Review report on the master thesis

Hamiltonicity of hypercubes without k-snakes and k-coils

by David Pěgřímek

The thesis studies structural properties of interconnecting networks. One type of the long term studied problems in this area is Hamiltonicity of hypercubes with faulty vertices or edges. In this thesis, the faulty vertices form a k-snake or a k-coil.

The thesis is split into seven chapters. Chapters 1, 2 and 3 introduce studied problems and previous results. Chapter 4 proves that the hypercubes with faulty vertices forming a k-snake is Hamiltonian laceable. A similar result for k-coils is proved in Chapter 5. Chapter 6 studies a technical lemma which the student did not proved in his bachelor thesis. The last chapter concludes the thesis.

The thesis contains original results that are publishable in journals with impact factor and it shows that the student understands interconnecting networks. However, the thesis contains many duplicities and therefore it can be significantly shortened to improve the readability of the thesis. I recommend to accept the work as a master thesis and I will suggest a mark after defence.

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Major remarks:

1. The thesis contains many duplicities. For example, Observations 2.2 and 6.3 and their proves are almost identical. Similarities of these proves follow a trivial fact that every k-snake is a k-dragon. Therefore, Observation 6.3 directly implies Observation 2.2. Next, Figures 4.3 and 5.2 are identical. Finally, constructions in Chapters 4 and 5 are very similar, so the common parts should not be repeated.

2. Page 30 states: Since $V(Q_4[r])$ is covered by H we can choose an edge pq of H in $Q_4[r]$ such that pq is not an edge of S. Why such an edge exists?

Selected minor remarks:

3. Page 6: The formula $d_{Q_n}(u,v) = l - 2$ should be replaced by $d_{Q_n}(u,v) \leq l - 2$ since edges e and e' may not be the only parallel edges.

4. Page 7: Hamiltonian laceability of a balanced graph implies Hamiltonicity except for the complete graph on two vertices.

5. Page 10: Hamiltonicity of the hypercube was proved in 19^{th} century and Ivan Havel [19] proved a stronger result.

6. Page 11 and 12: Brackets $\lfloor$ and $\rfloor$ should be used instead of [and].

7. Page 16 contains two consecutive paragraphs which restrict l to be both at least 4 and equal to 4. This is confusing.

8. Page 19: Claim 4.6 should also require that paths P' and R' are vertex disjoint. The proof of the claim considers cases $P \cap R = \emptyset$ and $P \cap R \neq \emptyset$, although the assumption $P \cap R \neq \emptyset$ is not used. Furthermore, paths H_i and G_i are constructed twice for subcubes Q_l shared by paths P and R which may lead to different paths H_i and G_i.

9. Page 24: Why cases $|S[p_{i-1}]| = 4$ and $|S[p_{i-1}]| \neq 4$ are distinguished? There should also be a non-blocked edge $y_{i-1}x_i$ when these two cases are not distinguished.