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PARTITION OF A GRAPH INTO CYCLES AND VERTICES

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Partition of a Graph into Cycles and Vertices

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Abstract

Let G be a graph of order n and k a positive integer. A set of subgraphs $\mathcal{H}=\{H_1, H_2, \ldots, H_k\}$ is called a *k-weak cycle partition* (abbreviated k-WCP) of G if $H_1, \cdots, H_k$ are vertex disjoint subgraphs of G such that $V(G) = \bigcup_{i=1}^{k} V(H_i)$ and for all i, $1 \leq i \leq k$, H_i is a cycle or K_1 or K_2. It has been shown by Enomoto and Li that if $|G| = n \geq k$ and if the degree sum of any pair of nonadjacent vertices is at least

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$n-k+1$, then G has a k-WCP. We prove that if G has a k-WCP and if the minimum degree is at least $\frac{n+2k}{3}$, then G can be partitioned into k subgraphs H_i, $1 \le i \le k$, where H_i is a cycle or K_1.

1 Introduction

In this paper, we only consider finite undirected graphs without loops and multiple edges. For a vertex x of a graph G, the neighborhood of x in G is denoted by $N_G(x)$, and $d_G(x) = |N_G(x)|$ is the degree of x in G. With a slight abuse of notation, for a subgraph H of G and a vertex $x \in V(G) - V(H)$, we also denote $N_H(x) = N_G(x) \cap V(H)$ and $d_H(x) = |N_H(x)|$. For a subset S of $V(G)$, the subgraph induced by S is denoted by $\langle S \rangle$, and $G - S = \langle V(G) - S \rangle$. For a graph G, $|V(G)|$ is the order of G, $\delta(G)$ is the minimum degree of G, and

$$\sigma_2(G) = \min\{d_G(x) + d_G(y) | x, y \in V(G), x \neq y, xy \notin E(G)\}$$

is the minimum degree sum of nonadjacent vertices. (When G is a complete graph, we define $\sigma_2(G) = \infty$.)

If $C = c_1 c_2 \cdots c_p c_1$ is a cycle, we let $c_i \overrightarrow{C} c_j$, for $i \le j$, be the subpath $c_i c_{i+1} \cdots c_j$, and $c_i \overleftarrow{C} c_j = c_i c_{i-1} \cdots c_j$, where the indices are taken modulo p. For any i and any $l \ge 2$, we put $c_i^+ = c_{i+1}$, $c_i^- = c_{i-1}$, $c_i^{+l} = c_{i+l}$ and $c_i^{-l} = c_{i-l}$.

In this paper, "disjoint" means "vertex-disjoint," since we only deal with partitions of the vertex set.

Suppose $H_1, \cdots, H_k$ are disjoint subgraphs of G such that $V(G) = \bigcup_{i=1}^k V(H_i)$ and for all i, $1 \le i \le k$, H_i is a cycle or K_1 or K_2, then we call $\mathcal{H} = \{H_1, H_2, \ldots, H_k\}$ a *k-weak cycle partition* (abbreviated k-WCP) of G. If, in addition, for all i, $1 \le i \le k$, H_i is a cycle, then the union of these H_i is a 2-factor of G with k components. A sufficient condition for the existence of a 2-factor with a specified number of components was given by Brandt et al. [1].

Theorem 1 *Suppose $|G| = n \ge 4k$ and $\sigma_2(G) \ge n$. Then G can be partitioned into k cycles, that is, G contains k disjoint cycles $H_1, \cdots, H_k$ satisfying $V(G) = \bigcup_{i=1}^k V(H_i)$.*

In order to generalize 2-factors, Enomoto and Li [5] defined k-WCP by considering single edge and single vertex as degenerated cycles. They showed that weaker conditions than Theorem 1 are sufficient for the existence of k-WCP.

Theorem 2 *Let G be a graph of order n and k any positive integer with $k \leq n$. If $\sigma_2(G) \geq n - k + 1$, then G has a k-WCP, except $G = C_5$ and $k = 2$.*

Note that a single vertex can be considered as a cycle of one vertex. Our purpose of this paper is to study the existence of a k-WCP $\{H_1, H_2, \ldots, H_k\}$, each of H_i is either a cycle or a single vertex. Firstly, we show that under a weaker condition on degree sum, there is a k-WCP containing at most one K_2. Secondly, we show that under a weaker condition on minimum degree, there is a k-WCP without K_2.

Theorem 3 *Let G be a graph of order $n \geq k + 12$ that has a k-WCP. If $\sigma_2(G) \geq \frac{2n+k-4}{3}$, then G has a k-WCP containing at most one subgraph isomorphic to K_2.*

Theorem 4 *Let G be a k-WCP graph of order n that has a k-WCP. If $\delta(G) \geq \frac{n+2k}{3}$, then G has a k-WCP without K_2.*

The graphs $G_t = mK_1 + (m+t)K_2$, $t \in \{1, 2\}$, show that both Theorem 3 and Theorem 4 are best possible. By Theorem 2 and Theorem 4, we get

Theorem 5 *Suppose $|G| = n \geq 7k - 3$ and $\delta(G) \geq \frac{n-k+1}{2}$. Then G can be partitioned into k disjoint subgraphs H_i, $1 \leq i \leq k$, where H_i is a cycle or K_1.*

2 Proof of Theorem 3

Let $\mathcal{H}$ be a k-WCP such that $t(\mathcal{H})$, the number of K_2's in $\mathcal{H}$, achieves the minimum.

Let us suppose, to the contrary, that Theorem 3 is false. Then, $t := t(\mathcal{H}) \geq 2$. Denote $\mathcal{H} = \{H_1, H_2, \ldots, H_k\}$ so that H_i, $1 \leq i \leq t$, is a K_2 of G. Suppose $V(H_i) = \{u_i, v_i\}$, $1 \leq i \leq t$. Set

$$A = \{v \in V(G) : v \text{ is not in any cycle of } \mathcal{H}\},$$

and

$$B = \{v \in V(G) : v \text{ is in some cycle of } \mathcal{H}\}.$$

Then, $V(G) = A \cup B$. We first have

(2.1) $N_A(u_i) \cap N_A(v_i) = \emptyset$, $1 \leq i \leq t$.

Suppose, to the contrary, that $x \in N_A(u_i) \cap N_A(v_i)$. Then, $x \in V(H_j)$ for some j with $j \neq i$ and $|V(H_j)| \leq 2$. Set $C^{(1)} = xu_iv_ix$ and

$$\mathcal{H}^{(1)} = \begin{cases} (\mathcal{H} \setminus \{H_i, H_j\}) \cup \{C^{(1)}, V(H_j) \setminus \{x\}\}, & \text{if } j \leq t \\ (\mathcal{H} \setminus \{H_i, H_j, H_l\}) \cup \{C^{(1)}, u_l, v_l\}, & \text{if } j > t, \end{cases}$$

where l is any integer in $\{1, 2, \ldots, t\} \setminus \{i\}$. Then, $\mathcal{H}^{(1)}$ is a k-WCP with $t(\mathcal{H}^{(1)}) < t$, contrary to the choice of $\mathcal{H}$. Hence (2.1) is true.

(2.2) If $t \geq 3$, then $d_{H_i}(u_j) + d_{H_i}(v_j) \leq 1$, $1 \leq i \neq j \leq t$.

To derive (2.2), we suppose, without loss of generality, that $d_{H_2}(u_1) + d_{H_2}(v_1) > 1$. Then, since both $\langle H_1 \rangle$ and $\langle H_2 \rangle$ are connected, $\langle V(H_1) \cup V(H_2) \rangle$ contains a cycle $C^{(2)}$. Define

$$\mathcal{H}^{(2)} = \begin{cases} (\mathcal{H} \setminus \{H_1, H_2\}) \cup \{C^{(2)}, (V(H_1) \cup V(H_2)) \setminus V(C^{(2)})\}, & \text{if } |C^{(2)}| = 3 \\ (\mathcal{H} \setminus \{H_1, H_2, H_3\}) \cup \{C^{(2)}, u_3, v_3\}, & \text{if } |C^{(2)}| = 4. \end{cases}$$

Then, $\mathcal{H}^{(2)}$ is a k-WCP with at most $t - 2$ subgraphs isomorphic to K_2, a contradiction. Hence (2.2) is true.

(2.3) $d_{H_i}(u_1) = d_{H_i}(v_1) = 0$, $2 \leq i \leq t$.

Suppose (2.3) is false, then $\langle V(H_1) \cup V(H_i) \rangle$ contains a path, say $u_1v_1u_iv_i$, of length 3. By (2.1), we have $u_1u_i, v_1v_i \notin E(G)$. Hence,

$$d_G(u_1) + d_G(v_1) + d_G(u_i) + d_G(v_i) \geq 2\sigma_2(G).$$

On the other hand, to avoid a k-WCP with $t-2$ K_2's, we have for every cycle C in $\mathcal{H}$ that $N_C^{+++}(u_1), N_C^{++}(v_1), N_C^{+}(u_i), N_C(v_i)$ are pairwise disjoint. This implies $d_C(u_1)+d_C(v_1)+d_C(u_i)+d_C(v_i) \leq |C|$, and hence

$$d_B(u_1)+d_B(v_1)+d_B(u_i)+d_B(v_i) \leq |B|.$$

Note that $\{H_j : 1 \leq j \leq k, |H_j| \leq 2\}$ is a $(|A|-t)$-weak partition of $\langle A\rangle$. By (2.1) and (2.2), we get

$$d_A(u_1)+d_A(v_1)+d_A(u_i)+d_A(v_i) \leq \begin{cases} 2|A|, & \text{if } t=2 \\ 2(|A|-t+1), & \text{if } t \geq 3. \end{cases}$$

This together with $|A| \leq \begin{cases} (k-1)+t, & \text{if } t \leq 11 \\ k+t, & \text{if } t \geq 12 \end{cases}$ implies

$$d_A(u_1)+d_A(v_1)+d_A(u_i)+d_A(v_i) \leq |A|+k+1.$$

Since $V(G)=A\cup B$, we have

$$d_G(u_1)+d_G(v_1)+d_G(u_i)+d_G(v_i) \leq (|A|+k+1)+|B| = n+k+1,$$

which implies $\frac{4n+2k-8}{3} \leq 2\sigma_2(G) \leq n+k+1$, contrary to $n \geq k+12$. Hence, (2.3) is true.

(2.4) $d_A(u_1)+d_A(v_1) \leq \frac{2|A|+k-5}{3}$.

Recall that $\{H_i : 1 \leq i \leq k, |H_i| \leq 2\}$ is a $(|A|-t)$-WCP of $\langle A\rangle$ with t subgraphs isomorphic to K_2 and $|A|-2t$ subgraphs isomorphic to K_1. By (2.1) and (2.3), we have $d_A(u_1)+d_A(v_1) \leq |A|-2t+2 \leq \min\{|A|-2, k-t+2\} \leq \frac{2(|A|-2)+(k-t+2)}{3}$. Hence, (2.4) is true for $t \geq 3$. Assume now $t=2$. Then, $|A| \leq k+2$ implying that $B \neq \emptyset$. So, $|A| \leq (k-1)+2$ and the assertion follows from $d_A(u_1)+d_A(v_1) \leq |A|-2t+2 = |A|-2 \leq k-1$. Therefore, (2.4) is true.

(2.5) $V(G) \neq A$.

Indeed, if $V(G)=A$, then by (2.4) we have $d_G(u_1)+d_G(v_1) \leq \frac{2n+k-5}{3} < \sigma_2(G)$. Similarly, $d_G(u_2)+d_G(v_2) < \sigma_2(G)$. Hence,

$$d_G(u_1)+d_G(v_1)+d_G(u_2)+d_G(v_2) < 2\sigma_2(G).$$

This implies $\{u_1u_2, v_1v_2\} \cap E(G) \neq \emptyset$. Without loss of generality, assume $u_1u_2 \in E(G)$. By (2.1), we have $u_1v_2, u_2v_1 \notin E(G)$ and hence

$$(d_G(u_1) + d_G(v_2)) + (d_G(u_2) + d_G(v_1)) \geq 2\sigma_2(G).$$

This contradiction completes the proof of (2.5).

It follows from (2.5) that $\mathcal{H}$ contains at least one cycle. Let C be any cycle in $\mathcal{H}$.

(2.6) $N_C^+(u_1) \cap N_C(v_1) = \emptyset$.

To justify (2.6), we assume, to the contrary, that $x \in N_C^+(u_1) \cap N_C(v_1)$. Set $C^{(3)} = x\overrightarrow{C}x^-u_1v_1x$ and $\mathcal{H}^{(3)} = (\mathcal{H} \setminus \{C, H_1, H_2\}) \cup \{C^{(3)}, u_2, v_2\}$. Then, $\mathcal{H}^{(3)}$ is a k-WCP with $t(\mathcal{H}') < t(\mathcal{H})$. This contradiction proves (2.6).

Similarly, we have

(2.7) $N_C^{++}(u_1) \cap N_C(v_1) = N_C^{++}(u_1) \cap N_C^+(u_1) = \emptyset$.

It follows from (2.6) and (2.7) that $2d_C(u_1) + d_C(v_1) \leq |C|$. By symmetry, we also have $2d_C(v_1) + d_C(u_1) \leq |C|$. Hence

(2.8) $d_C(u_1) + d_C(v_1) \leq \frac{2|C|}{3}$.

Note that $\{V(H_i) : 1 \leq i \leq k, H_i \text{ is a cycle}\}$ is a partition of B. By (2.8), we have

$$d_B(u_1) + d_B(v_1) \leq \frac{2|B|}{3}.$$

This together with (2.4) implies $d_G(u_1) + d_G(v_1) \leq \frac{2|A|+k-5}{3} + \frac{2|B|}{3} = \frac{2n+k-5}{3} < \sigma_2(G)$. Similarly, we have $d_G(u_2) + d_G(v_2) < \sigma_2(G)$. On the other hand, by an argument similar to the proof of (2.5), we can get $d_G(u_1) + d_G(v_1) + d_G(u_2) + d_G(v_2) \geq 2\sigma_2(G)$. This contradiction completes the proof of Theorem 3.

3 Proof of Theorem 4

Note that $\sigma_2(G) \geq 2\delta(G) \geq \frac{2n+4k}{3}$. By an argument similar to that in the proof of Theorem 3, we can derive that G has a k-WCP, which contains at most one subgraph isomorphic to K_2. Among all of these partitions, choose one, say $\mathcal{H}$, such that $c(\mathcal{H})$, the number of cycles in the partition, achieves the minimum.

Let us suppose, to the contrary, that Theorem 4 is false. Then, $\mathcal{H}$ contains exactly one subgraph isomorphic to K_2. Denote $\mathcal{H}= \{H_1, H_2, \ldots, H_k\}$, where $H_1 = uv$ is a K_2 of $\mathcal{H}$.

(3.1) $c(\mathcal{H}) \geq 1$.

Indeed, if $c(\mathcal{H}) = 0$, then $|V(G)| = k+1$ and hence $\delta(G) \geq \frac{n+2k}{3} > n-1$, a contradiction. Hence, (3.1) is true.

Define A and B the same as those in Section 2. To avoid a desired k-WCP, we have

(3.2) For every cycle C in $\mathcal{H}$, $N_C^{++}(u) \cap N_C(v) = N_C^{++}(u) \cap N_C^{+}(u) = \emptyset$.

(3.3) There exists a cycle C in $\mathcal{H}$ such that $N_C^{+}(u) \cap N_C(v) \neq \emptyset$.

Indeed, if (3.3) is false, then by (3.2), we have for every cycle C in $\mathcal{H}$ that $2d_C(u) + d_C(v) \leq |C|$, and hence $2d_B(u) + d_B(v) \leq |B|$. Since $|A| = 2 + (k - 1 - c(\mathcal{H})) \leq k$,

$$\begin{aligned} 2d_G(u) + d_G(v) &= (2d_A(u) + d_A(v)) + (2d_B(u) + d_B(v)) \\ &\leq 3(|A| - 1) + |B| \\ &\leq n + 2k - 3, \end{aligned}$$

contrary to $\delta(G) \geq \frac{n+2k}{3}$. Hence, (3.3) is true.

By (3.3), there exists a cycle C in $\mathcal{H}$ such that $N_C^{+}(u) \cap N_C(v) \neq \emptyset$. Let $x \in N_C^{+}(u) \cap N_C(v)$.

(3.4) $N_C^{+}(x^-) \cap N_C(v) = \emptyset$.

Suppose, to the contrary, that $y \in N_C^+(x^-) \cap N_C(v)$. Then $x^-y^- \in E(G)$, which implies $y \neq x$. Set $C^{(1)} = y\overrightarrow{C}x^-y^-\overleftarrow{C}xvy$. Then $(\mathcal{H} \setminus \{C, H_1\}) \cup \{C^{(1)}, u\}$ is a desired k-WCP. This contradiction completes the proof of (3.4).

(3.5) $N_C(v) \cap N_C^{++}(u) = \emptyset$.

To derive (3.5), suppose $y \in N_C(v) \cap N_C^{++}(u)$. Then, $y^{--}u \in E(G)$. Note that $x^-u \in E(G)$. By (3.2), we have $y \neq x$. Similarly, by $x, y \in N_C(v)$, we have $y \neq x^+$. Set $C^{(2)} = y\overrightarrow{C}x^-uy^{--}\overleftarrow{C}xvy$. Then $(\mathcal{H} \setminus \{C, H_1\}) \cup \{C^{(2)}, y^-\}$ is a desired k-WCP. This contradiction proves (3.5).

(3.6) $N_C^+(x^-) \cap N_C^{++}(u) \subseteq \{x^-, x^+\}$.

Suppose the contrary: $y \in N_C^+(x^-) \cap N_C^{++}(u) \subseteq \{x^-, x^+\}$. Then, $y \neq x$. Set $C^{(3)} = x^-y^-\overrightarrow{C}x^-$ and $C^{(4)} = x\overrightarrow{C}y^{--}uvx$. Since $y \neq x^-, x, x^+$, $C^{(3)}$ and $C^{(4)}$ are disjoint cycles of G. So, $(\mathcal{H} \setminus \{C, H_1\}) \cup \{C^{(3)}, C^{(4)}\}$ is a desired k-WCP. This proves (3.6).

It follows from (3.4)-(3.6) that $d_C(x^-) + d_C(u) + d_C(v) \leq |C| + 2$. Similarly, we have $d_C(x) + d_C(u) + d_C(v) \leq |C| + 2$. Therefore,

(3.7) $d_C(x^-) + d_C(x) + 2d_C(u) + 2d_C(v) \leq 2|C| + 4$.

Note that $|A| = k + 1 - c(\mathcal{H})$. To avoid a desired k-WCP, every vertex of A is not insertable in C. Hence,

(3.8) $N_A(x^-) \cap N_A(x) = \emptyset$.

(3.9) $c(\mathcal{H}) \geq 2$.

Indeed, if $c(\mathcal{H}) = 1$, then by (3.7) we have

$$d_B(x^-) + d_B(x) + 2d_B(u) + 2d_B(v) \leq 2|B| + 4.$$

Recall that $|A| \leq k$. Since $u, v \in A$, by (3.8),

$$d_G(x^-) + d_G(x) + 2d_G(u) + 2d_G(v)$$

$$
\begin{aligned}
&= (d_A(x^-) + d_A(x) + 2d_A(u) + 2d_A(v)) \\
&\quad +(d_B(x^-) + d_B(x) + 2d_B(u) + 2d_B(v)) \\
&\leq (5|A| - 4) + (2|B| + 4) \\
&\leq 2n + 3k,
\end{aligned}
$$

contrary to $\delta(G) \geq \frac{n+2k}{3}$. This proves (3.9).

In the following, we let C' be any cycle in $\mathcal{H} \setminus \{C\}$. To avoid a desired k-WCP, we have

(3.10) $N_{C'}(v) \cap N^+_{C'}(v) = N^{+++}_{C'}(x^-) \cap N^+_{C'}(v) = \emptyset$.

(3.11) $N^{+++}_{C'}(x^-) \cap N_{C'}(v) = \emptyset$.

Suppose, to the contrary, that $y \in N^{+++}_{C'}(x^-) \cap N_{C'}(v)$. Set

$$C'' = x\overrightarrow{C}x^- y^{---}\overleftarrow{C'}yvx$$

and $\mathcal{H}' = (\mathcal{H} \setminus \{C, C', uv\}) \cup \{C'', y^- y^{--}, u\}$. Then, $\mathcal{H}'$ is a k-WCP of G containing one K_2 and $c(\mathcal{H}') < c(\mathcal{H})$. This contradiction completes the proof of (3.11).

It follows from (3.10) and (3.11) that $d_{C'}(x^-) + 2d_{C'}(v) \leq |C'|$. Similarly, we have $d_{C'}(x) + 2d_{C'}(u) \leq |C'|$, and hence

(3.12) $d_{C'}(x^-) + d_{C'}(x) + 2d_{C'}(u) + 2d_{C'}(v) \leq 2|C'|$.

By (3.7) and (3.12), we see that

$$d_B(x^-) + d_B(x) + 2d_B(u) + 2d_B(v) \leq 2|B| + 4.$$

By an argument similar to that in the proof of (3.9), we can get a contradiction. This completes the proof of Theorem 4.

References

[1] S.Brandt, G.Chen, R.Faudree, R.J.Gould and L.Lesniak, Degree conditions for 2-factors, J. Graph Theory 24 (1997) 165-173.

[2] G. Chartrand, L. Lesniak, *Graphs & Digraphs* (third edition), Chapman & Hall, London, 1996.

[3] Y.Egawa, R.J.Faudree, E.Győri, Y.Ishigami, R.H.Schelp and H.Wang, Vertex-disjoint cycles containing specified edges, Graphs and Combinatorics, 16 (2000). 81-92.

[4] H.Enomoto, On the existence of disjoint cycles in a graph, Combinatorica 18 (1998) pp. 487-492.

[5] H.Enomoto, H. Li, Partition of a graph into Cycles and Degenerated Cycles, Rapport de Recherche N° 1337, L.R.I., CNRS-Université Paris-Sud, submitted to Discrete Mathematics.

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