

# A review of the Byzantine problem

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- In fact, they send **arbitrary messages** to other generals.
- In order for them to reach consensus, two conditions must be satisfied:
  - 1 Every loyal general must obtain the same information  $v(1), v(2) \dots, v(n)$
  - 2 The value sent by a loyal general should be used by all loyal generals

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### Definition (Byzantine Generals Problem)

A **commanding general** must send an order to his  $n - 1$  **lieutenant generals** s.t.:

IC1. All loyal lieutenants obey the same order.

IC2. If the commanding general is loyal, then every loyal lieutenant obeys the order he sends.

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\* Also note that, E.g. when General  $n$  sends  $v(n)$  lieutenant  $n - 1$  retrieves a message from  $n - 2$  generals and then apply a function  $Majority(v(1), v(2), \dots, v(n - 2))$  and adds  $v(n)$  to the list  $V_1$

## A review of the Byzantine problem *cont.*

Lamport gave a recursive algorithm based on **majority function** for the mentioned problem in case of having **oral messages** whose content is solely managed by the sender.

- 1 **It is expensive**  $\rightarrow O(n!)$
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In order to deal with problem 2, he proposed an algorithm based on **unforgeable messages**.