

CS F364

Design & Analysis of Algorithms

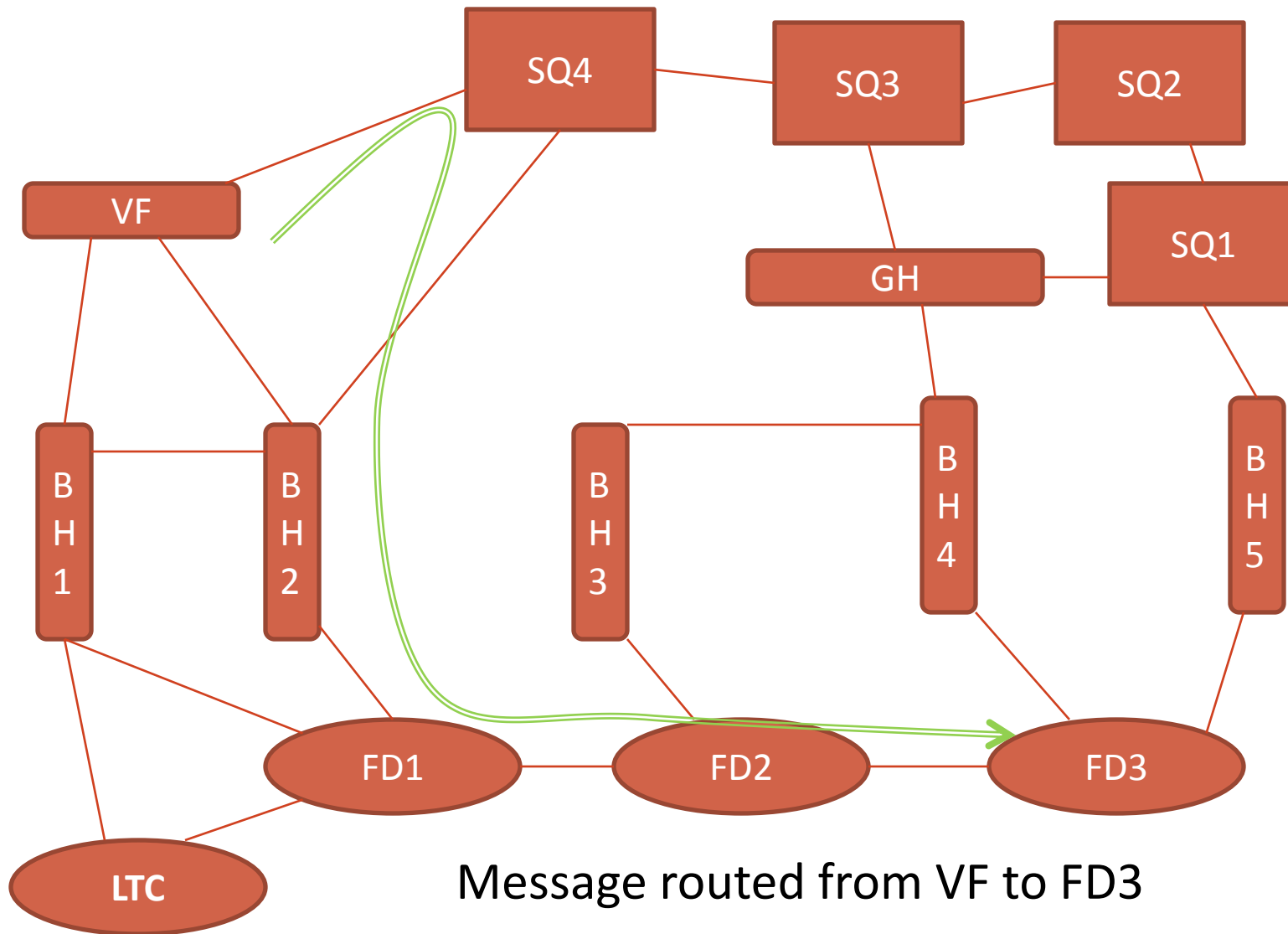
# ALGORITHM DESIGN: GREEDY TECHNIQUE

## Minimum Spanning Trees - Modeling and Definition

# MINIMUM SPANNING TREES

- Given a computer network modeled as a graph:
  - A path is computed for routing end-to-end messages
    - Shortest paths minimize the cost of communication per source-destination pair.

# NETWORKS AND PATHS



# MINIMUM SPANNING TREES

- Given a computer network modeled as a graph:
  - What if the communication is a broadcast? i.e.
    - a single message is to be sent from (any) source to all destinations and
    - nodes can forward messages
  - The goal in this case would be to minimize the total cost of broadcasting
  - The (optimal) broadcast path would be *a tree that spans all vertices* such that the sum of weights of edges is minimal.

## CSIS, BITS, Pilani



## A spanning tree

# MINIMUM SPANNING TREES

## ○ Definitions:

- Give a weighted, connected, undirected graph  $G=(V,E,w)$ :
  - **a *spanning tree*  $T$**  is a tree  $(V,E')$  such that  $E'$  is a subset of  $E$ .
  - **a *minimum spanning tree*** is a tree  $T$  with the smallest total weight
    - i.e.  $\sum_{e \in T} w(e)$  is minimum

## ○ Question:

- Minimizing the number of edges is meaningless – Why?