# CCSU

## DEPARTMENT OF MATHEMATICAL SCIENCES

# COLLOQUIUM

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Maria Sanford, Room 101

# ON THE LENGTH OF FAULT-FREE CYCLES IN FAULTY HYPERCUBES


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### ABSTRACT

When $f$ "faulty" vertices of the same parity are deleted from the $n$-dimensional binary hypercube $Q_n$, the length of the longest fault-free cycle cannot exceed $2^n - 2f$. Some authors have found upper bounds for the values of $f$ for which a fault-free cycle of length at least $2^n - 2f$ exists. The best result known so far was the following theorem of J-S. Fu: If $n \geq 3$ and $0 \leq f \leq 2n - 4$ then for any set of vertices $F$ in $Q_n$ of cardinality $f$ there exists a cycle in $Q_n \setminus F$ of length at least $2^n - 2f$. This result was known to be sharp only for $n = 3$ and $n = 4$.

We improve the above result as follows: If $n \geq 5$ and $f$ are integers with $0 \leq f \leq 3n - 7$ then for any set of vertices $F$ in $Q_n$ of cardinality $f$ there exists a cycle in $Q_n \setminus F$ of length at least $2^n - 2f$.

We also provide an example showing that if $n \geq 4$ then there exists a set $F$ of $f = \frac{n(n-1)}{2} - 1$ vertices such that the maximal length of a cycle in $Q_n \setminus F$ is less than $2^n - 2f$. In particular, this example shows that our result cannot be improved when $n = 5$.

This example and the above two results motivate the following conjecture (which is clearly a theorem when $n = 4$ and $n = 5$).

**Conjecture:** Let $n \geq 4$ and $f$ be integers with $0 \leq f \leq \frac{n(n-1)}{2} - 2$. Let also $F$ be a set of vertices in $Q_n$ of cardinality $f$. Then there exists a cycle in $Q_n \setminus F$ of length at least $2^n - 2f$.


***For further information:***


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