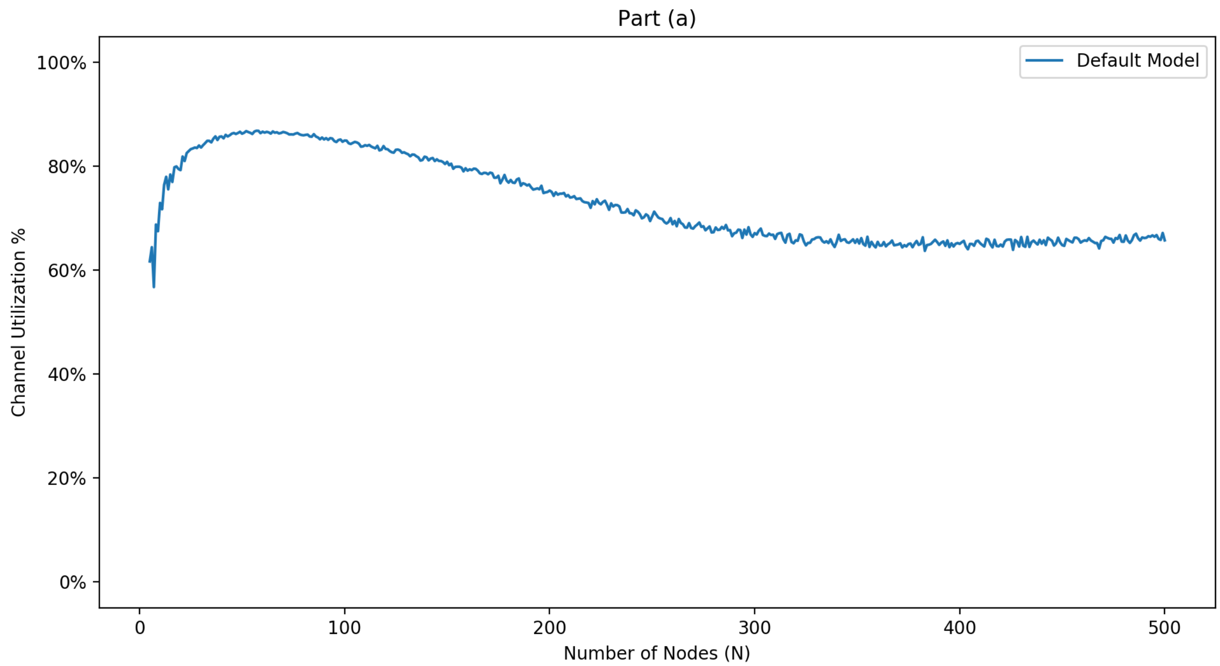
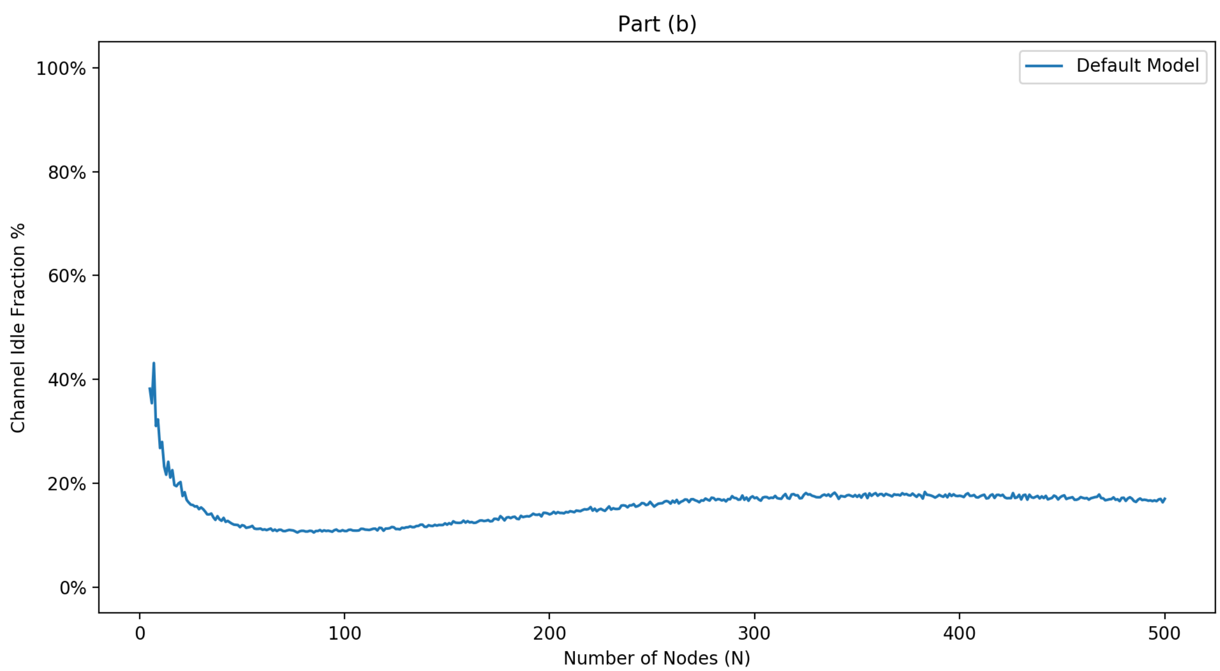
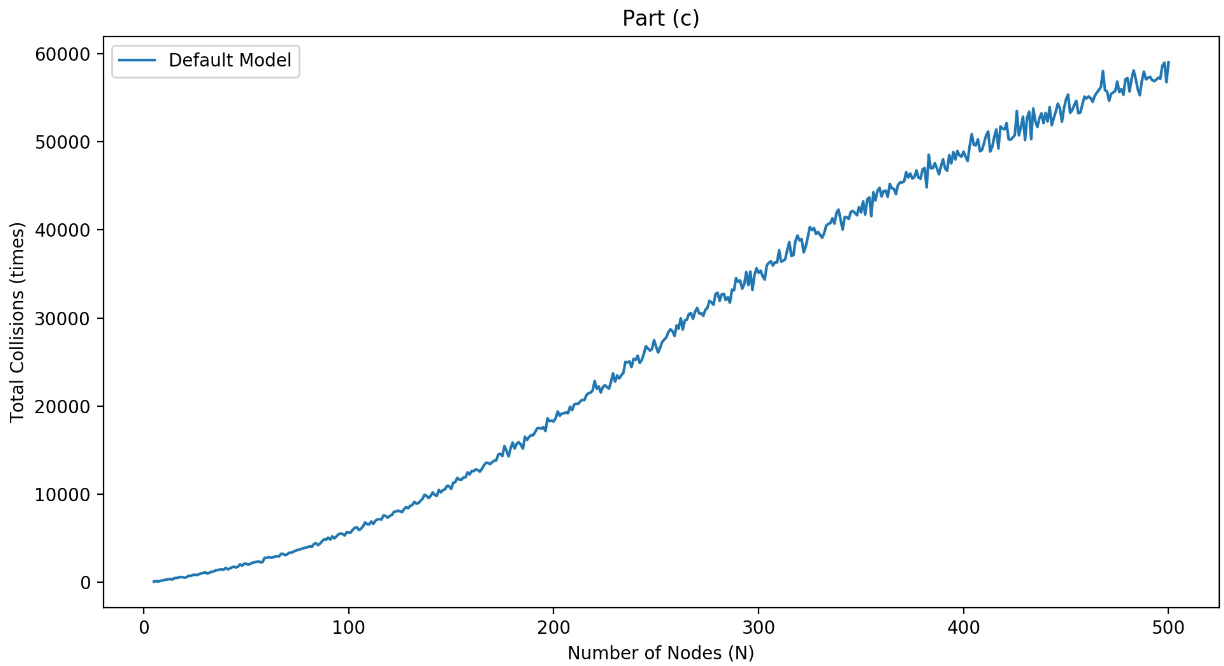
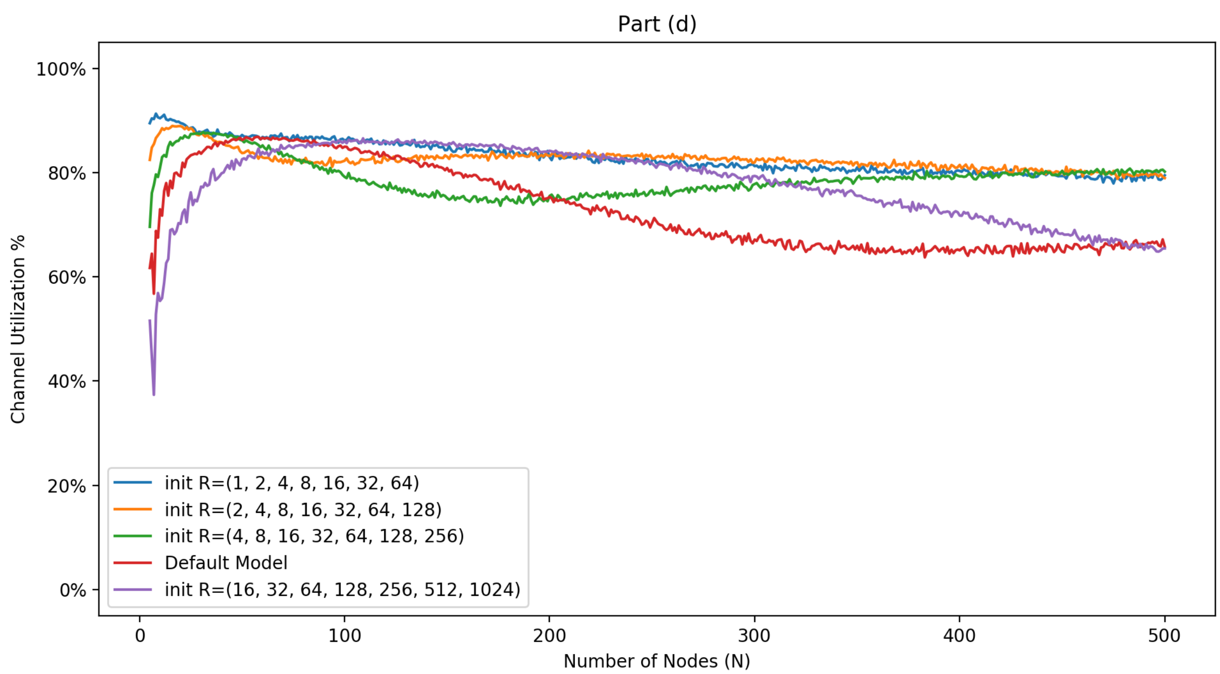
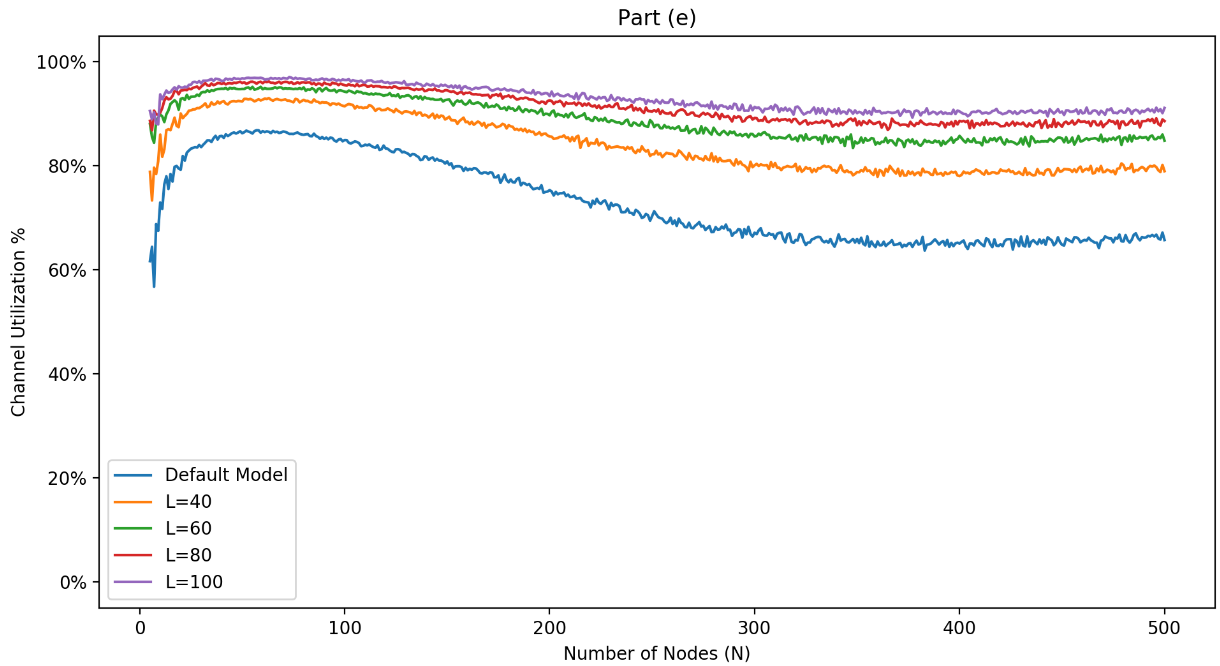

Part (a)
Default Model
Channel Utilization %
100%
80%
60%
40%
20%
0%
0
100
200
300
400
500
Number of Nodes (N)


Part (b)
Default Model
Channel Idle Fraction %
100%
80%
60%
40%
20%
0%
0
100
200
300
400
500
Number of Nodes (N)


Part (c)
Default Model
Total Collisions (times)
60000
50000
40000
30000
20000
10000
0
0
100
200
300
400
500
Number of Nodes (N)


Part (d)
Channel Utilization %
100%
80%
60%
40%
20%
0%
init R=(1, 2, 4, 8, 16, 32, 64)
init R=(2, 4, 8, 16, 32, 64, 128)
init R=(4, 8, 16, 32, 64, 128, 256)
Default Model
init R=(16, 32, 64, 128, 256, 512, 1024)
0
100
200
300
400
500
Number of Nodes (N)



(f) In all cases, utilization rate peaks within [0, 100] and converges to a lower value when N increases, implying the optimal N can be bounded *empirically* above by 100. Too many nodes (>100) in a shared wired network will likely decrease utilization under current policy.

By varying initial R value, we see that curve will start with a higher baseline and peak at a lower N when initial R is picked at low value. For example, in part (d), the curve corresponding to initial R of 1 has generally higher utilization rate and peaks at the very beginning, where as curve corresponding to initial R of 16 starts with utilization rate around 40% and peaks almost when N reaches 100. Additionally, curves corresponding to higher R value converge to lower utilization rate compared to those with low initial R value, and is also more sensitive with input N. On the contrary, cases R=1 or R=2 behave most consistently and optimally. The higher utilization rate may be reflected simply from the fact that smaller R means smaller back off value, and so that node obtains smaller idle period between each transmission attempt, whereas nodes with larger R value are forced to wait longer before initiate transmission even with low collision rate (notice that a single collision doubles the R value), thus artificially inflating the idle fraction.

By varying L value, we see that curve will start with a higher baseline and peak at a lower N when initial L is picked at high value, with lower L policy more sensitive to variation in N. We suspect the reason for such behavior to be the fact that lower L implies more independent random events (random value picked as the backoff value between transmission) and hence more collision event would occur, since each backoff value is picked independently at random, and each collision probability is independent with respect to N and R (both fixed).