HW 2

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Q1

We have an Ethernet LAN, a malicious node and other perfect nodes carrying out CSMA-CD protocol. Malicious node has to transmit atleast N% of the times of succesful transmission.
We can achieve this by the following protocol for the node:

- Maintain a counter for total number of succesful transmissions [Can be done by CS all the time]
- Career sense the medium, if no one is transmitting then wait for 9.6 μs and then transmit frames.
- If no collision occurs then all the transmission is by the malicious node only and hence satisfies the required condition while remaining undetected as no one else has anything to transmit.
- If there is a collision, then both the nodes will stop transmitting and back off. Now, the malicious node checks if the current value of succesful transmissions is less than or more than N% of succesful transmissions. If it is less, then it has a back off time of 0 and starts transmitting again. If it is more, then it behaves like a normal node and chooses a random wait time.

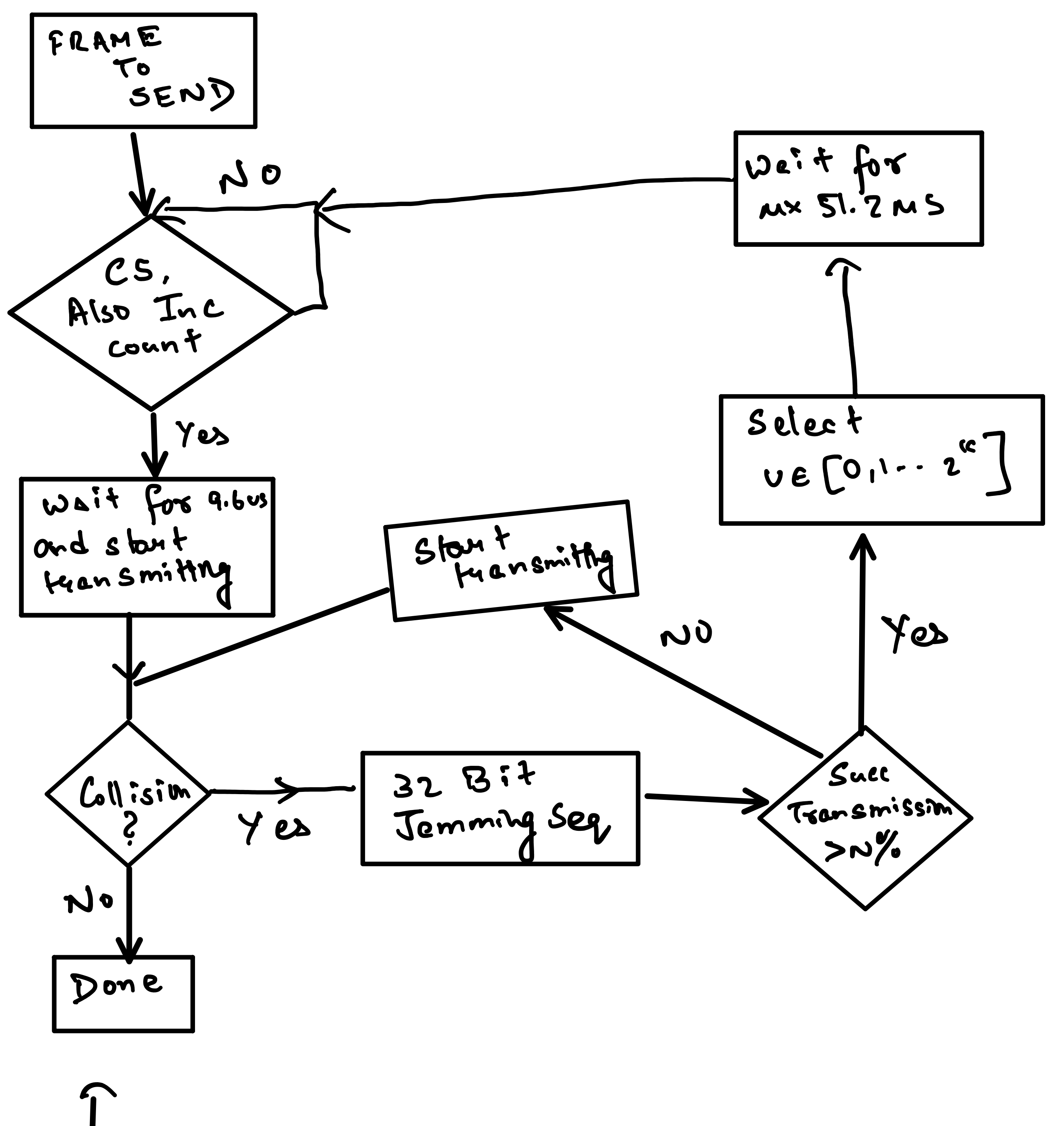
- Remains Undetected

The node transmits normally if current value is greater than N%, hence lot of the time it behaves normally and can blend in. If collision occurs repeatedly, then the other node would back off exponentially and hence the node would be able to send some frames succesfully [when < N%] and increment its success percentage while remaining undetected.

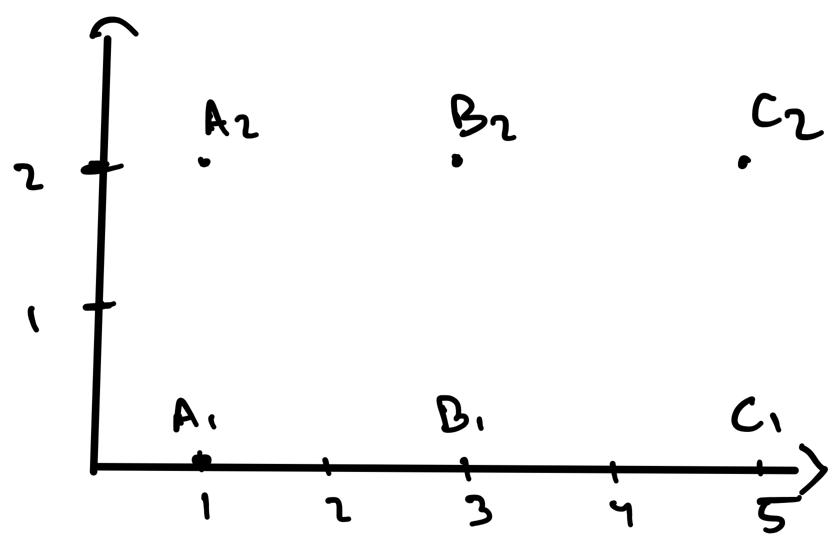
- Ensuring N% of succesful transmissions

This can be easily shown as from start to a time interval, we are ensuring the success percentage to be more than N, and if not, then it is pushed further by 0 backoff.

Flowchart



Q2



B_1 can hear both A_1 and C_1. Also B_2 can hear RTS of both A_1 and C_1. Hence, while A_1 or C_1 is transmitting B_1 cannot interfere. And when B_1 is transmitting, A_1 and C_1 cannot transmit.

We assume that the throughputs are averaged over time. Hence, let's assume that A_1, B_1 and C_1 get separate but equal amount of time to transmit their data. But A_1 cannot hear RTS of C_1 and vice verse. So, we can allow C_1 to transmit while A_1 is transmitting and also allow A_1 to transmit when C_1 is transmitting. So, if before this eddition, all three had $\frac{1}{3}$rd of the time, now A and C have $\frac{2}{3}$rds while B has $1/3$rd only. Hence we can conclude that the throughputs T_A and T_C are equal and are both greater than T_B.

$$\boxed{T_A = T_C > T_B}$$