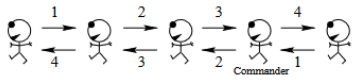
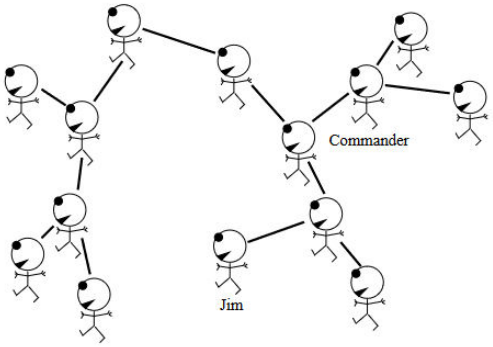
Chapter 16 - Message Passing

Message-Passing Algorithm - an algorithm performed on a network/graph, where information is passed locally among nodes, **iteratively**, using **simple operations**, to eventually **solve a global problem**

16.1 Counting

- Naive approaches are expensive
- 

    - **Line Graph**
    - You need soldiers to shout their name to the commander and the commander must be able to hear all of them and add up all of the numbers
    - **Message Passing -** each soldier adds 1 to the number whispered from behind or from in front, then pass it in the same direction, and the commander adds the front and back numbers together and adds 1
    - The above doesn't work in a graph with a cycle, as you can't split the total two 3 numbers that can be computed separately
- 

1. Count your number of neighbours, N.
2. Keep count of the number of messages you have received from your neighbours, m, and of the values $v_1, v_2, \ldots, v_N$ of each of those messages. Let V be the running total of the messages you have received.
3. If the number of messages you have received, m, is equal to $N-1$, then identify the neighbour who has not sent you a message and tell them the number $V+1$.
4. If the number of messages you have received is equal to N, then:
    (a) the number $V+1$ is the required total.
    (b) for each neighbour n {
        say to neighbour n the number $V+1-v_n$.
    }

- **Tree**
- We can modify our line graph solution to work for a tree
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