CLAIMS

1. A method for defining a flat XOR erasure code for a system having a predetermined number of data disks, the method comprising:

selecting a predetermined acceptable number of failures for the system;

constructing a first Tanner graph for a two failures acceptable system having the predetermined number of data disks;

determining a first erasure code from the first Tanner graph; and

repeating the constructing step and the determining step by increasing the acceptable number of failures by one and (a) constructing another Tanner graph in response to the increased acceptable number of failures and an increased number of parity nodes and (b) determining a subsequent erasure code from the constructed Tanner graph, the repeating step repeating the constructing and determining until an erasure code is determined for the predetermined number of failures for the system, wherein the erasure code is flat XOR code in which each strip includes only one element of either data or parity, the constructed Tanner graphs include an index for each symbol node that represents either a data symbol or a parity symbol, and encoding and decoding of the erasure code are based on integer indices in the constructed Tanner graphs.

2. The method in accordance with Claim 1, wherein the step of constructing a first Tanner graph for a two failures acceptable system comprises:

determining the number of data nodes based on the predetermined number of data disks;

determining the number of parity nodes required in the system based on the number of data nodes;

determining the number of symbol nodes in the Tanner graph in response to the sum of the number of data nodes and parity nodes;

determining the number of check nodes in the Tanner graph from the number of the parity nodes; and

constructing a first Tanner graph for a two failures acceptable system by using the number of symbol nodes and check nodes.

3. The method in accordance with Claim 2, wherein the step of determining the number of parity nodes required in the system comprises:

A) choosing an integer set as node indices;

B) determining the number of digits (d) in the node index so that each node has a unique index; and

C) computing the number of parity nodes by d to the power of q-1 (d^{q-1}).

4. The method in accordance with Claim 1, wherein the repeating step further comprises adding both the increased number of parity nodes and an increased number of check nodes into the Tanner graph to construct a system that tolerates more than three node failures.

5. The method in accordance with Claim 1, wherein the repeating step further comprises adding both the increased number of parity nodes and an increased number of check nodes into the Tanner graph to construct a four failures acceptable system.

6. The method in accordance with Claim 1, wherein the repeating step further comprises adding both the increased number of parity nodes and an increased number of check nodes into the Tanner graph to construct a more than four failures acceptable system.

7. The method in accordance with Claim 3, wherein the integer set chosen as the node indices in the Tanner graph are binary integers.

8. The method in accordance with Claim 3, wherein the integer set chosen as the node indices in the Tanner graph are q-ary (base q) integers.

9. A non-transient computer readable medium containing program instructions for causing a computer to perform the method for defining a flat XOR erasure code for a system having a predetermined number of data disks, the method comprising:

selecting a predetermined acceptable number of failures for the system;

constructing a first Tanner graph for a two failures acceptable system having the predetermined number of data disks;

determining a first erasure code from the first Tanner graph; and

repeating the constructing step and the determining step by increasing the acceptable number of failures by one and (a) constructing another Tanner graph in response to the increased acceptable number of failures and an increased number of parity nodes and (b) determining a subsequent erasure code from the constructed Tanner graph, the repeating step repeating the constructing and determining until an erasure code is determined for the predetermined number of failures for the system, wherein the erasure code is flat XOR code in which each strip includes only one element of either data or parity, the constructed Tanner graphs include an index for each symbol node that represents either a data symbol or a parity symbol, and encoding and decoding of the erasure code are based on integer indices in the constructed Tanner graphs.

10. A system comprising:

an apparatus having a predetermined number of data disks; and

a computer for defining a flat XOR erasure code, having a processor configured to:

select a predetermined acceptable number of failures for the system;

construct a first Tanner graph for a two failures acceptable system having the predetermined number of data disks;

determine a first erasure code from the first Tanner graph; and

repeat the constructing step and the determining step by increasing the acceptable number of failures by one and (a) constructing another Tanner graph in response to the increased acceptable number of failures and an increased number of parity nodes and (b) determining a subsequent erasure code from the constructed Tanner graph, the repeating step repeating the constructing and determining until an erasure code is determined for the predetermined number of failures for the system, wherein the erasure code is flat XOR code in which each strip includes only one element of either data or parity, the constructed Tanner graphs include an index for each symbol node that represents either a data symbol or a parity symbol, and encoding and decoding of the erasure code are based on integer indices in the constructed Tanner graphs.