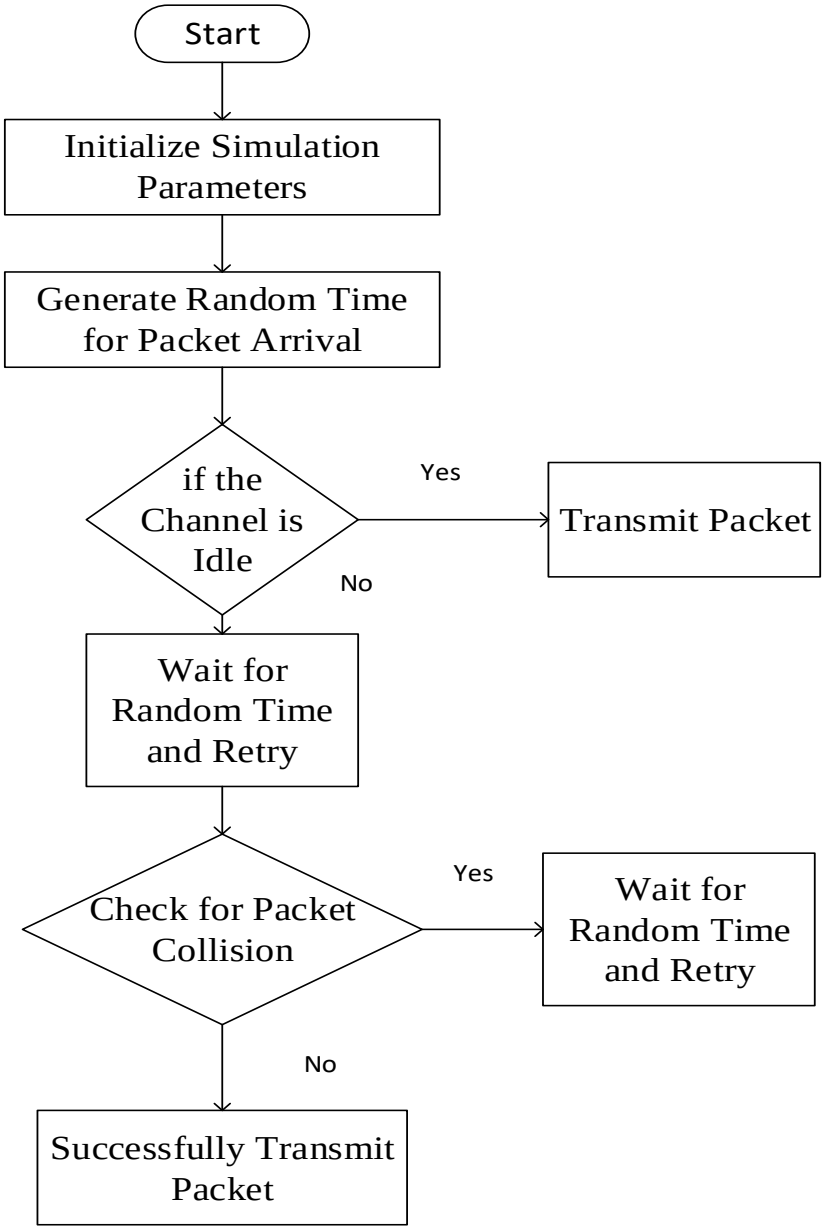
ALOHA and Slotted ALOHA Experiment

Objective:

To simulate the **ALOHA** and **Slotted ALOHA** protocols in MATLAB and observe the effect of network load, throughput, and collision rates for both protocols.

ALOHA:

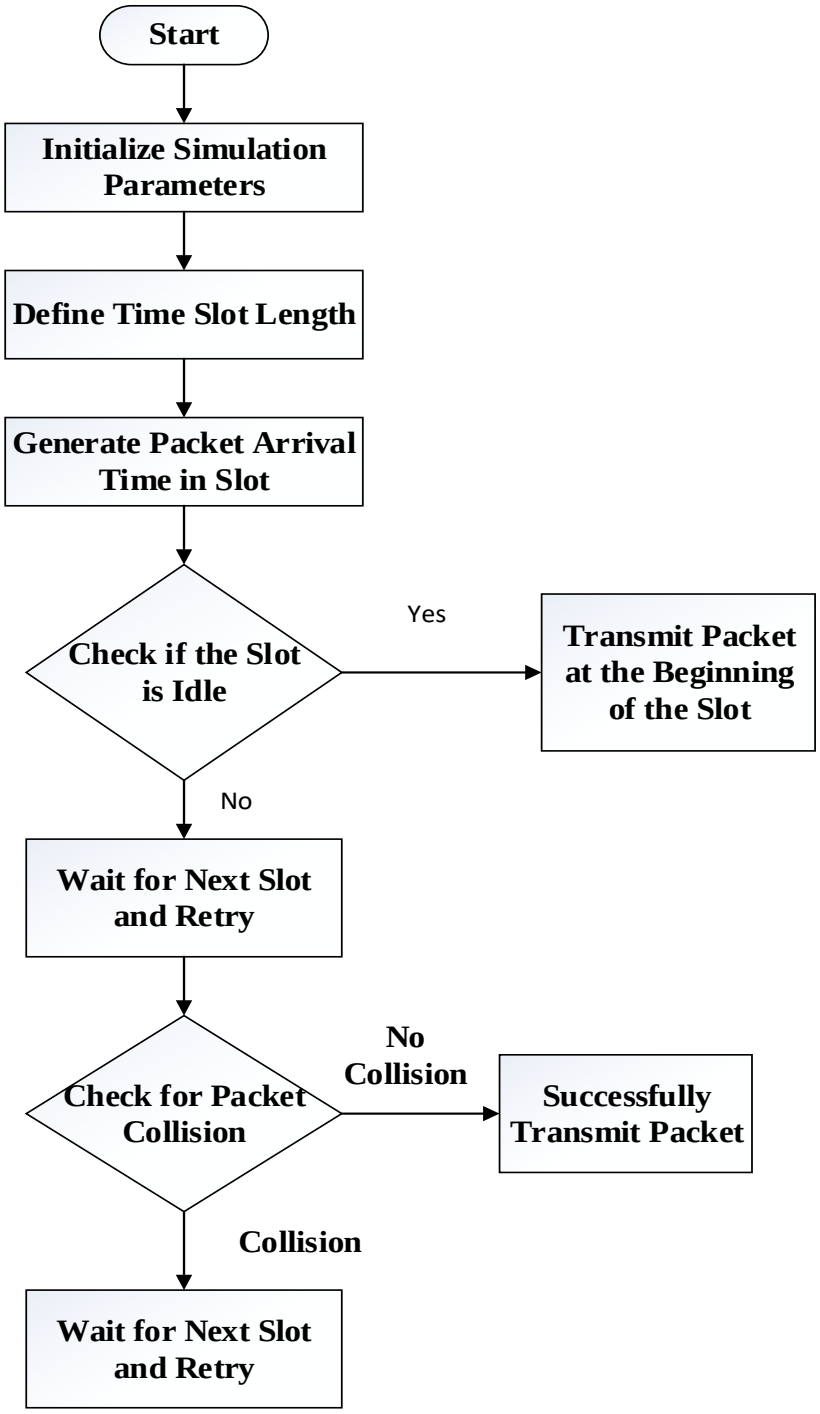
1. Each node transmits its data **randomly** (without any time synchronization).
2. If two nodes collide (i.e., they transmit at the same time), both nodes back off for a **random time** and then try again.



Flow chart of ALOHA

Slotted ALOHA:

1. Time is divided into discrete **slots**. Each node is **synchronized** and can only transmit at the start of each time slot.
2. If two nodes attempt to transmit during the same time slot, a **collision** occurs, and both nodes back off and retry at a random time.



Flow chart of Slotted-ALOHA

Network Parameters

`numNodes`	Number of nodes in the simulation
`numSlots`	Total number of slots (time units) for transmission
`numTrials`	Number of trials to simulate in order to average results
`transmissionProb`	Probability that a node will transmit in a given time slot (used to simulate **traffic load**).

Simulation Loop:

1. Each trial generates a matrix of **random transmissions** for all nodes at each time slot.
2. **ALOHA** and **Slotted ALOHA** protocols are simulated by calling respective functions (*runAloha* and *runSlottedAloha*).

Results:

1. **Throughput**: Percentage of successful transmissions over total slots.
2. **Collision Rate**: Percentage of time slots where a collision occurred.
3. The results are visualized using **bar charts** to compare the **average throughput** and **collision rate** for both protocols.

Hints:

- **Throughput** for **ALOHA** will be lower than **Slotted ALOHA** due to the lack of time synchronization, resulting in higher collision rates.
- **Slotted ALOHA** should show higher throughput as nodes only transmit at the start of a time slot, minimizing collisions.

In Lab Manual:

- **MATLAB Code**: Submit the complete code for the experiment.
- **Graphs**: Include bar charts showing **throughput** and **collision rate** for both **ALOHA** and **Slotted ALOHA**.
- **Analysis Report**: Explain the results, compare the performance of both protocols, and discuss the **advantages** of **Slotted ALOHA** over **ALOHA**.