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## Capstone Abstract: LT Codes

Luby transform codes (LT codes) are a practical way to transmit messages over an unreliable channel. Specifically, LT codes are a class of erasure correcting codes that can handle deletions of parts of the message — note that LT codes by itself can not correct for errors or corruption in transmitted data. LT codes are particularly useful in scenarios where a traditional acknowledgement-based scheme is impractical such as broadcasting and across mediums with a large latency because LT codes are essentially a one-way communication stream that does not require any response from the receiver. Given a message of  $K$  blocks, the sender can generate an infinite number of encoded blocks. The receiver only needs to receive a subset of those encoded blocks of size  $K'$ ,  $K'$  slightly larger than  $K$ , to have a high probability of being able to decode the original message. For my capstone project, I built an implementation of LT codes.

To generate each packet to be sent, the sender chooses randomly a degree  $d$  for the packet. LT codes can work with any distribution of  $d$ , but a careful selection of the distribution is needed to ensure a high probability of decoding. The robust soliton distribution is commonly used and the one I used in my implementation. The degree denotes how many blocks are contained in the packet, with blocks being chosen uniformly at random. The selected blocks are then bitwise XOR-ed and transmitted with metadata that allows the decoder to determine which blocks were XOR-ed. The receiver keeps a queue of packets until it has one with degree of exactly one. The receiver uses packets of degree one to establish the contents of the message for that block as well as to reduce the degree of other packets containing that block by XORing them. The process continues until the receiver has the full message.