 10, 27, 8, 11, 21, 4, 26, 2, 15)(3, 23, 19, 5, 17)(6, 25, 18, 22, 12)(9, 14, 24)(13, 28, 16)
$C_3 \cup 2C_4 \cup C_5 \cup C_{13}$	(1, 20, 11, 8, 27, 10, 29, 7, 25, 4, 26, 2, 15)(3, 17, 23)(5, 19, 14, 24, 18)(6, 12, 22, 21)(9, 13, 28, 16)
$4C_4 \cup C_{13}$	(1, 20, 23, 9, 11, 7, 29, 10, 27, 8, 26, 2, 15)(3, 24, 18, 22)(4, 19, 5, 25)(6, 13, 28, 16)(12, 21, 17, 14)
$4C_3 \cup C_4 \cup C_{13}$	(1, 20, 6, 12, 26, 7, 29, 10, 27, 8, 22, 2, 15)(3, 25, 18, 24)(4, 21, 19)(5, 14, 17)(9, 23, 11)(13, 28, 16)
$C_5 \cup 2C_{12}$	(1, 27, 13, 7, 14, 4, 25, 6, 16, 21, 3, 24)(2, 17, 26, 10, 28)(5, 11, 22, 12, 29, 15, 20, 19, 23, 9, 8, 18)
$C_6 \cup C_{11} \cup C_{12}$	(1, 27, 13, 21, 3, 24)(2, 28, 10, 26, 7, 19, 16, 23, 9, 22, 20, 17)(4, 14, 8, 12, 29, 15, 6, 11, 5, 18, 25)
$2C_3 \cup C_{11} \cup C_{12}$	(1, 27, 13, 8, 12, 29, 15, 22, 21, 3, 24)(2, 17, 5, 18, 16, 19, 23, 9, 7, 26, 10, 28)(4, 25, 14)(6, 11, 20)
$C_7 \cup C_{10} \cup C_{12}$	(1, 27, 13, 7, 25, 4, 14, 21, 3, 24)(2, 17, 9, 8, 26, 10, 28)(5, 18, 19, 12, 29, 15, 6, 16, 23, 20, 22, 11)
$C_3 \cup C_4 \cup C_{10} \cup C_{12}$	(1, 27, 13, 18, 5, 16, 6, 11, 22, 21, 3, 24)(2, 28, 10, 26, 8, 12, 29, 15, 20, 17)(4, 25, 14)(7, 19, 23, 9)
$C_8 \cup C_9 \cup C_{12}$	(1, 27, 13, 9, 12, 29, 15, 20, 22, 21, 3, 24)(2, 17, 16, 23, 8, 26, 10, 28)(4, 25, 7, 19, 18, 5, 11, 6, 14)
$C_3 \cup C_5 \cup C_9 \cup C_{12}$	(1, 27, 13, 22, 12, 29, 15, 6, 16, 21, 3, 24)(2, 17, 14, 4, 25, 7, 26, 10, 28)(5, 11, 9, 8, 18)(19, 23, 20)
$2C_4 \cup C_9 \cup C_{12}$	(1, 27, 13, 22, 9, 25, 4, 14, 18, 21, 3, 24)(2, 17, 20, 23, 19, 7, 26, 10, 28)(5, 11, 6, 16)(8, 12, 29, 15)
$C_3 \cup C_6 \cup C_8 \cup C_{12}$	(1, 27, 13, 22, 11, 21, 3, 24)(2, 17, 6, 20, 23, 19, 18, 16, 5, 26, 10, 28)(4, 25, 14)(7, 9, 8, 12, 29, 15)
$C_4 \cup C_5 \cup C_8 \cup C_{12}$	(1, 24, 3, 21, 11, 6, 20, 22, 9, 7, 13, 27)(2, 17, 26, 10, 28)(4, 25, 8, 14)(5, 16, 23, 12, 29, 15, 19, 18)
$3C_3 \cup C_8 \cup C_{12}$	(1, 27, 13, 5, 11, 21, 3, 24)(2, 28, 10, 7, 26, 8, 12, 29, 15, 6, 20, 17)(4, 25, 18)(9, 14, 22)(16, 23, 19)
$C_3 \cup 2C_7 \cup C_{12}$	(1, 24, 3, 21, 22, 13, 27)(2, 28, 10, 26, 11, 6, 20, 19, 14, 4, 25, 17)(5, 16, 18)(7, 9, 23, 8, 12, 29, 15)
$C_4 \cup C_6 \cup C_7 \cup C_{12}$	(1, 27, 13, 21, 3, 24)(2, 17, 22, 11, 26, 10, 28)(4, 25, 6, 14)(5, 16, 19, 23, 20, 12, 29, 15, 7, 9, 8, 18)
$2C_5 \cup C_7 \cup C_{12}$	(1, 27, 13, 9, 7, 19, 16, 5, 18, 21, 3, 24)(2, 17, 26, 10, 28)(4, 25, 8, 23, 11, 6, 14)(12, 29, 15, 22, 20)
$2C_3 \cup C_4 \cup C_7 \cup C_{12}$	(1, 27, 13, 22, 21, 3, 24)(2, 17, 5, 16, 18, 19, 23, 9, 7, 26, 10, 28)(4, 25, 14)(6, 11, 20)(8, 12, 29, 15)
$C_5 \cup 2C_6 \cup C_{12}$	(1, 27, 13, 21, 3, 24)(2, 28, 10, 26, 7, 25, 4, 14, 23, 20, 22, 17)(5, 11, 9, 8, 18)(6, 16, 19, 12, 29, 15)
$2C_3 \cup C_5 \cup C_6 \cup C_{12}$	(1, 27, 13, 21, 3, 24)(2, 28, 10, 25, 4, 14, 22, 9, 7, 16, 5, 17)(6, 11, 26)(8, 12, 29, 15, 18)(19, 23, 20)
$C_3 \cup 2C_4 \cup C_6 \cup C_{12}$	(1, 27, 13, 5, 16, 23, 12, 29, 15, 21, 3, 24)(2, 17, 9, 7, 10, 28)(4, 25, 18, 19)(6, 26, 8, 14)(11, 22, 20)
$C_3 \cup C_4 \cup 2C_5 \cup C_{12}$	(1, 27, 13, 22, 10, 28, 2, 17, 16, 21, 3, 24)(4, 25, 11, 6, 14)(5, 26, 8, 18)(7, 9, 12, 29, 15)(19, 20, 23)
$3C_4 \cup C_5 \cup C_{12}$	(1, 27, 13, 9, 22, 11, 26, 8, 18, 21, 3, 24)(2, 28, 10, 6, 17)(4, 25, 7, 14)(5, 12, 29, 15)(16, 20, 23, 19)
$4C_3 \cup C_5 \cup C_{12}$	(1, 27, 13, 18, 24)(2, 28, 10, 12, 29, 15, 3, 21, 16, 4, 19, 17)(5, 11, 22)(6, 23, 20)(7, 14, 25)(8, 26, 9)
$3C_3 \cup 2C_4 \cup C_{12}$	(1, 27, 13, 19, 4, 17, 2, 28, 10, 21, 3, 24)(5, 12, 29, 15)(6, 23, 16)(7, 11, 26, 9)(8, 18, 25)(14, 22, 20)
$C_7 \cup 2C_{11}$	(1, 20, 14, 16, 3, 15, 2, 22, 19, 6, 25)(4, 24, 18, 21, 8, 12, 23)(5, 28, 10, 13, 9, 7, 29, 11, 26, 17, 27)
$C_3 \cup C_4 \cup 2C_{11}$	(1, 20, 23, 4, 12, 22, 2, 15, 3, 16, 25)(5, 27, 10, 28)(6, 19, 9, 11, 29, 7, 24, 18, 26, 13, 17)(8, 14, 21)
$C_8 \cup C_{10} \cup C_{11}$	(1, 25, 17, 13, 9, 14, 21, 20)(2, 15, 3, 16, 18, 26, 11, 29, 7, 22)(4, 23, 8, 12, 27, 5, 28, 10, 6, 19, 24)
$C_3 \cup C_5 \cup C_{10} \cup C_{11}$	(1, 20, 24, 17, 25)(2, 15, 3, 16, 27, 5, 28, 10, 19, 6, 22)(4, 12, 23)(7, 13, 18, 21, 9, 14, 8, 26, 11, 29)
$2C_4 \cup C_{10} \cup C_{11}$	(1, 20, 24, 6, 22, 2, 15, 3, 16, 25)(4, 23, 19, 12)(5, 27, 10, 28)(7, 29, 11, 9, 14, 8, 21, 13, 26, 17, 18)
$2C_9 \cup C_{11}$	(1, 25, 17, 18, 12, 8, 14, 9, 20)(2, 15, 3, 16, 27, 5, 28, 10, 6, 19, 22)(4, 24, 7, 29, 11, 26, 13, 21, 23)
$C_3 \cup C_6 \cup C_9 \cup C_{11}$	(1, 25, 16, 3, 15, 2, 22, 6, 17, 14, 20)(4, 21, 23)(5, 28, 10, 19, 24, 18, 12, 8, 27)(7, 29, 11, 26, 13, 9)
$C_4 \cup C_5 \cup C_9 \cup C_{11}$	(1, 20, 9, 22, 2, 15, 3, 16, 25)(4, 12, 13, 7, 29, 11, 17, 6, 24, 19, 23)(5, 27, 10, 28)(8, 14, 21, 18, 26)
$3C_3 \cup C_9 \cup C_{11}$	(1, 25, 16, 3, 15, 2, 22, 8, 20)(4, 21, 23)(5, 28, 10, 6, 14, 17, 12, 11, 29, 7, 27)(9, 26, 13)(18, 19, 24)
$C_3 \cup C_7 \cup C_8 \cup C_{11}$	(1, 20, 19, 12, 17, 24, 18, 25)(2, 15, 3, 16, 14, 6, 22)(4, 21, 23)(5, 28, 10, 13, 9, 7, 29, 11, 26, 8, 27)
$C_4 \cup C_6 \cup C_8 \cup C_{11}$	(1, 20, 22, 2, 15, 3, 16, 25)(4, 23, 8, 14, 6, 17, 12, 13, 21, 18, 26)(5, 27, 10, 28)(7, 29, 11, 24, 19, 9)
$2C_5 \cup C_8 \cup C_{11}$	(1, 25, 17, 27, 5, 28, 10, 13, 18, 21, 20)(2, 22, 12, 8, 14, 16, 3, 15)(4, 24, 19, 6, 23)(7, 29, 11, 26, 9)
$2C_3 \cup C_4 \cup C_8 \cup C_{11}$	(1, 25, 9, 14, 6, 16, 3, 15, 2, 22, 20)(4, 12, 23)(5, 27, 10, 28)(7, 29, 11, 19, 24, 17, 8, 21)(13, 18, 26)
$C_4 \cup 2C_7 \cup C_{11}$	(1, 20, 19, 12, 8, 22, 2, 15, 3, 16, 25)(4, 24, 18, 26, 17, 6, 23)(5, 27, 10, 28)(7, 29, 11, 14, 21, 13, 9)
$C_5 \cup C_6 \cup C_7 \cup C_{11}$	(1, 20, 19, 24, 18, 7, 29, 11, 26, 9, 25)(2, 22, 6, 16, 3, 15)(4, 12, 8, 21, 23)(5, 28, 10, 13, 17, 14, 27)
$2C_3 \cup C_5 \cup C_7 \cup C_{11}$	(1, 25, 14, 21, 20)(2, 15, 3, 16, 27, 5, 28, 10, 24, 6, 22)(4, 23, 19)(7, 9, 13, 18, 26, 11, 29)(8, 17, 12)
$C_3 \cup 2C_4 \cup C_7 \cup C_{11}$	(1, 20, 11, 29, 7, 22, 2, 15, 3, 16, 25)(4, 12, 23)(5, 27, 10, 28)(6, 14, 8, 17)(9, 19, 24, 18, 26, 13, 21)
$3C_6 \cup C_{11}$	(1, 20, 9, 21, 14, 25)(2, 22, 6, 16, 3, 15)(4, 12, 19, 24, 18, 23)(5, 28, 10, 13, 7, 29, 11, 26, 8, 17, 27)
$2C_3 \cup 2C_6 \cup C_{11}$	(1, 20, 24, 6, 22, 2, 15, 3, 16, 18, 25)(4, 23, 19)(5, 27, 14, 21, 10, 28)(7, 29, 11, 26, 13, 9)(8, 17, 12)
$C_3 \cup C_4 \cup C_5 \cup C_6 \cup C_{11}$	(1, 25, 16, 3, 15, 2, 22, 6, 17, 14, 20)(4, 12, 8, 21, 23)(5, 27, 10, 28)(7, 29, 11, 19, 24, 18)(9, 26, 13)
$3C_4 \cup C_6 \cup C_{11}$	(1, 20, 14, 21, 8, 23, 4, 19, 24, 17, 25)(2, 22, 6, 16, 3, 15)(5, 27, 10, 28)(7, 29, 11, 9)(12, 18, 26, 13)
$4C_3 \cup C_6 \cup C_{11}$	(1, 20, 10, 28, 5, 11, 29, 7, 16, 3, 25)(2, 22, 12, 8, 17, 15)(4, 27, 14)(6, 21, 23)(9, 26, 13)(18, 19, 24)
$C_3 \cup 3C_5 \cup C_{11}$	(1, 20, 23, 14, 6, 22, 2, 15, 3, 16, 25)(4, 12, 19)(5, 28, 10, 17, 27)(7, 29, 11, 24, 18)(8, 21, 9, 13, 26)
$2C_4 \cup 2C_5 \cup C_{11}$	(1, 20, 24, 18, 21, 22, 2, 15, 3, 16, 25)(4, 12, 19, 6, 23)(5, 27, 10, 28)(7, 29, 11, 17, 13)(8, 26, 9, 14)

Table 21: Strong VMTLs of the third 70 2-regular graphs of order 29.

Graph	Edge Labels
$3C_3 \cup C_4 \cup C_5 \cup C_{11}$	(1, 20, 19, 12, 25)(2, 15, 3, 16, 14, 27, 5, 28, 10, 13, 22)(4, 18, 24)(6, 21, 23)(7, 29, 11, 9)(8, 17, 26)
$2C_3 \cup 3C_4 \cup C_{11}$	(1, 25, 14, 21, 6, 16, 3, 15, 2, 22, 20)(4, 19, 24)(5, 27, 10, 28)(7, 29, 11, 9)(8, 23, 18, 26)(12, 17, 13)
$6C_3 \cup C_{11}$	(1, 25, 18, 5, 28, 10, 6, 24, 17, 14, 20)(2, 22, 15)(3, 16, 26)(4, 21, 23)(7, 29, 11)(8, 27, 12)(9, 19, 13)
$C_9 \cup 2C_{10}$	(1, 27, 8, 16, 5, 20, 6, 25, 17)(2, 21, 23, 4, 18, 12, 7, 22, 19, 15)(3, 13, 24, 9, 11, 28, 10, 26, 14, 29)
$C_3 \cup C_6 \cup 2C_{10}$	(1, 17, 25, 12, 8, 27)(2, 21, 9, 16, 5, 19, 22, 4, 18, 15)(3, 13, 6, 23, 11, 28, 10, 26, 14, 29)(7, 20, 24)
$C_4 \cup C_5 \cup 2C_{10}$	(1, 27, 8, 25, 17)(2, 21, 9, 15)(3, 29, 14, 26, 10, 28, 11, 20, 24, 13)(4, 16, 5, 22, 12, 7, 19, 6, 23, 18)
$3C_3 \cup 2C_{10}$	(1, 17, 7, 12, 21, 2, 19, 23, 8, 27)(3, 13, 4, 18, 11, 28, 10, 26, 14, 29)(5, 22, 15)(6, 20, 24)(9, 16, 25)
$C_3 \cup C_7 \cup C_9 \cup C_{10}$	(1, 27, 8, 18, 4, 16, 9, 25, 17)(2, 21, 12, 7, 23, 6, 15)(3, 29, 14, 26, 10, 28, 11, 20, 24, 13)(5, 19, 22)
$C_4 \cup C_6 \cup C_9 \cup C_{10}$	(1, 17, 25, 12, 22, 5, 16, 8, 27)(2, 21, 23, 18, 4, 15)(3, 13, 20, 9, 11, 28, 10, 26, 14, 29)(6, 24, 7, 19)
$2C_5 \cup C_9 \cup C_{10}$	(1, 27, 8, 25, 17)(2, 21, 20, 24, 7, 19, 5, 22, 15)(3, 13, 6, 23, 11, 28, 10, 26, 14, 29)(4, 18, 12, 9, 16)
$2C_3 \cup C_4 \cup C_9 \cup C_{10}$	(1, 17, 4, 20, 24, 6, 25, 8, 27)(2, 15, 5, 21)(3, 13, 9, 16, 11, 28, 10, 26, 14, 29)(7, 12, 22)(18, 23, 19)
$C_3 \cup 2C_8 \cup C_{10}$	(1, 27, 8, 23, 18, 4, 16, 5, 25, 17)(2, 21, 6, 19, 7, 12, 22, 15)(3, 13, 11, 28, 10, 26, 14, 29)(9, 20, 24)
$C_4 \cup C_7 \cup C_8 \cup C_{10}$	(1, 27, 8, 22, 19, 25, 17)(2, 15, 5, 20, 6, 23, 4, 18, 16, 21)(3, 13, 11, 28, 10, 26, 14, 29)(7, 12, 9, 24)
$C_5 \cup C_6 \cup C_8 \cup C_{10}$	(1, 27, 8, 25, 17)(2, 21, 9, 16, 5, 15)(3, 13, 11, 28, 10, 26, 14, 29)(4, 23, 6, 20, 24, 7, 12, 22, 19, 18)
$2C_3 \cup C_5 \cup C_8 \cup C_{10}$	(1, 27, 8, 22, 12, 7, 19, 6, 25, 17)(2, 21, 16, 5, 15)(3, 13, 11, 28, 10, 26, 14, 29)(4, 23, 18)(9, 20, 24)
$C_3 \cup 2C_4 \cup C_8 \cup C_{10}$	(1, 27, 8, 17)(2, 15, 5, 16, 25, 6, 20, 24, 9, 21)(3, 13, 11, 28, 10, 26, 14, 29)(4, 23, 19, 18)(7, 12, 22)
$C_5 \cup 2C_7 \cup C_{10}$	(1, 27, 8, 22, 5, 20, 17)(2, 15, 9, 12, 21)(3, 13, 6, 23, 11, 28, 10, 26, 14, 29)(4, 18, 24, 7, 19, 25, 16)
$2C_6 \cup C_7 \cup C_{10}$	(1, 17, 25, 5, 16, 8, 27)(2, 21, 23, 18, 4, 15)(3, 13, 24, 9, 11, 28, 10, 26, 14, 29)(6, 20, 7, 22, 12, 19)
$2C_3 \cup C_6 \cup C_7 \cup C_{10}$	(1, 17, 25, 6, 16, 8, 27)(2, 19, 22, 15, 5, 21)(3, 13, 4, 23, 11, 28, 10, 26, 14, 29)(7, 18, 12)(9, 20, 24)
$C_3 \cup C_4 \cup C_5 \cup C_7 \cup C_{10}$	(1, 17, 24, 9, 12, 8, 27)(2, 15, 16, 21)(3, 13, 6, 23, 11, 28, 10, 26, 14, 29)(4, 22, 20, 7, 18)(5, 19, 25)
$3C_4 \cup C_7 \cup C_{10}$	(1, 27, 8, 22, 12, 25, 17)(2, 21, 23, 18)(3, 13, 4, 15, 11, 28, 10, 26, 14, 29)(5, 19, 6, 16)(7, 24, 9, 20)
$4C_3 \cup C_7 \cup C_{10}$	(1, 17, 12, 5, 16, 8, 27)(2, 20, 21)(3, 13, 7, 23, 11, 28, 10, 26, 14, 29)(4, 15, 22)(6, 19, 25)(9, 18, 24)
$C_3 \cup C_4 \cup 2C_6 \cup C_{10}$	(1, 27, 8, 16, 5, 17)(2, 21, 4, 15)(3, 13, 7, 22, 11, 28, 10, 26, 14, 29)(6, 20, 24)(9, 25, 12, 19, 23, 18)
$C_3 \cup 2C_5 \cup C_6 \cup C_{10}$	(1, 27, 8, 25, 17)(2, 15, 4, 18, 16, 21)(3, 13, 12, 9, 11, 28, 10, 26, 14, 29)(5, 19, 22)(6, 20, 24, 7, 23)
$2C_4 \cup C_5 \cup C_6 \cup C_{10}$	(1, 27, 8, 25, 17)(2, 21, 9, 16, 5, 15)(3, 29, 14, 26, 10, 28, 11, 20, 24, 13)(4, 23, 6, 18)(7, 19, 22, 12)
$3C_3 \cup C_4 \cup C_6 \cup C_{10}$	(1, 17, 7, 12, 8, 27)(2, 25, 9, 21)(3, 13, 4, 22, 11, 28, 10, 26, 14, 29)(5, 20, 24)(6, 16, 15)(18, 23, 19)
$C_4 \cup 3C_5 \cup C_{10}$	(1, 27, 8, 25, 17)(2, 21, 23, 18, 19)(3, 13, 4, 16, 11, 28, 10, 26, 14, 29)(5, 20, 6, 24)(7, 15, 9, 22, 12)
$3C_3 \cup 2C_5 \cup C_{10}$	(1, 27, 8, 16, 17)(2, 20, 21)(3, 13, 7, 23, 11, 28, 10, 26, 14, 29)(4, 15, 22)(5, 24, 18, 9, 12)(6, 19, 25)
$2C_3 \cup 2C_4 \cup C_5 \cup C_{10}$	(1, 27, 8, 16, 17)(2, 15, 5, 21)(3, 13, 6, 19, 11, 28, 10, 26, 14, 29)(4, 18, 23)(7, 22, 20, 24)(9, 25, 12)
$C_3 \cup 4C_4 \cup C_{10}$	(1, 27, 8, 17)(2, 24, 9, 21)(3, 13, 18, 23, 11, 28, 10, 26, 14, 29)(4, 15, 6, 16)(5, 19, 25, 12)(7, 22, 20)
$5C_3 \cup C_4 \cup C_{10}$	(1, 17, 5, 22, 3, 29, 14, 26, 8, 27)(2, 15, 21)(4, 12, 25, 16)(6, 13, 18)(7, 23, 19)(9, 20, 24)(10, 28, 11)
$C_3 \cup C_8 \cup 2C_9$	(1, 22, 16)(2, 23, 10, 11, 7, 19, 5, 14)(3, 17, 18, 4, 26, 13, 21, 6, 25)(8, 29, 12, 28, 15, 27, 9, 20, 24)
$C_4 \cup C_7 \cup 2C_9$	(1, 22, 10, 19, 7, 14, 2, 23, 16)(3, 17, 5, 13, 21, 6, 25)(4, 20, 18, 26)(8, 11, 24, 9, 27, 15, 28, 12, 29)
$C_5 \cup C_6 \cup 2C_9$	(1, 22, 5, 19, 16)(2, 23, 13, 26, 4, 18, 11, 7, 14)(3, 17, 21, 10, 9, 25)(6, 20, 24, 8, 29, 12, 28, 15, 27)
$2C_3 \cup C_5 \cup 2C_9$	(1, 22, 16)(2, 23, 4, 18, 13, 21, 11, 7, 14)(3, 17, 27, 15, 28, 12, 29, 8, 25)(5, 19, 20, 6, 24)(9, 26, 10)
$C_3 \cup 2C_4 \cup 2C_9$	(1, 22, 16)(2, 23, 13, 19, 25, 3, 17, 5, 14)(4, 26, 9, 20)(6, 21, 18, 8, 29, 12, 28, 15, 27)(7, 11, 10, 24)
$C_4 \cup 2C_8 \cup C_9$	(1, 22, 11, 10, 9, 18, 20, 6, 16)(2, 14, 21, 23)(3, 25, 4, 26, 13, 5, 19, 17)(7, 24, 8, 29, 12, 28, 15, 27)
$C_5 \cup C_7 \cup C_8 \cup C_9$	(1, 22, 14, 2, 23, 6, 16)(3, 17, 4, 26, 13, 5, 19, 25)(7, 27, 15, 28, 12, 29, 8, 18, 20)(9, 24, 11, 21, 10)
$2C_6 \cup C_8 \cup C_9$	(1, 16, 20, 24, 9, 22)(2, 23, 6, 18, 4, 26, 13, 5, 14)(3, 25, 10, 11, 21, 17)(7, 27, 15, 28, 12, 29, 8, 19)
$2C_3 \cup C_6 \cup C_8 \cup C_9$	(1, 22, 16)(2, 23, 6, 18, 4, 26, 13, 5, 14)(3, 17, 19, 7, 20, 24, 9, 25)(8, 27, 15, 28, 12, 29)(10, 21, 11)
$C_3 \cup C_4 \cup C_5 \cup C_8 \cup C_9$	(1, 22, 16)(2, 23, 11, 24, 9, 20, 7, 14)(3, 17, 19, 25)(4, 26, 13, 6, 18)(5, 21, 10, 8, 29, 12, 28, 15, 27)
$3C_4 \cup C_8 \cup C_9$	(1, 22, 13, 21, 5, 14, 2, 23, 16)(3, 17, 19, 25)(4, 26, 6, 18)(7, 24, 9, 20)(8, 10, 11, 27, 15, 28, 12, 29)
$4C_3 \cup C_8 \cup C_9$	(1, 22, 16)(2, 23, 13, 26, 5, 17, 3, 18, 14)(4, 20, 24)(6, 21, 8, 29, 12, 28, 15, 27)(7, 19, 11)(9, 25, 10)
$C_6 \cup 2C_7 \cup C_9$	(1, 22, 4, 26, 13, 6, 16)(2, 14, 18, 20, 7, 11, 10, 21, 23)(3, 17, 19, 5, 24, 9, 25)(8, 29, 12, 28, 15, 27)
$2C_3 \cup 2C_7 \cup C_9$	(1, 22, 16)(2, 23, 10, 9, 26, 4, 14)(3, 25, 11, 20, 24, 5, 17)(6, 21, 18)(7, 19, 13, 8, 29, 12, 28, 15, 27)
$C_3 \cup C_4 \cup C_6 \cup C_7 \cup C_9$	(1, 22, 16)(2, 14, 25, 3, 17, 19, 5, 21, 23)(4, 26, 6, 13, 20, 9, 18)(7, 11, 10, 24)(8, 29, 12, 28, 15, 27)
$C_3 \cup 2C_5 \cup C_7 \cup C_9$	(1, 22, 16)(2, 23, 11, 7, 14)(3, 25, 10, 9, 13, 19, 17)(4, 20, 24, 5, 26)(6, 21, 18, 8, 29, 12, 28, 15, 27)
$2C_4 \cup C_5 \cup C_7 \cup C_9$	(1, 16, 5, 13, 21, 23, 2, 14, 22)(3, 25, 10, 17)(4, 26, 6, 18)(7, 24, 9, 20, 19)(8, 29, 12, 28, 15, 27, 11)
$3C_3 \cup C_4 \cup C_7 \cup C_9$	(1, 22, 16)(2, 23, 9, 18, 11, 7, 14)(3, 19, 17)(4, 20, 24)(5, 25, 10, 21)(6, 13, 26, 8, 29, 12, 28, 15, 27)
$C_3 \cup C_5 \cup 2C_6 \cup C_9$	(1, 22, 16)(2, 14, 5, 21, 23)(3, 25, 6, 18, 4, 26, 13, 19, 17)(7, 11, 10, 24, 9, 20)(8, 29, 12, 28, 15, 27)
$2C_4 \cup 2C_6 \cup C_9$	(1, 22, 5, 16)(2, 14, 21, 23)(3, 17, 19, 10, 9, 25)(4, 26, 13, 20, 6, 18)(7, 24, 8, 29, 12, 28, 15, 27, 11)
$C_4 \cup 2C_5 \cup C_6 \cup C_9$	(1, 22, 9, 20, 7, 11, 21, 5, 16)(2, 23, 10, 24, 14)(3, 17, 19, 25)(4, 26, 13, 6, 18)(8, 29, 12, 28, 15, 27)
$3C_3 \cup C_5 \cup C_6 \cup C_9$	(1, 22, 16)(2, 23, 11, 25, 14)(3, 17, 4, 24, 5, 13, 20, 7, 19)(6, 18, 26)(8, 29, 12, 28, 15, 27)(9, 10, 21)
$2C_3 \cup 2C_4 \cup C_6 \cup C_9$	(1, 22, 16)(2, 23, 4, 26, 6, 18, 21, 5, 14)(3, 17, 19, 25)(7, 11, 10, 24)(8, 29, 12, 28, 15, 27)(9, 20, 13)
$4C_5 \cup C_9$	(1, 16, 5, 13, 22)(2, 23, 10, 24, 14)(3, 17, 7, 19, 25)(4, 26, 6, 21, 18)(8, 29, 12, 28, 15, 27, 9, 20, 11)
$2C_3 \cup C_4 \cup 2C_5 \cup C_9$	(1, 22, 16)(2, 23, 11, 7, 14)(3, 17, 27, 15, 28, 12, 29, 8, 25)(4, 20, 19, 13, 18)(5, 21, 6, 24)(9, 26, 10)
$C_3 \cup 3C_4 \cup C_5 \cup C_9$	(1, 22, 16)(2, 23, 13, 5, 14)(3, 17, 27, 15, 28, 12, 29, 8, 19)(4, 20, 6, 24)(7, 25, 9, 26)(10, 21, 18, 11)
$5C_3 \cup C_5 \cup C_9$	(1, 22, 5, 23, 16)(2, 20, 14)(3, 26, 10, 8, 29, 12, 28, 15, 27)(4, 21, 17)(6, 13, 18)(7, 19, 25)(9, 24, 11)
$5C_4 \cup C_9$	(1, 22, 17, 16)(2, 14, 21, 23)(3, 26, 6, 24)(4, 18, 20, 8, 29, 12, 28, 15, 27)(5, 13, 7, 19)(9, 10, 11, 25)
$4C_3 \cup 2C_4 \cup C_9$	(1, 16, 22)(2, 23, 6, 14)(3, 18, 4, 24)(5, 13, 21)(7, 17, 27, 15, 28, 12, 29, 8, 25)(9, 26, 10)(11, 20, 19)
$C_5 \cup 3C_8$	(1, 18, 6, 25, 8, 21, 4, 26)(2, 19, 3, 20, 22, 10, 29, 14)(5, 15, 23, 11, 7, 28, 16, 12)(9, 27, 13, 24, 17)
$C_6 \cup C_7 \cup 2C_8$	(1, 18, 8, 24, 4, 26)(2, 19, 3, 20, 21, 10, 29, 14)(5, 15, 22, 11, 23, 6, 12)(7, 28, 16, 9, 27, 13, 25, 17)
$2C_3 \cup C_7 \cup 2C_8$	(1, 18, 6, 11, 7, 28, 16, 26)(2, 19, 3, 20, 10, 29, 14)(4, 22, 9, 27, 13, 21, 12, 25)(5, 23, 15)(8, 17, 24)
$C_3 \cup C_4 \cup C_6 \cup 2C_8$	(1, 18, 11, 6, 12, 22, 4, 26)(2, 19, 3, 20, 21, 10, 29, 14)(5, 15, 23)(7, 28, 16, 8, 17, 25)(9, 27, 13, 24)
$C_3 \cup 2C_5 \cup 2C_8$	(1, 26, 12, 5, 18)(2, 19, 3, 15, 22, 10, 29, 14)(4, 24, 7, 28, 16)(6, 23, 11, 13, 27, 9, 21, 20)(8, 17, 25)
$2C_4 \cup C_5 \cup 2C_8$	(1, 26, 11, 6, 18)(2, 19, 3, 20, 8, 10, 29, 14)(4, 22, 12, 21)(5, 25, 17, 24)(7, 28, 16, 15, 23, 9, 27, 13)
$3C_3 \cup C_4 \cup 2C_8$	(1, 26, 12, 18)(2, 19, 3, 23, 8, 10, 29, 14)(4, 21, 20)(5, 15, 17, 25, 9, 27, 13, 24)(6, 22, 11)(7, 28, 16)
$3C_7 \cup C_8$	(1, 18, 6, 23, 11, 15, 26)(2, 19, 3, 20, 22, 10, 29, 14)(4, 24, 7, 28, 16, 17, 21)(5, 25, 12, 8, 9, 27, 13)
$C_3 \cup C_4 \cup 2C_7 \cup C_8$	(1, 18, 24, 13, 27, 9, 8, 26)(2, 19, 3, 20, 10, 29, 14)(4, 22, 11, 21)(5, 23, 15)(6, 12, 17, 7, 28, 16, 25)
$C_3 \cup C_5 \cup C_6 \cup C_7 \cup C_8$	(1, 18, 8, 21, 4, 26)(2, 19, 3, 20, 22, 10, 29, 14)(5, 23, 15)(6, 12, 25, 9, 27, 13, 11)(7, 28, 16, 17, 24)

Table 22: Strong VMTLs of the remaining 63 2-regular graphs of order 29.

Graph	Edge Labels
$2C_4 \cup C_6 \cup C_7 \cup C_8$	(1, 18, 7, 28, 16, 4, 26)(2, 19, 3, 20, 22, 10, 29, 14)(5, 21, 17, 24)(6, 12, 25, 8, 23, 11)(9, 27, 13, 15)
$C_4 \cup 2C_5 \cup C_7 \cup C_8$	(1, 26, 6, 18)(2, 19, 3, 20, 8, 10, 29, 14)(4, 22, 11, 9, 27, 13, 21)(5, 24, 17, 25, 12)(7, 28, 16, 15, 23)
$3C_3 \cup C_5 \cup C_7 \cup C_8$	(1, 26, 11, 22, 8, 17, 24, 18)(2, 19, 3, 21, 10, 29, 14)(4, 25, 9, 27, 13)(5, 15, 23)(6, 12, 20)(7, 28, 16)
$2C_3 \cup 2C_4 \cup C_7 \cup C_8$	(1, 26, 7, 28, 16, 21, 11, 18)(2, 19, 3, 15, 10, 29, 14)(4, 22, 20)(5, 23, 8, 12)(6, 17, 24)(9, 27, 13, 25)
$C_3 \cup 3C_6 \cup C_8$	(1, 18, 5, 24, 6, 26)(2, 19, 3, 17, 8, 10, 29, 14)(4, 20, 22, 9, 27, 13)(7, 28, 16, 25, 12, 21)(11, 15, 23)
$C_4 \cup C_5 \cup 2C_6 \cup C_8$	(1, 18, 24, 8, 26)(2, 19, 3, 20, 21, 10, 29, 14)(4, 22, 15, 23, 5, 25)(6, 11, 9, 27, 13, 12)(7, 28, 16, 17)
$3C_3 \cup 2C_6 \cup C_8$	(1, 18, 22, 20, 12, 26)(2, 19, 3, 25, 8, 10, 29, 14)(4, 21, 5, 15, 9, 27)(6, 23, 11)(7, 28, 16)(13, 17, 24)
$3C_5 \cup C_6 \cup C_8$	(1, 26, 8, 12, 5, 18)(2, 19, 3, 23, 15, 10, 29, 14)(4, 20, 22, 6, 25)(7, 28, 16, 21, 11)(9, 27, 13, 17, 24)
$2C_3 \cup C_4 \cup C_5 \cup C_6 \cup C_8$	(1, 26, 6, 24, 18)(2, 19, 3, 23, 8, 10, 29, 14)(4, 21, 20)(5, 15, 22, 11, 17, 12)(7, 28, 16)(9, 27, 13, 25)
$C_3 \cup 3C_4 \cup C_6 \cup C_8$	(1, 26, 11, 18)(2, 19, 3, 17, 24, 10, 29, 14)(4, 20, 22, 6, 12, 13)(5, 21, 9, 27)(7, 28, 16)(8, 23, 15, 25)
$5C_3 \cup C_6 \cup C_8$	(1, 18, 22, 8, 9, 27, 6, 26)(2, 19, 12, 10, 29, 14)(3, 17, 25)(4, 21, 20)(5, 24, 13)(7, 28, 16)(11, 15, 23)
$2C_3 \cup 3C_5 \cup C_8$	(1, 26, 12, 13, 18)(2, 19, 3, 21, 8, 10, 29, 14)(4, 22, 20, 17, 24)(5, 15, 25)(6, 11, 23, 9, 27)(7, 28, 16)
$C_3 \cup 2C_4 \cup 2C_5 \cup C_8$	(1, 18, 24, 4, 26)(2, 19, 3, 15, 22, 10, 29, 14)(5, 21, 20)(6, 23, 8, 12, 11)(7, 28, 16, 17)(9, 27, 13, 25)
$4C_4 \cup C_5 \cup C_8$	(1, 18, 12, 26)(2, 19, 3, 25, 8, 10, 29, 14)(4, 21, 20, 22)(5, 15, 9, 27)(6, 17, 23, 11)(7, 28, 16, 13, 24)
$4C_3 \cup C_4 \cup C_5 \cup C_8$	(1, 26, 4, 13, 18)(2, 19, 21, 3, 15, 10, 29, 14)(5, 24, 17)(6, 22, 20)(7, 28, 16)(8, 25, 12)(9, 27, 11, 23)
$3C_3 \cup 3C_4 \cup C_8$	(1, 26, 8, 18)(2, 19, 12, 6, 23, 10, 29, 14)(3, 21, 20, 22)(4, 13, 24)(5, 17, 15, 25)(7, 28, 16)(9, 27, 11)
$7C_3 \cup C_8$	(1, 20, 21)(9, 15, 29)(5, 11, 28)(2, 17, 26)(8, 18, 24)(3, 14, 22)(6, 12, 25)(7, 23, 4, 16, 19, 10, 13, 27)
$C_3 \cup C_5 \cup 3C_7$	(1, 19, 24, 2, 22, 5, 20)(3, 29, 15, 27, 9, 14, 26)(4, 13, 18)(6, 28, 11, 8, 10)(7, 21, 17, 16, 25, 12, 23)
$2C_4 \cup 3C_7$	(1, 19, 8, 23, 5, 13, 20)(2, 22, 21, 17)(3, 29, 15, 27, 9, 14, 26)(4, 12, 25, 16, 10, 7, 18)(6, 28, 11, 24)
$C_3 \cup 2C_6 \cup 2C_7$	(1, 20, 13, 17, 24, 19)(2, 22, 16)(3, 29, 15, 27, 9, 14, 26)(4, 12, 25, 10, 7, 18)(5, 21, 6, 28, 11, 8, 23)
$C_4 \cup C_5 \cup C_6 \cup 2C_7$	(1, 20, 2, 22, 8, 19)(3, 29, 15, 27, 9, 14, 26)(4, 24, 7, 10, 16, 17, 21)(5, 11, 28, 6, 13)(12, 23, 18, 25)
$3C_3 \cup C_6 \cup 2C_7$	(1, 20, 2, 22, 8, 19)(3, 29, 15, 27, 9, 17, 26)(4, 14, 21)(5, 11, 28, 6, 13, 25, 12)(7, 16, 24)(10, 18, 23)
$3C_5 \cup 2C_7$	(1, 20, 23, 2, 22, 16, 19)(3, 29, 15, 27, 9, 14, 26)(4, 24, 17, 13, 18)(5, 11, 28, 6, 21)(7, 12, 25, 8, 10)
$2C_3 \cup C_4 \cup C_5 \cup 2C_7$	(1, 19, 22, 2, 17, 8, 20)(3, 29, 15, 27, 9, 7, 26)(4, 18, 25, 12, 23)(5, 13, 10, 21)(6, 28, 11)(14, 16, 24)
$C_3 \cup 3C_4 \cup 2C_7$	(1, 20, 8, 19)(2, 22, 16, 24)(3, 29, 15, 27, 9, 7, 26)(4, 14, 5, 17, 13, 10, 21)(6, 11, 28)(12, 23, 18, 25)
$5C_3 \cup 2C_7$	(9, 19, 23)(2, 15, 24)(11, 16, 25)(5, 18, 26)(6, 13, 27)(1, 17, 3, 22, 21, 8, 29)(7, 14, 20, 4, 12, 10, 28)
$C_4 \cup 3C_6 \cup C_7$	(1, 19, 8, 22, 2, 20)(3, 29, 15, 27, 9, 26)(4, 12, 25, 18, 23, 5, 21)(6, 28, 11, 7, 10, 13)(14, 17, 16, 24)
$2C_5 \cup 2C_6 \cup C_7$	(1, 19, 24, 7, 20)(2, 23, 18, 4, 13, 22)(3, 29, 15, 27, 9, 14, 26)(5, 25, 12, 16, 17, 21)(6, 28, 11, 8, 10)
$2C_3 \cup C_4 \cup 2C_6 \cup C_7$	(1, 19, 7, 10, 8, 20)(2, 21, 22)(3, 29, 15, 27, 9, 26)(4, 18, 23)(5, 11, 28, 6, 13, 12, 25)(14, 17, 16, 24)
$2C_3 \cup 2C_5 \cup C_6 \cup C_7$	(1, 19, 24, 17, 8, 20)(2, 22, 16)(3, 29, 15, 27, 9, 14, 26)(4, 13, 18)(5, 11, 28, 6, 21)(7, 23, 10, 25, 12)
$C_3 \cup 2C_4 \cup C_5 \cup C_6 \cup C_7$	(1, 20, 2, 22, 16, 19)(3, 29, 15, 27, 9, 14, 26)(4, 13, 17, 24)(5, 11, 28, 6, 21)(7, 18, 25, 12)(8, 23, 10)
$4C_4 \cup C_6 \cup C_7$	(1, 19, 4, 20)(2, 17, 24, 14)(3, 29, 15, 27, 9, 26)(5, 25, 12, 13)(6, 28, 11, 16)(7, 21, 22, 18, 8, 23, 10)
$4C_3 \cup C_4 \cup C_6 \cup C_7$	(1, 19, 4, 13, 18, 20)(2, 17, 23)(3, 29, 15, 27, 9, 7, 26)(5, 21, 22)(6, 28, 11, 24)(8, 14, 10)(12, 16, 25)
$C_3 \cup C_4 \cup 3C_5 \cup C_7$	(1, 19, 22, 2, 20)(3, 29, 15, 27, 9, 7, 26)(4, 23, 5, 13)(6, 17, 8, 11, 28)(10, 16, 24, 14, 21)(12, 18, 25)
$3C_4 \cup 2C_5 \cup C_7$	(1, 20, 8, 19)(2, 23, 17, 21, 22)(3, 29, 15, 27, 9, 7, 26)(4, 13, 18, 5, 14)(6, 24, 11, 28)(10, 16, 25, 12)
$4C_3 \cup 2C_5 \cup C_7$	(1, 19, 22, 4, 20)(2, 21, 17)(3, 29, 15, 27, 9, 7, 26)(5, 13, 12)(6, 28, 11, 16, 24)(8, 14, 23)(10, 18, 25)
$3C_3 \cup 2C_4 \cup C_5 \cup C_7$	(1, 19, 24, 4, 20)(2, 16, 10, 21)(3, 29, 15, 27, 9, 7, 26)(5, 14, 8, 22)(6, 28, 11)(12, 25, 13)(17, 18, 23)
$2C_3 \cup 4C_4 \cup C_7$	(1, 19, 21, 20)(2, 22, 16, 14)(3, 29, 15, 27, 9, 17, 26)(4, 18, 5, 23)(6, 28, 11)(7, 12, 13, 24)(8, 25, 10)
$6C_3 \cup C_4 \cup C_7$	(1, 17, 3, 22, 21, 8, 29)(4, 12, 11, 27)(6, 13, 28)(2, 15, 20)(9, 18, 24)(7, 19, 25)(10, 14, 26)(5, 16, 23)
$C_5 \cup 4C_6$	(1, 22, 7, 11, 24)(2, 15, 28, 4, 12, 25)(3, 23, 10, 20, 21, 18)(5, 14, 6, 16, 8, 26)(9, 19, 17, 27, 13, 29)
$2C_3 \cup C_5 \cup 3C_6$	(1, 22, 11, 26, 5, 24)(2, 25, 16, 4, 28, 15)(3, 21, 18)(6, 20, 14, 8, 10)(7, 23, 12)(9, 19, 17, 27, 13, 29)
$C_3 \cup 2C_4 \cup 3C_6$	(1, 22, 11, 24)(2, 25, 16, 4, 28, 15)(3, 18, 12, 6, 20, 19)(5, 14, 23)(7, 17, 27, 13, 29, 9)(8, 26, 10, 21)
$C_3 \cup C_4 \cup 2C_5 \cup 2C_6$	(1, 22, 8, 23, 5, 24)(2, 15, 28, 4, 12, 25)(3, 19, 16)(6, 18, 21, 20, 14)(7, 11, 10, 26)(9, 17, 27, 13, 29)
$3C_4 \cup C_5 \cup 2C_6$	(1, 22, 11, 24)(2, 15, 28, 4, 25)(3, 18, 6, 16)(5, 13, 29, 9, 7, 23)(8, 26, 14, 12)(10, 21, 20, 19, 17, 27)
$4C_3 \cup C_5 \cup 2C_6$	(1, 24, 6, 20, 19, 22)(2, 25, 4, 28, 15)(3, 21, 16)(5, 11, 23)(7, 26, 14)(8, 12, 10)(9, 29, 13, 18, 17, 27)
$3C_3 \cup 2C_4 \cup 2C_6$	(1, 22, 6, 24)(2, 15, 28, 4, 12, 25)(3, 18, 23)(5, 17, 27, 7, 26, 14)(8, 10, 21)(9, 29, 13, 11)(16, 20, 19)
$C_3 \cup 4C_5 \cup C_6$	(1, 24, 10, 8, 22)(2, 25, 4, 28, 15)(3, 18, 6, 14, 19)(5, 11, 26)(7, 21, 20, 16, 23, 12)(9, 17, 27, 13, 29)
$2C_4 \cup 3C_5 \cup C_6$	(1, 22, 11, 7, 24)(2, 15, 28, 4, 12, 25)(3, 19, 5, 16)(6, 14, 21, 18, 23)(8, 20, 10, 26)(9, 17, 27, 13, 29)
$3C_3 \cup C_4 \cup 2C_5 \cup C_6$	(1, 22, 9, 29, 13, 24)(2, 25, 4, 28, 15)(3, 16, 19, 17, 27)(5, 11, 23)(6, 18, 21, 20)(7, 26, 14)(8, 12, 10)
$2C_3 \cup 3C_4 \cup C_5 \cup C_6$	(1, 22, 11, 24)(2, 25, 4, 28, 15)(3, 23, 5, 16)(6, 18, 19, 17, 27, 12)(7, 13, 29, 9)(8, 26, 14)(10, 21, 20)
$6C_3 \cup C_5 \cup C_6$	(1, 22, 11, 23, 7, 24)(2, 19, 25)(3, 26, 14)(4, 28, 15)(5, 17, 9, 29, 13)(6, 18, 10)(8, 27, 12)(16, 20, 21)
$C_3 \cup 5C_4 \cup C_6$	(1, 22, 6, 24)(2, 25, 16, 4, 28, 15)(3, 21, 18)(5, 11, 26, 14)(7, 19, 17, 27)(8, 23, 12, 10)(9, 29, 13, 20)
$5C_3 \cup 2C_4 \cup C_6$	(1, 24, 12, 22)(2, 25, 16, 4, 28, 15)(3, 21, 18)(5, 26, 14)(6, 23, 10)(7, 19, 11)(8, 20, 17, 27)(9, 29, 13)
$C_4 \cup 5C_5$	(1, 24, 18, 10, 19)(2, 28, 16, 6, 25)(3, 20, 23, 13, 21)(4, 22, 15, 17)(5, 11, 7, 26, 14)(8, 27, 12, 29, 9)
$3C_3 \cup 4C_5$	(1, 19, 24)(2, 28, 16, 7, 25)(3, 18, 13, 21, 15)(4, 20, 22)(5, 14, 26, 11, 17)(6, 23, 10)(8, 9, 29, 12, 27)
$2C_3 \cup 2C_4 \cup 3C_5$	(1, 24, 10, 19)(2, 28, 16, 6, 25)(3, 13, 15, 21)(4, 22, 20, 23, 17)(5, 14, 18)(7, 11, 26)(8, 27, 12, 29, 9)
$C_3 \cup 4C_4 \cup 2C_5$	(1, 19, 18, 24)(2, 28, 16, 3, 25)(4, 20, 6, 17)(5, 11, 23, 13)(7, 26, 14, 15)(8, 9, 29, 12, 27)(10, 21, 22)
$5C_3 \cup C_4 \cup 2C_5$	(1, 19, 24)(2, 28, 16, 7, 25)(3, 13, 26, 5, 21)(4, 15, 18)(6, 11, 17, 23)(8, 27, 10)(9, 29, 12)(14, 20, 22)
$6C_4 \cup C_5$	(1, 19, 4, 24)(2, 28, 16, 6, 25)(3, 14, 15, 18)(5, 13, 11, 21)(7, 12, 29, 9)(8, 26, 10, 27)(17, 22, 20, 23)
$4C_3 \cup 3C_4 \cup C_5$	(1, 19, 24)(2, 28, 16, 3, 25)(4, 18, 11, 20)(5, 13, 21)(6, 26, 7, 10)(8, 27, 15)(9, 29, 12)(14, 22, 17, 23)
$8C_3 \cup C_5$	(1, 19, 24)(2, 25, 14)(3, 21, 15)(4, 28, 16, 13, 27)(5, 17, 18)(6, 20, 22)(7, 23, 10)(8, 11, 26)(9, 29, 12)
$3C_3 \cup 5C_4$	(1, 19, 23, 18)(2, 22, 3, 25)(4, 27, 13)(5, 29, 14, 16)(6, 26, 12, 10)(7, 11, 28)(8, 15, 21)(9, 17, 20, 24)
$7C_3 \cup 2C_4$	(1, 21, 9, 18)(2, 23, 15)(3, 17, 25)(4, 19, 22)(5, 29, 14, 26)(6, 27, 10)(7, 28, 11)(8, 16, 13)(12, 20, 24)

References

[1] Wieb Bosma, John Cannon and Catherine Playoust, The Magma algebra system. I. The user language, *J. Symbolic Comput.* **24** (1997), 235–265. (`http://magma.maths.usyd.edu.au/`)

[2] I. D. Gray, Vertex-magic total labelings of regular graphs, *SIAM J. Discrete Math.* **21** (2007), no. 1, 170–177.

[3] I. D. Gray and J. A. MacDougall, Vertex-magic total labelings of regular graphs II, *Discrete Math.* **309** (2009), 5986–5999.

[4] J. A. MacDougall, Vertex-magic Labeling of Regular Graphs, lecture, July 2002, DIMACS Connect Institute.

[5] J. A. MacDougall, Mirka Miller, Slamin and W. D. Wallis, Vertex-magic Total Labelings of Graphs, *Utilitas Math.* **61** (2002), 3–21.

[6] D. McQuillan, Vertex-magic Cubic Graphs, *J. Combin. Math. Combin. Comput.* **48** (2004), 103–106.

[7] D. McQuillan, A technique for constructing magic labelings of 2-regular graphs, *J. Combin. Math. Combin. Comput.* **75** (2010), 129–135.

[8] M. Meringer, Fast Generation of Regular Graphs and Construction of Cages, *J. Graph Theory* **30** (1999), 137–146.

[9] N. J. A. Sloane, *The On-Line Encyclopedia of Integer Sequences*, published electronically at `http://oeis.org` (2010).

(Received 13 Dec 2010; revised 30 Mar 2011)