Code Section

```
aloha
                    v  v                        v                   v
h0: ..................<--><-->.....................<---|.....<---|.............<---|.........<---|
                                  v    v               v           v
h1: ....................................<---|...........<---|.................<---|.............<---
                               v  v          v                    v
h2: ..............................<--><---|.............<---|.............<---|.........<--><---|..
success_rate: 0.2
idle_rate: 0.41
collision_rate: 0.39
```

```
slotted_aloha
                    v  v                        v                   v
h0: ....................<--><-->.....................<---|.....<---|.........<---|...................
                                  v    v               v           v
h1: ....................................<---|.............<---|.....<--><---|.............<--->
                               v  v          v                    v
h2: ..................................<--><---|<--><---|............................<--><--->.....
success_rate: 0.4
idle_rate: 0.4
collision_rate: 0.2
```

```
csma
                    v  v                        v                   v
h0: ..................<--><-->.....................................<-->.<---|.....................
                                  v    v               v           v
h1: ..............................................<---|.................<---|.........<---|........
                               v  v          v                    v
h2: ..............................<--><-->.......<---|.....<-->.......................<---|.......
success_rate: 0.3
idle_rate: 0.52
collision_rate: 0.18
```

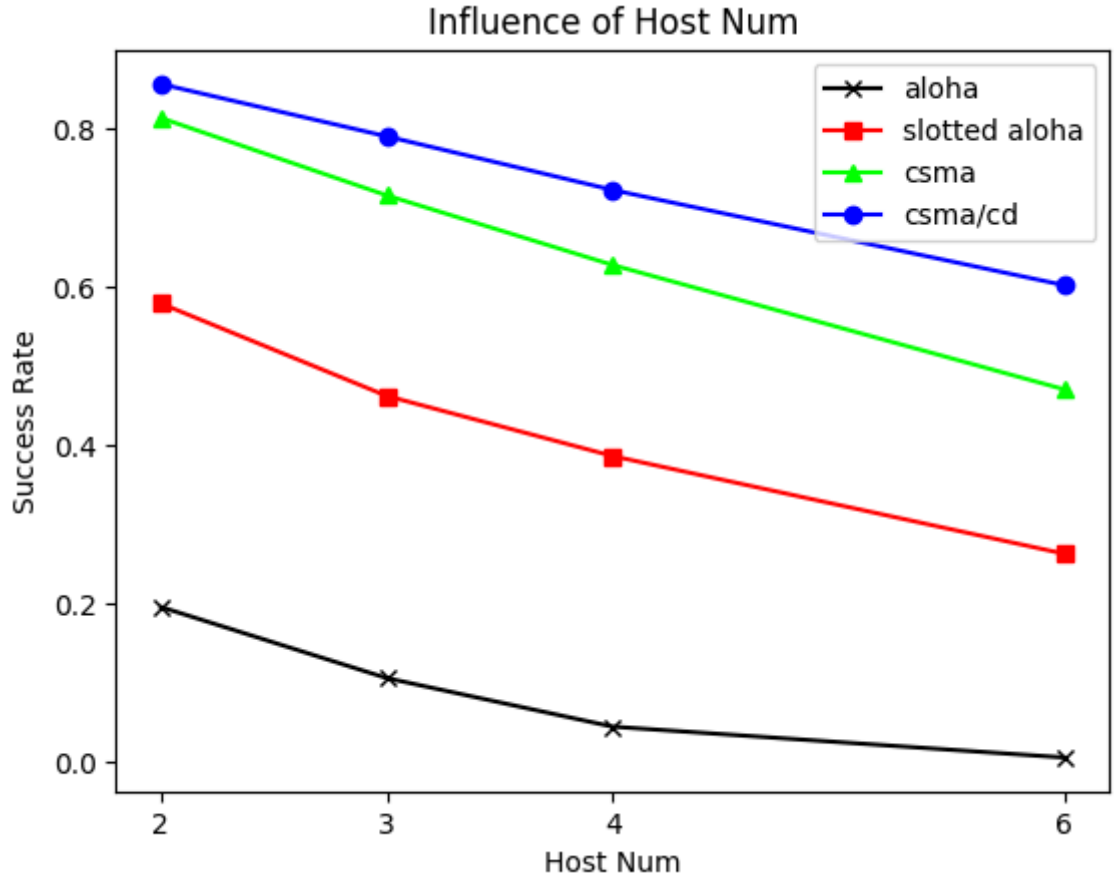
```
csma_cd
                    v  v                        v                   v
h0: ..................<--><-->.....................................................................
                                  v    v               v           v
h1: ..............................................<|.....<--><--><-->......<-->.................
                               v  v          v                    v
h2: ..............................<--><-->.......<--|.....................................<--><-->..
success_rate: 0.5
idle_rate: 0.46
collision_rate: 0.04
```

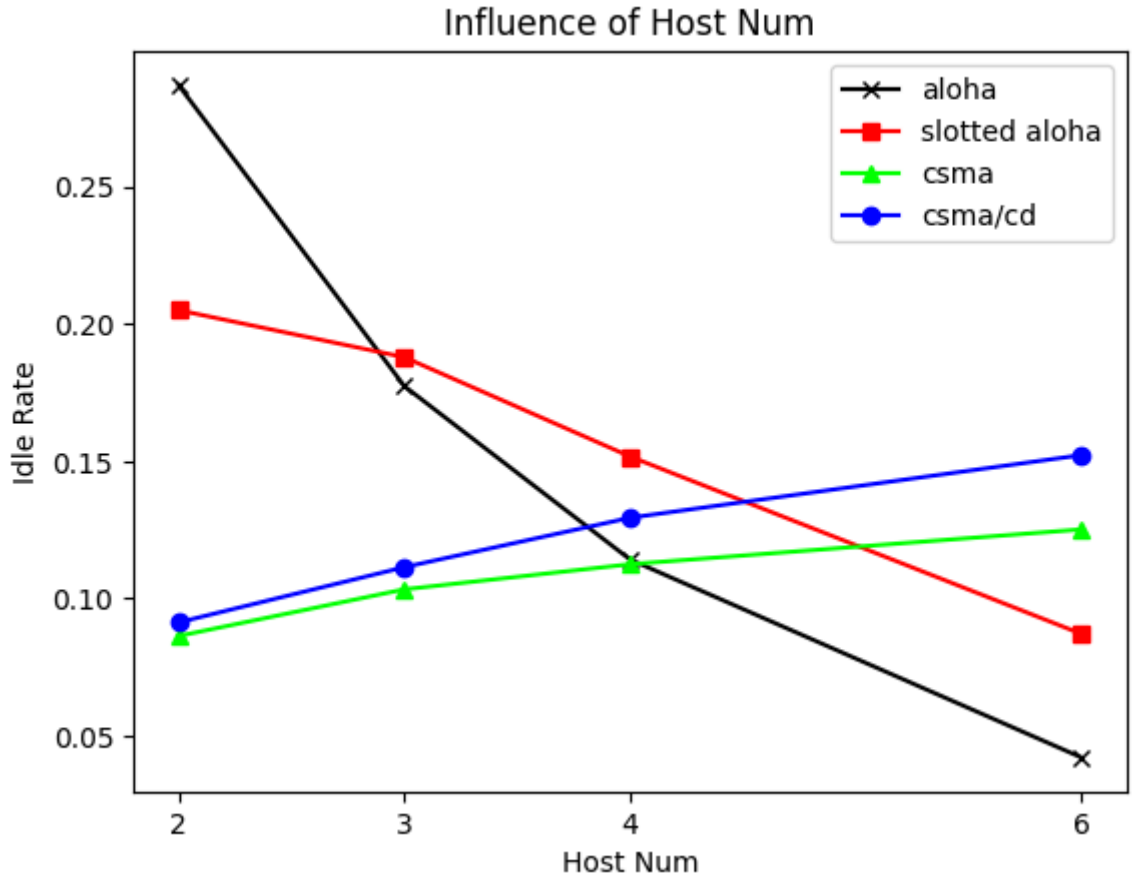
Questions

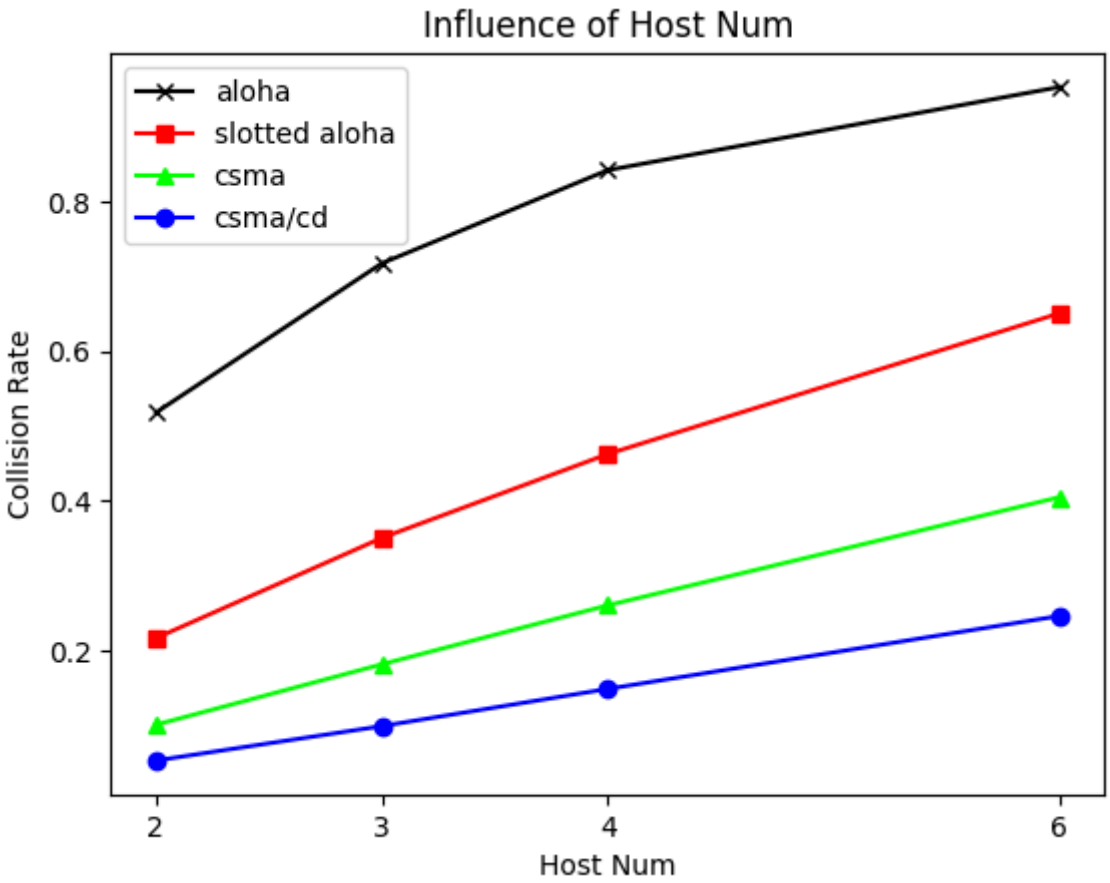
1.

- max_collision_wait_time = c * host_num * packet_time
- p_resend = 1 / (c * host_num)

2.

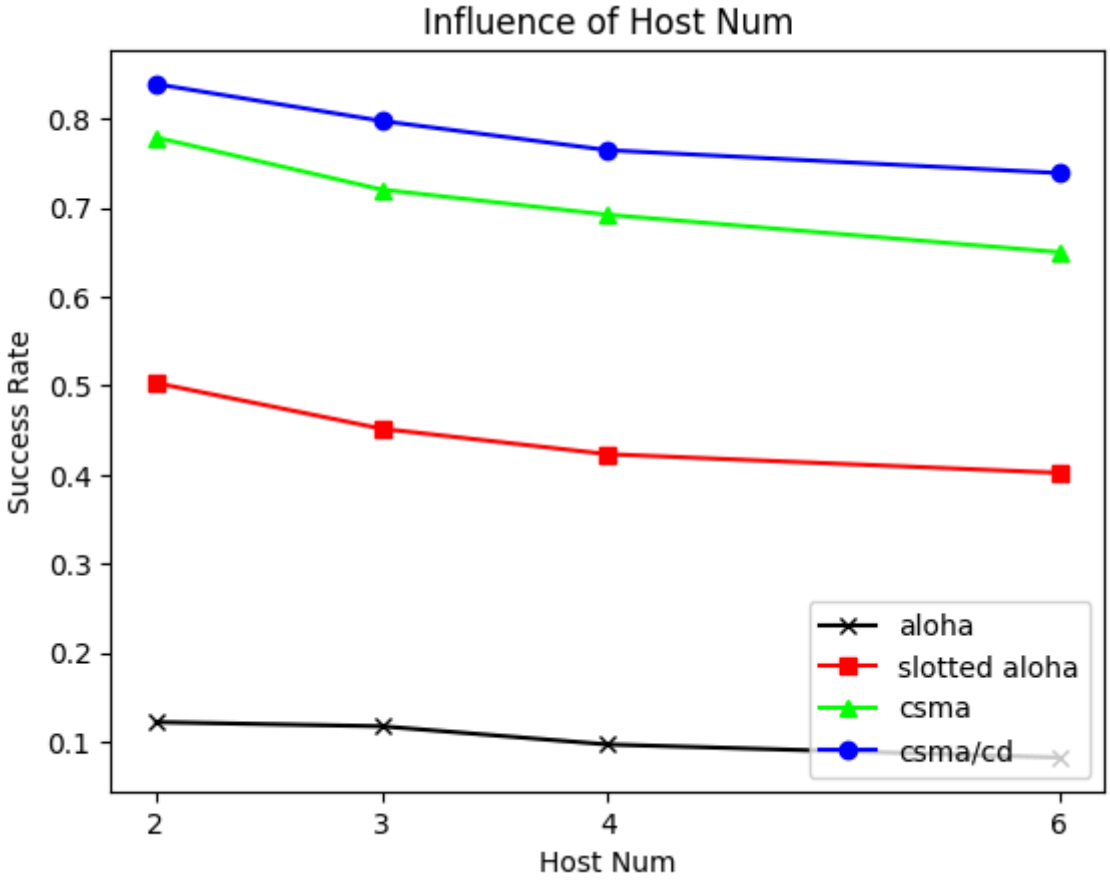

Influence of Host Num
aloha
slotted aloha
csma
csma/cd
Success Rate
0.0
0.2
0.4
0.6
0.8
2
3
4
6
Host Num

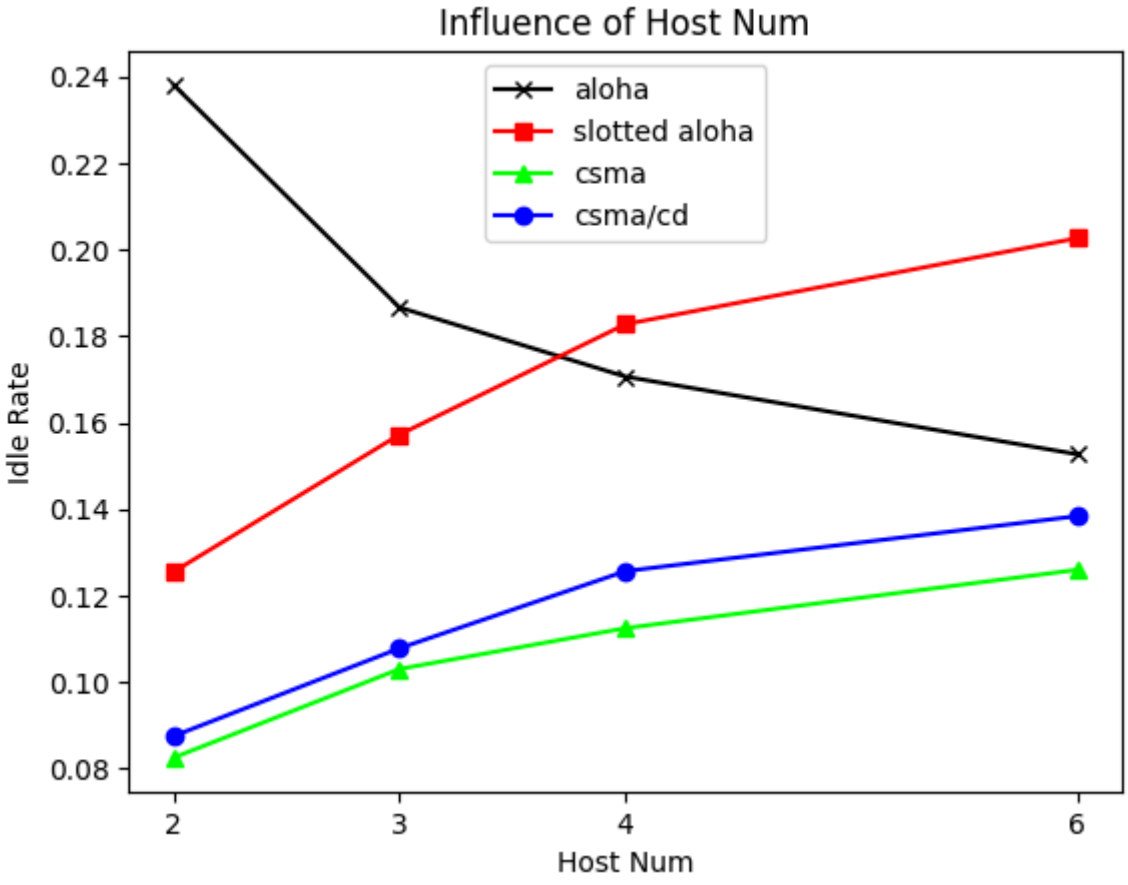

Influence of Host Num
aloha
slotted aloha
csma
csma/cd
Idle Rate
0.05
0.10
0.15
0.20
0.25
2
3
4
6
Host Num

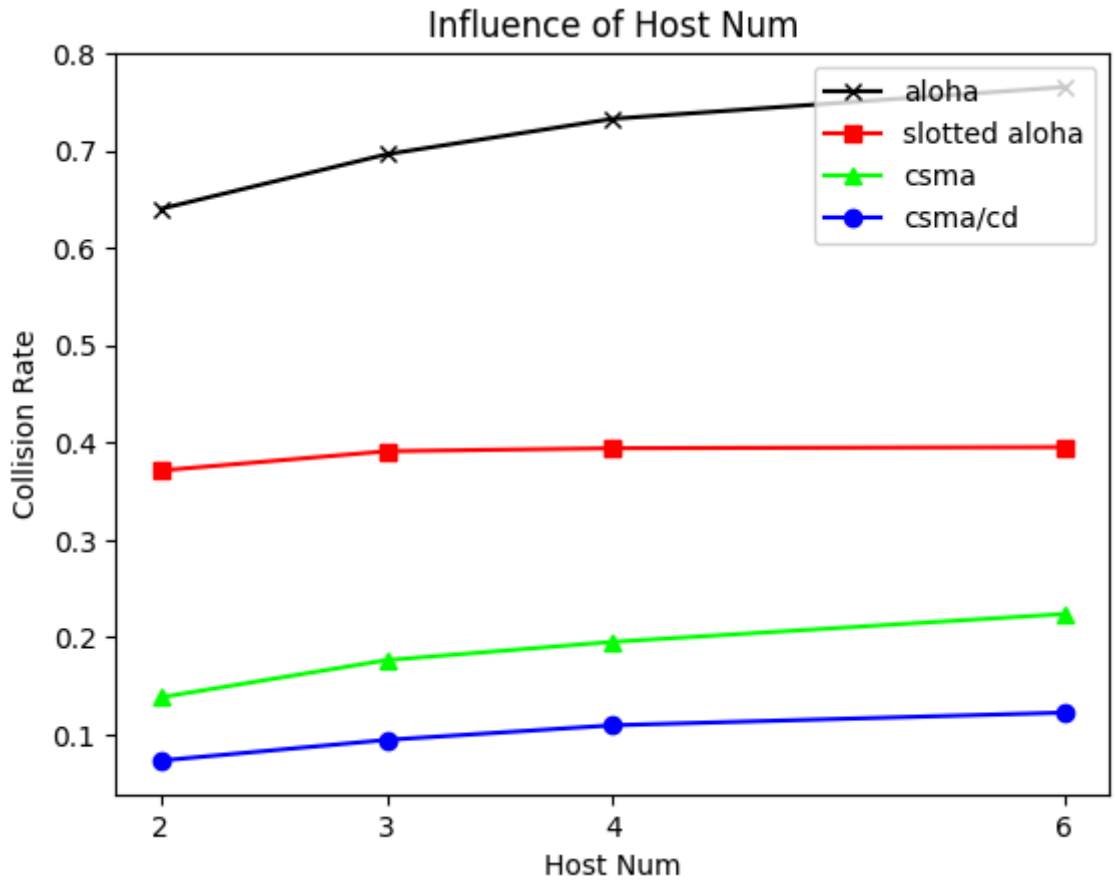


The more host there are, the lower the success rate is. Because of the unavoidable increase in collision rate.
Idle rate drastically drop for aloha because they won't detect before sending, all the hosts tries to send at the same time.

3.

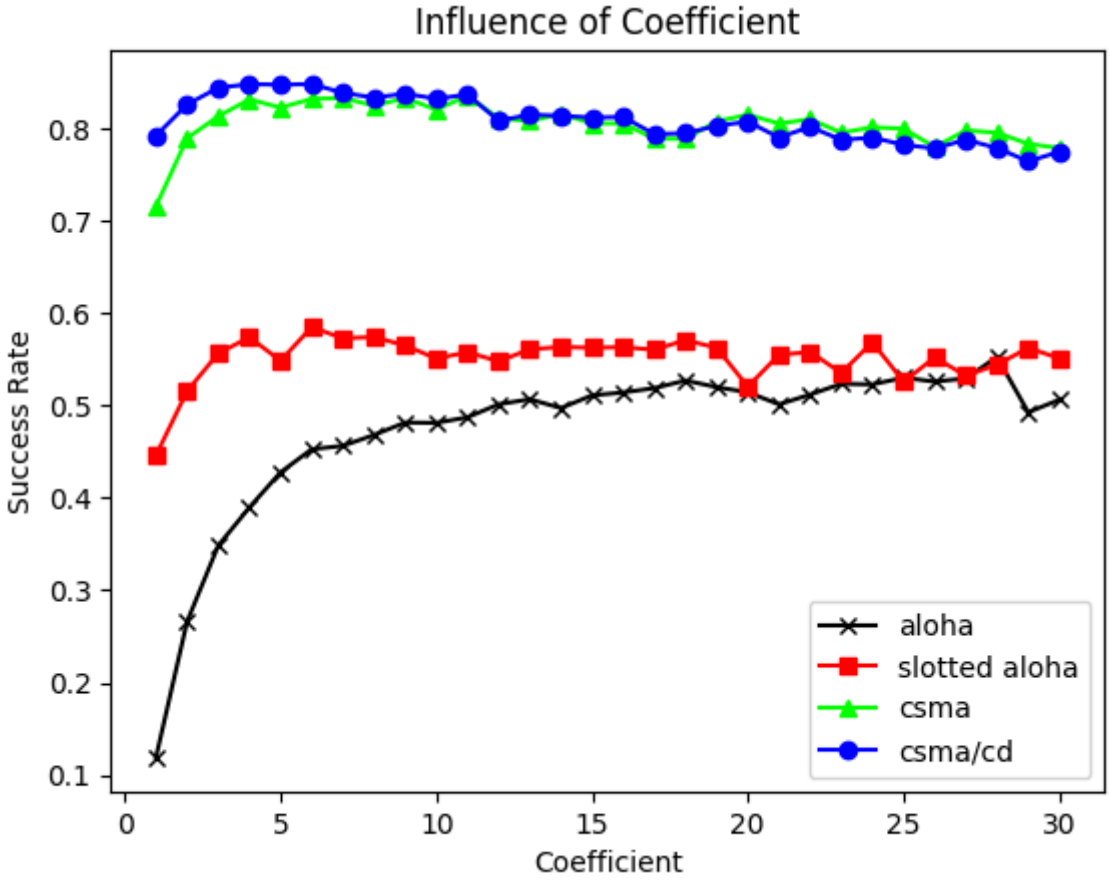

Influence of Host Num
Success Rate
Host Num
aloha
slotted aloha
csma
csma/cd

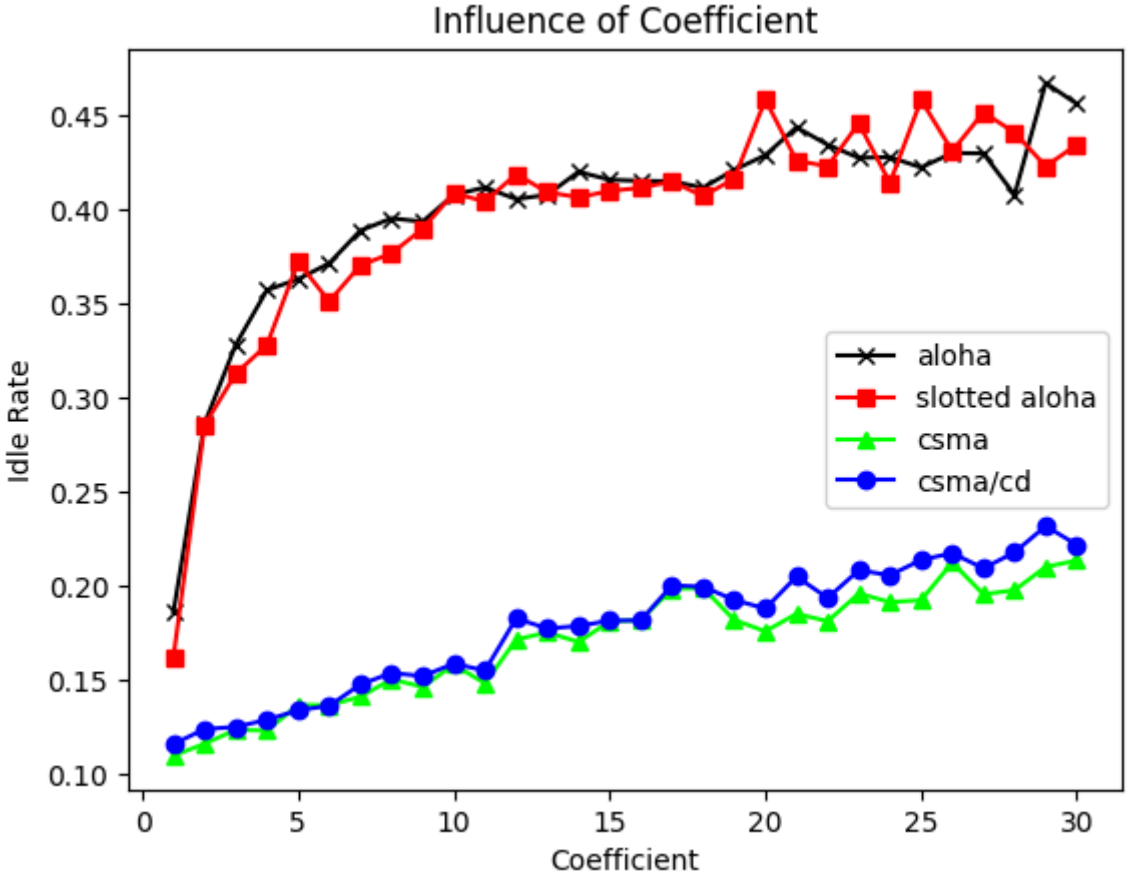

Influence of Host Num
Idle Rate
Host Num
aloha
slotted aloha
csma
csma/cd

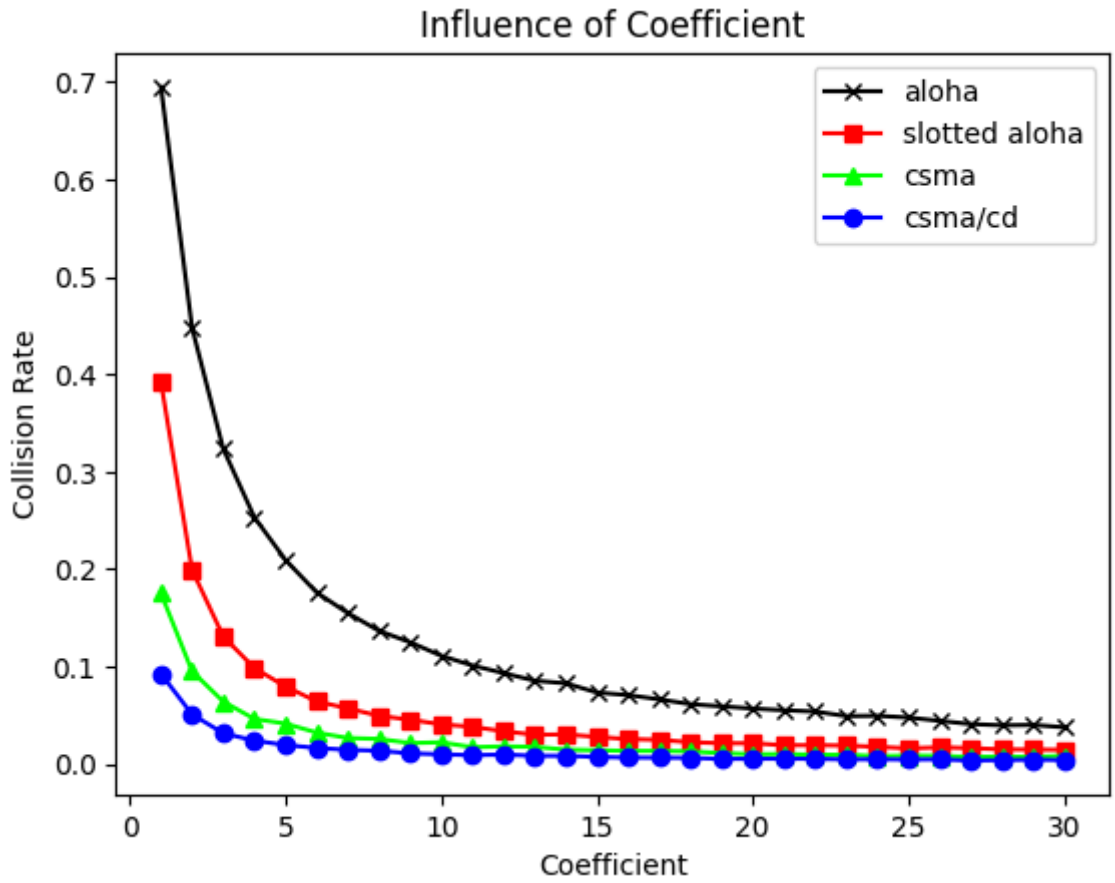


Because the `max_collision_wait_time` and `p_resend` take account of the host_num when using coefficient, the success rate didn't drop as much as Q2 when the hosts num rises. The initial success rate at low host num is worse than Q2 because when the coefficient=1, the `max_collision_wait_time` is lower that constant 20.

4.

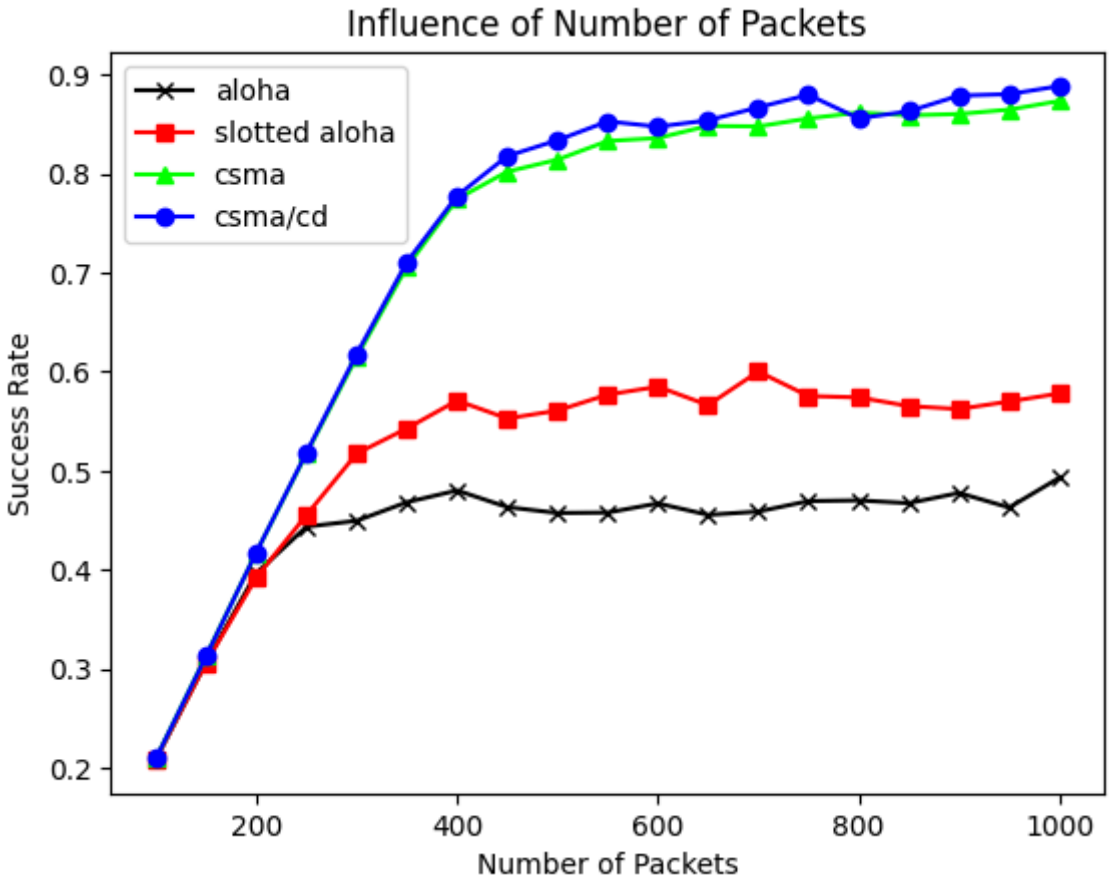

Influence of Coefficient
Success Rate
Coefficient
aloha
slotted aloha
csma
csma/cd

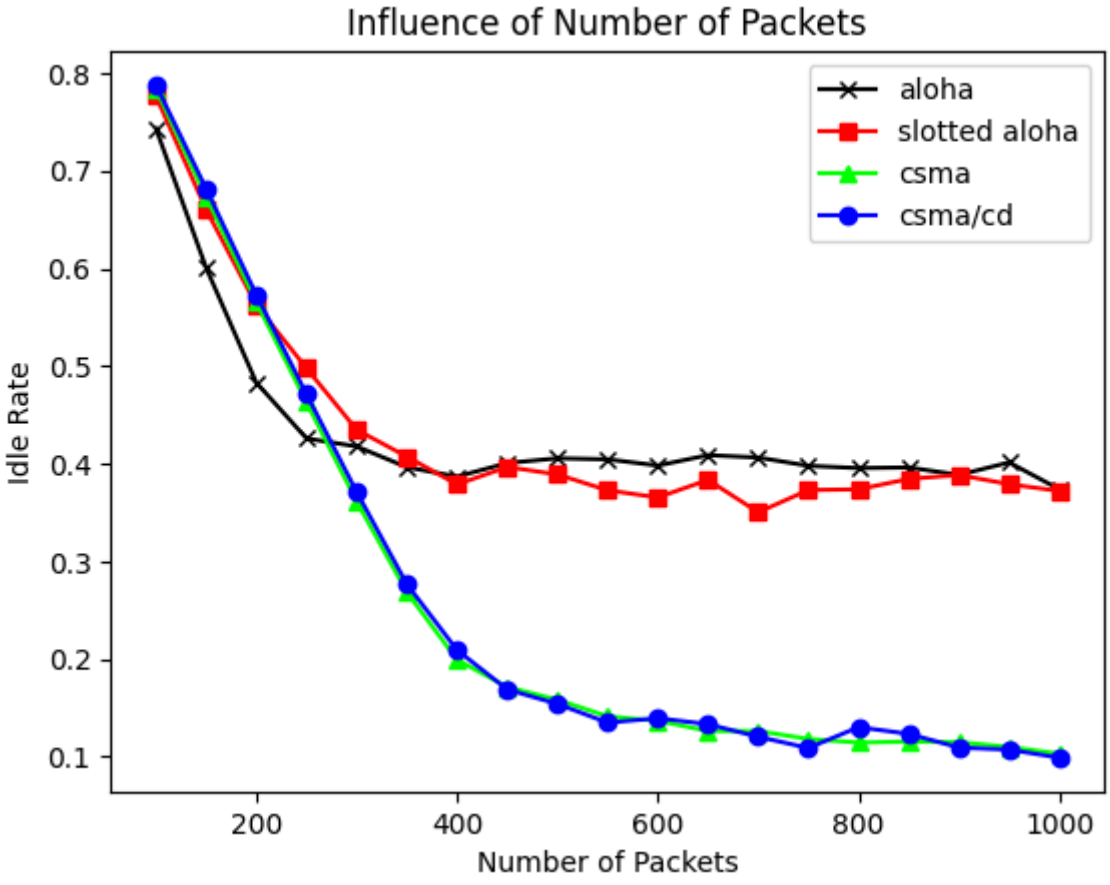

Influence of Coefficient
Idle Rate
Coefficient
aloha
slotted aloha
csma
csma/cd

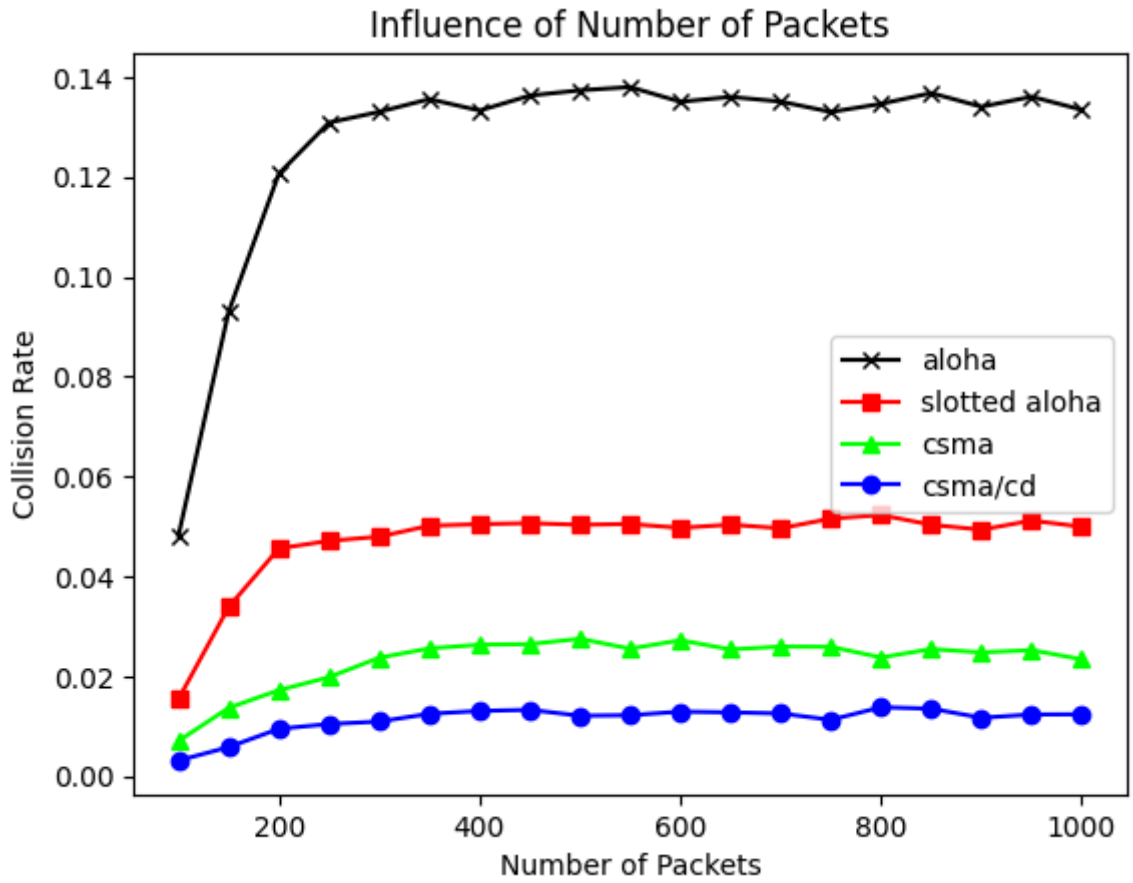


As the coefficient increases, the success rate increase at the start because the collision rate drops greatly. The idle rate rises natually with a longer backoff time.

5.

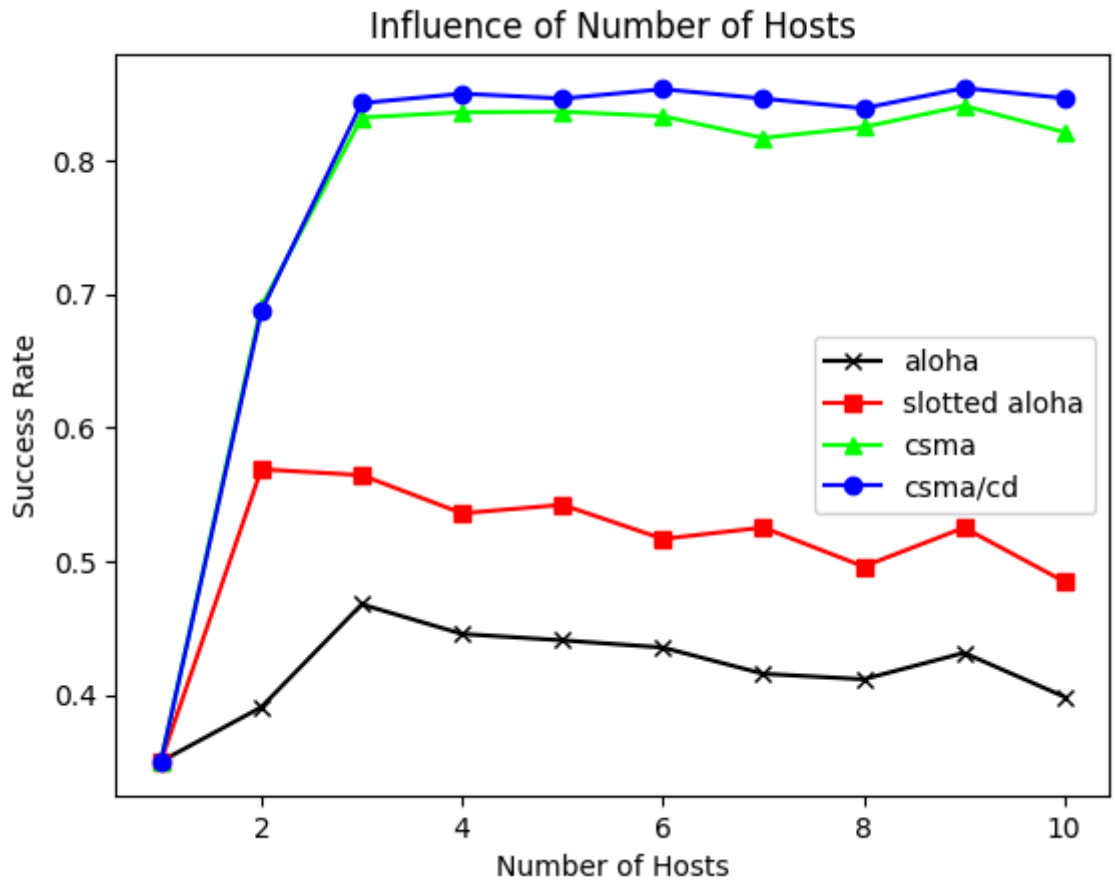

Influence of Number of Packets
aloha
slotted aloha
csma
csma/cd
Success Rate
Number of Packets
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
200
400
600
800
1000

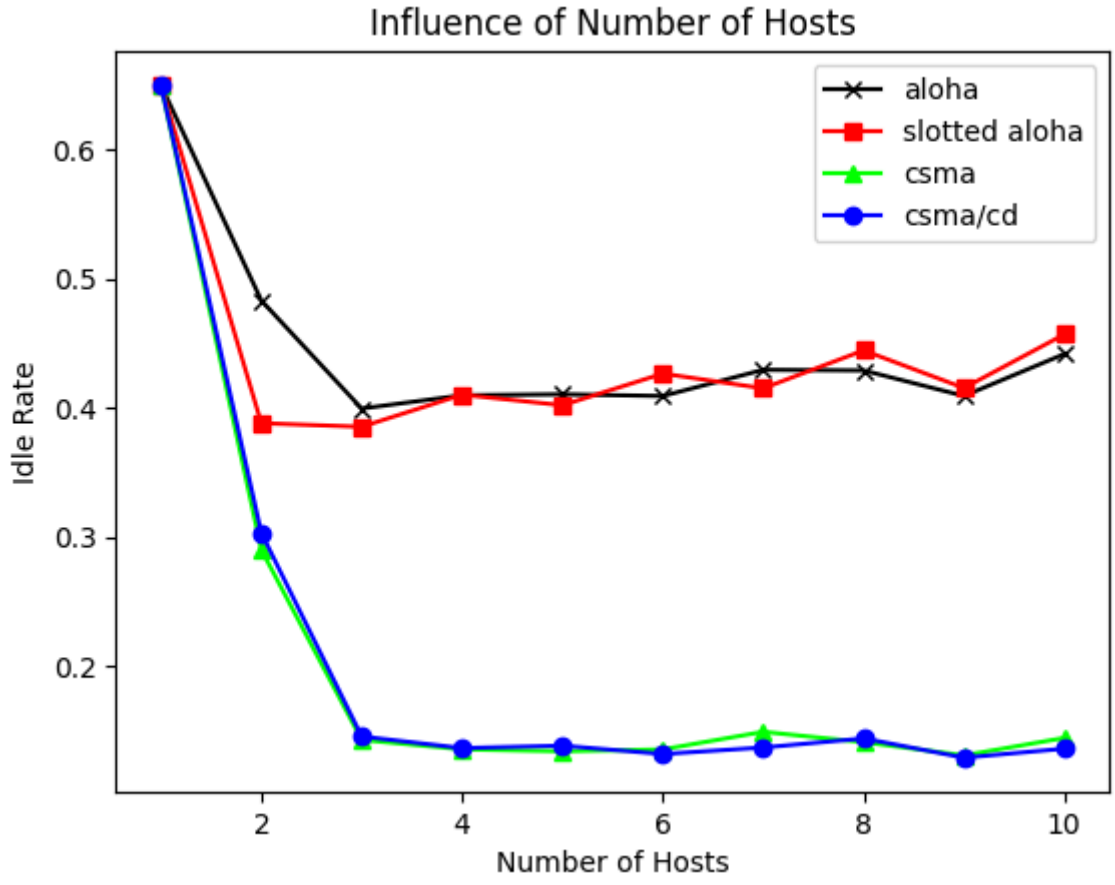

Influence of Number of Packets
aloha
slotted aloha
csma
csma/cd
Idle Rate
Number of Packets
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
200
400
600
800
1000

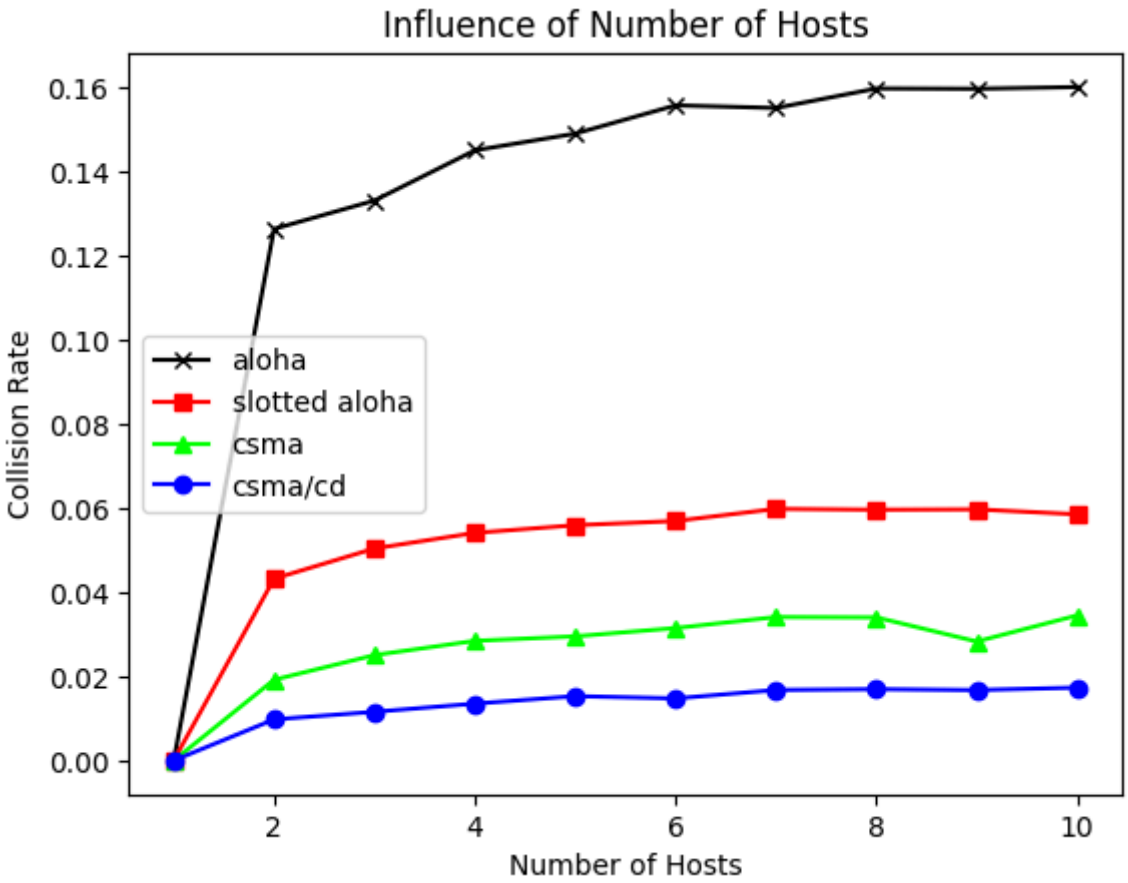


The success rate is low in the beginning due to the long simulation time and little packets to actually being transmitted. So is the idle rate. Then the statistics goes to a stable state of each protocol as the number of packets increases.

6.

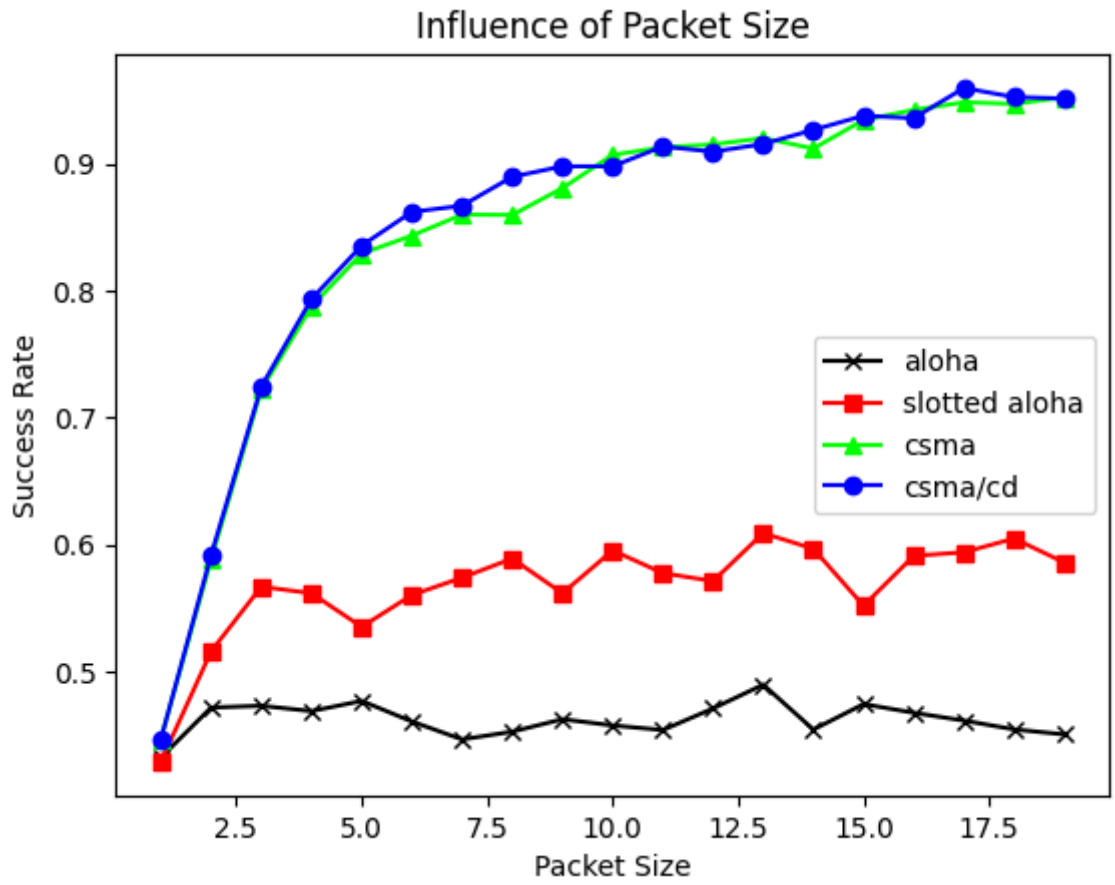

Influence of Number of Hosts
Success Rate
Number of Hosts
aloha
slotted aloha
csma
csma/cd
0.4
0.5
0.6
0.7
0.8
2
4
6
8
10

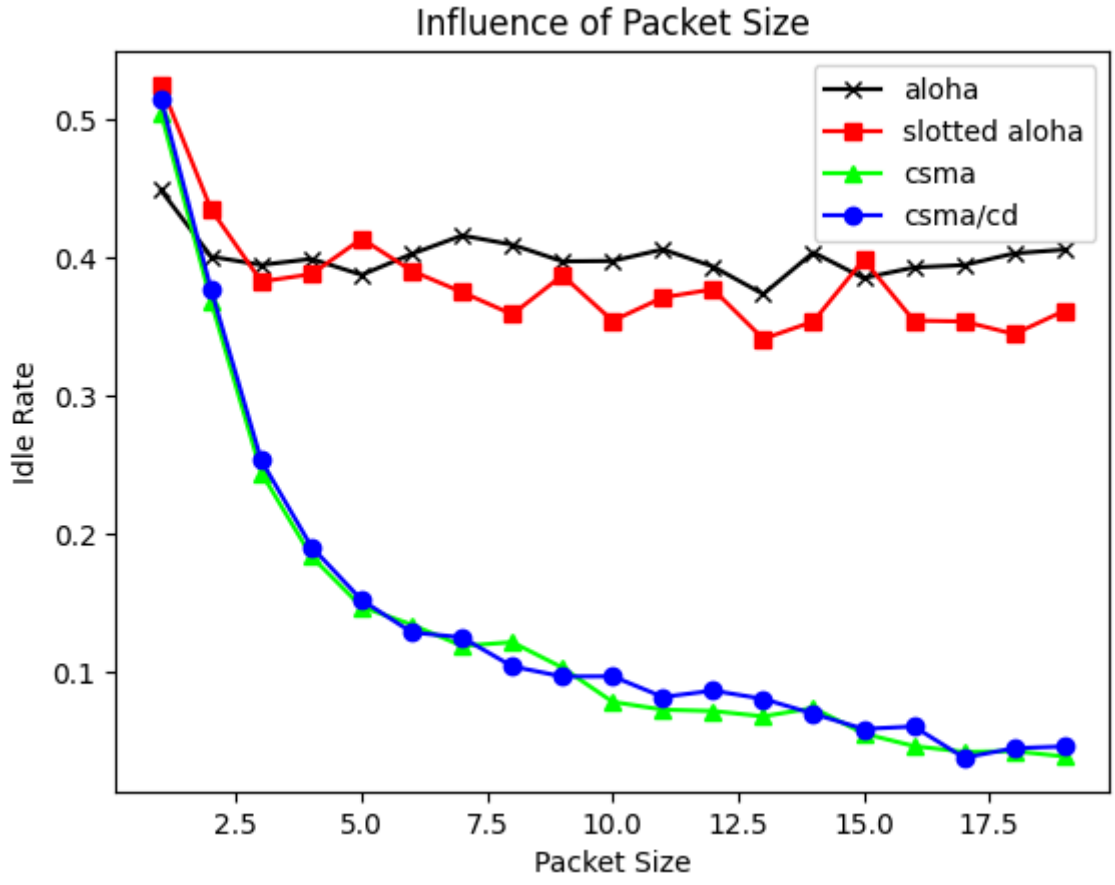

Influence of Number of Hosts
Idle Rate
Number of Hosts
aloha
slotted aloha
csma
csma/cd
0.2
0.3
0.4
0.5
0.6
2
4
6
8
10

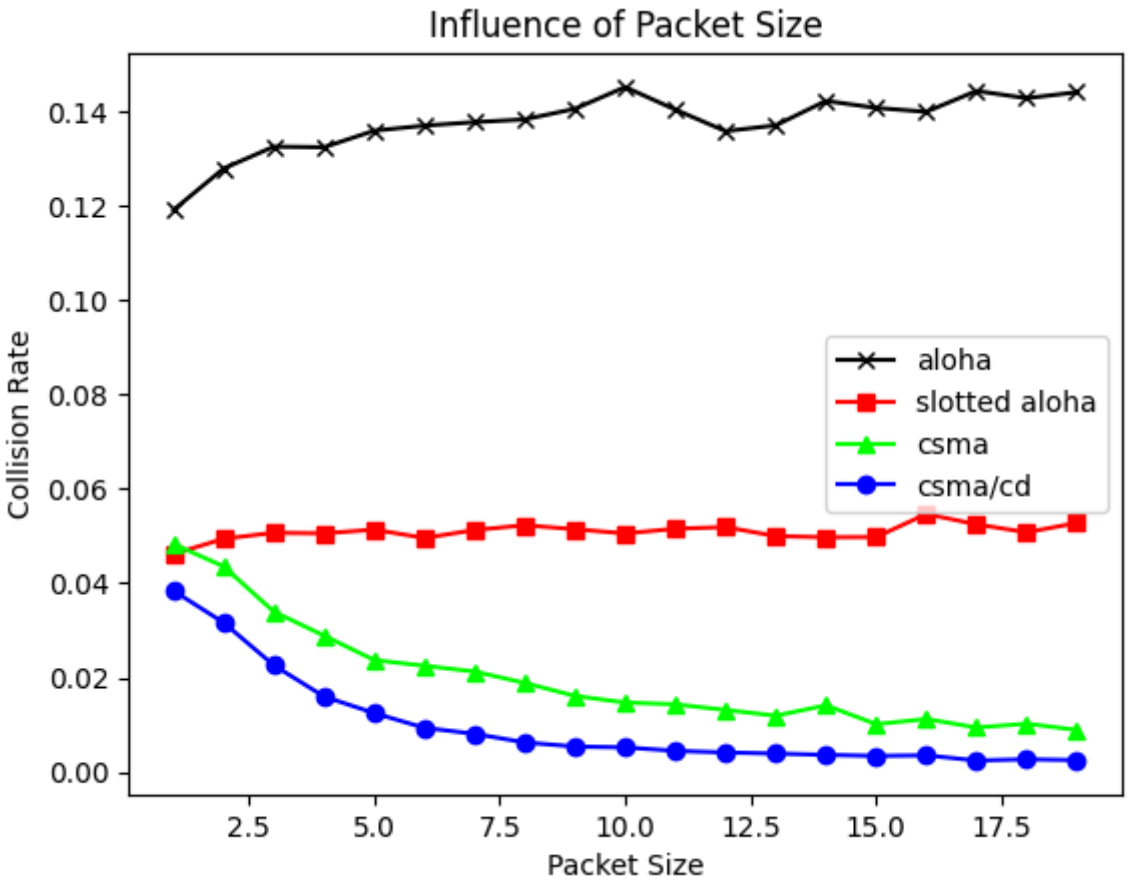


The result is somewhat similar to Q5 in some aspect because the increment of hosts also mean a increase in number of packets.

7.

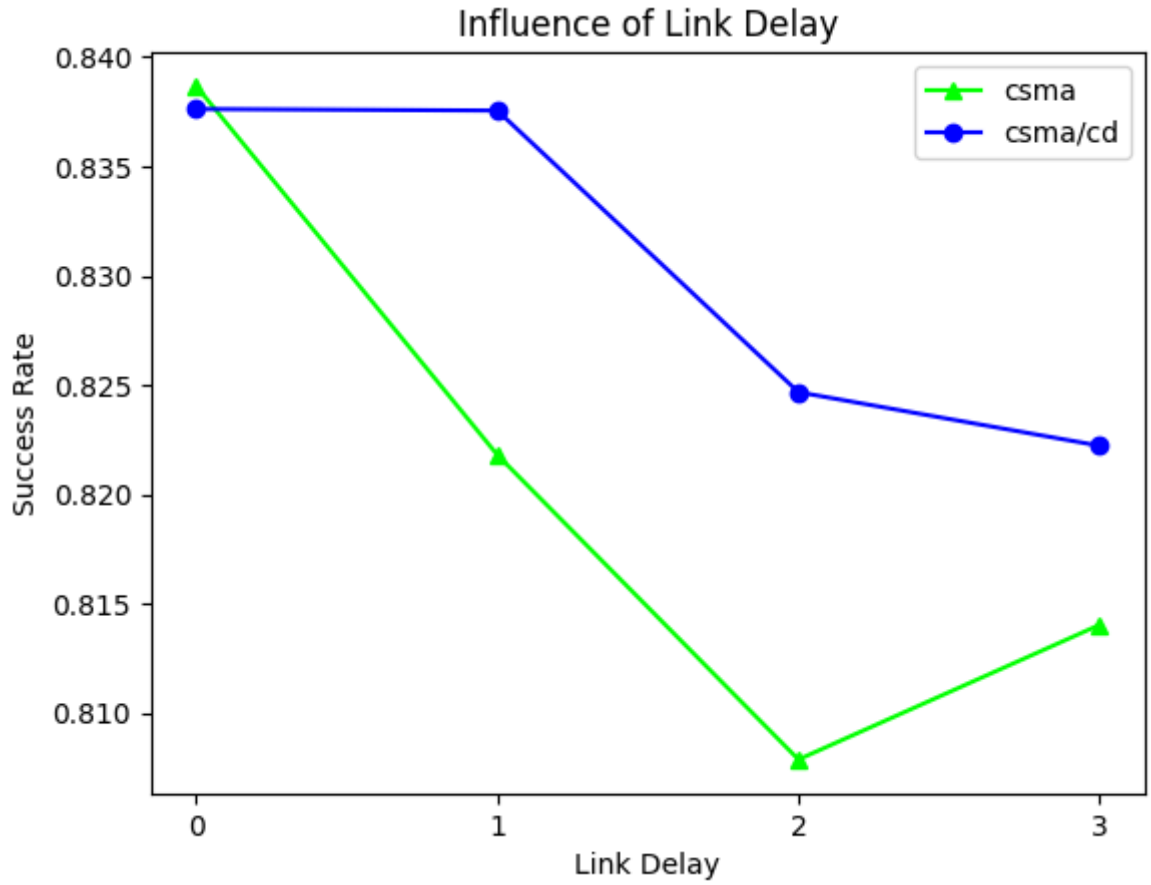

Influence of Packet Size
Success Rate
Packet Size
aloha
slotted aloha
csma
csma/cd
0.5
0.6
0.7
0.8
0.9
2.5
5.0
7.5
10.0
12.5
15.0
17.5

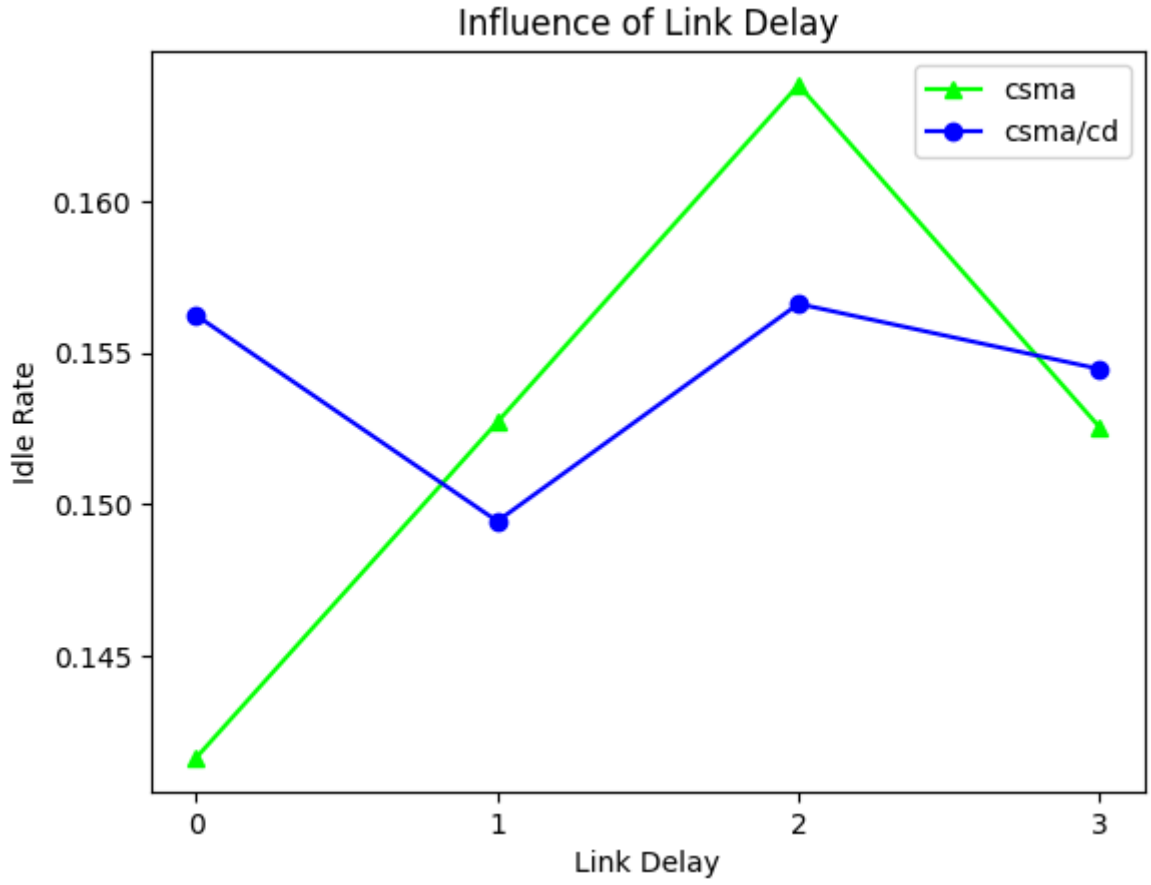

Influence of Packet Size
Idle Rate
Packet Size
aloha
slotted aloha
csma
csma/cd
0.1
0.2
0.3
0.4
0.5
2.5
5.0
7.5
10.0
12.5
15.0
17.5

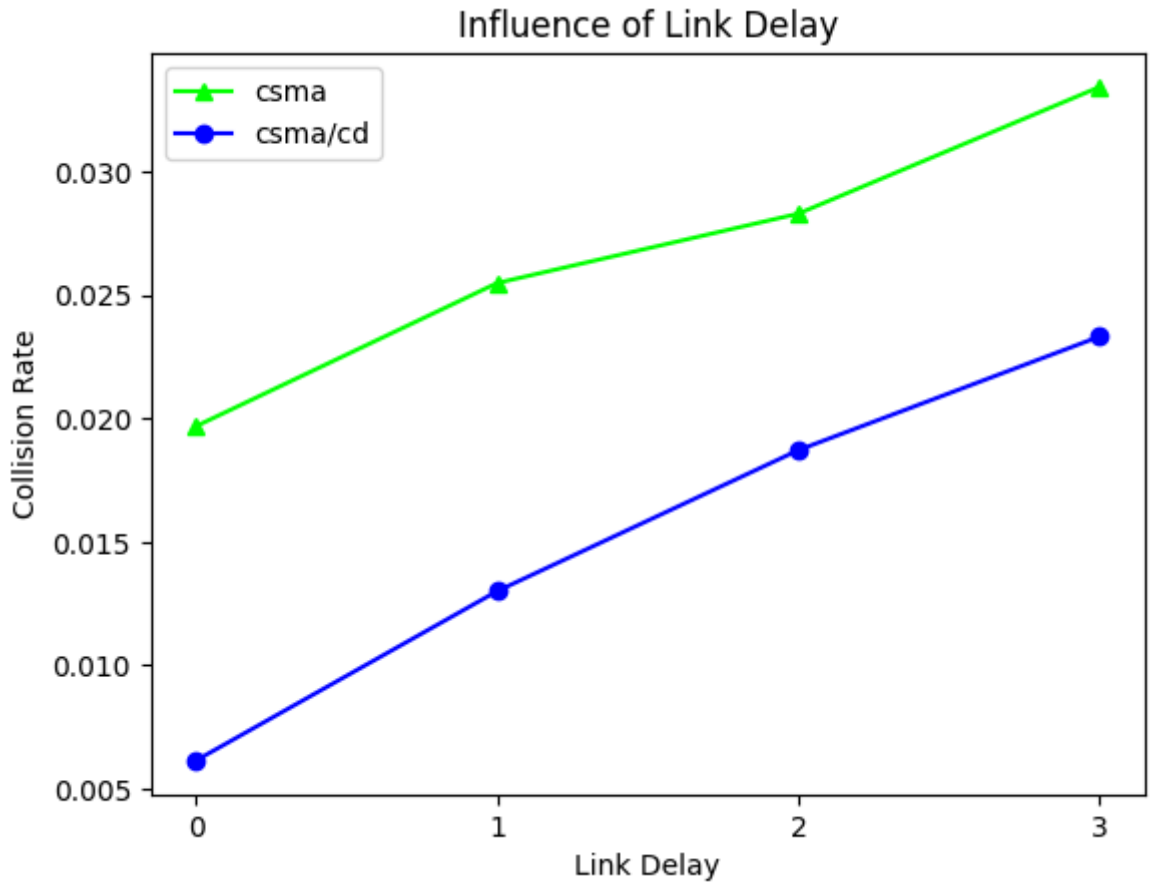


There isn't much changes in the collision rate because the backoff time takes packet size into consideration, doing which lowers collision rate accordingly. But the idle time is significantly lower in csma family. Because they listen and wait before trying to transmit, and with a larger packet size, csma will wait longer and new packets are generated while waiting for other hosts to finish transmittion. In the case of aloha, the hosts keep interupting each other and wait together which cause idle time. That also decrease aloha's success rate.

8.


Influence of Link Delay
0.840
0.835
0.830
0.825
0.820
0.815
0.810
Success Rate
0
1
2
3
Link Delay
csma
csma/cd


Influence of Link Delay
0.160
0.155
0.150
0.145
Idle Rate
0
1
2
3
Link Delay
csma
csma/cd



The increase of link delay cripples the ability to listen for other hosts of csma. And made the collisiown rate increase. Therefore lowers the success rate.