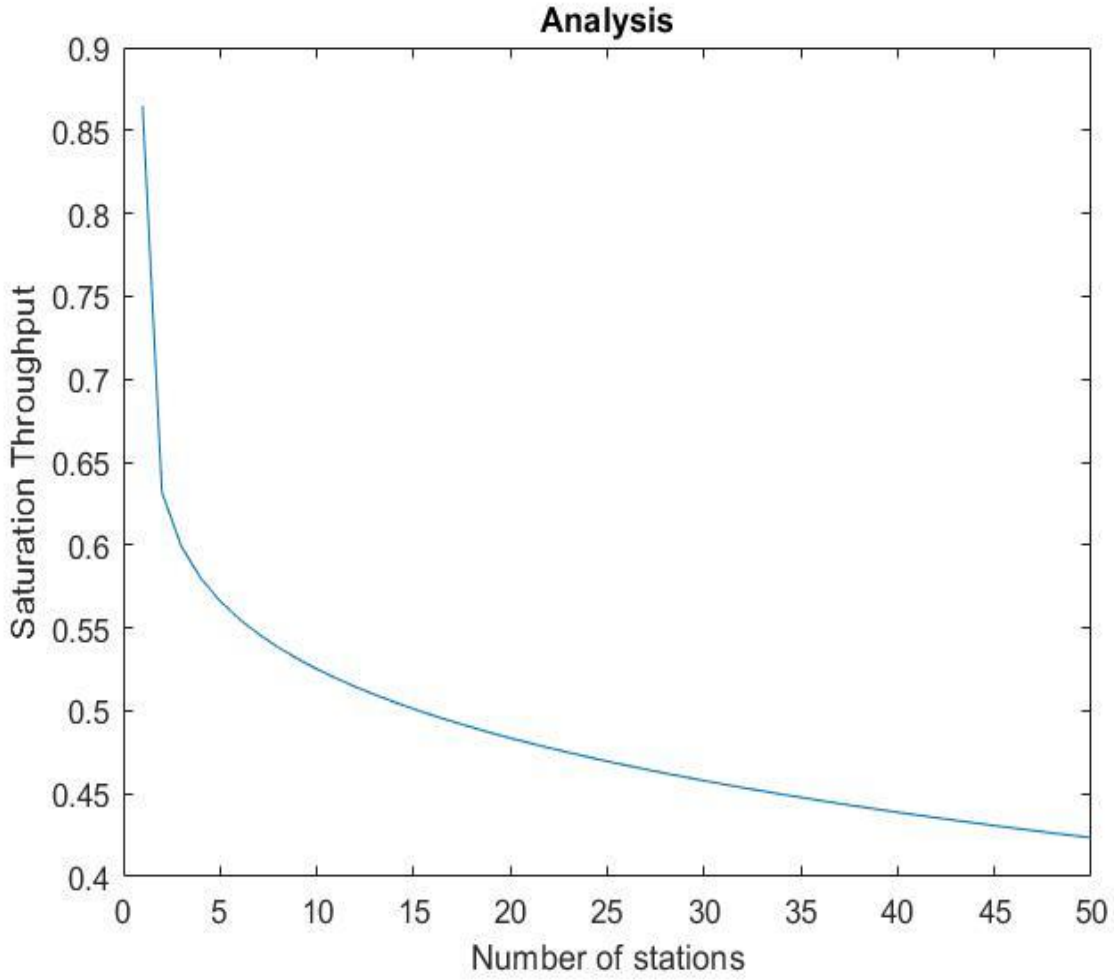
Simulation of Saturation Throughput in NS-3

Shahid Mohammed Shaikbepari

Section 1 : MATLAB code : Numerical calculation on Bianchi's 802.11 Saturation Throughput Analysis.

Figure 1: Case A : minimum backoff window size as 1 and maximum backoff window size as 1023 units of slot times.



The following were the values received for the number of nodes, N = 50.

Function & output

{

[Throughput,Throughput_perNode] = bianchi_analysisCaseA(1, 50)

Throughput =

Columns 1 through 11

0.8649 0.6318 0.5991 0.5800 0.5662 0.5553 0.5462 0.5383 0.5314 0.5252 0.5196

Columns 12 through 22

0.5144 0.5097 0.5052 0.5011 0.4972 0.4935 0.4900 0.4867 0.4835 0.4805 0.4776

Columns 23 through 33

0.4748 0.4722 0.4696 0.4671 0.4647 0.4623 0.4601 0.4579 0.4557 0.4537 0.4516

Columns 34 through 44

0.4497 0.4478 0.4459 0.4440 0.4423 0.4405 0.4388 0.4371 0.4355 0.4339 0.4323

Columns 45 through 50

0.4308 0.4293 0.4278 0.4263 0.4249 0.4235

Throughput_perNode =

Columns 1 through 11

0.0173 0.0126 0.0120 0.0116 0.0113 0.0111 0.0109 0.0108 0.0106 0.0105 0.0104

Columns 12 through 22

0.0103 0.0102 0.0101 0.0100 0.0099 0.0099 0.0098 0.0097 0.0097 0.0096 0.0096

Columns 23 through 33

0.0095 0.0094 0.0094 0.0093 0.0093 0.0092 0.0092 0.0092 0.0091 0.0091 0.0090

Columns 34 through 44

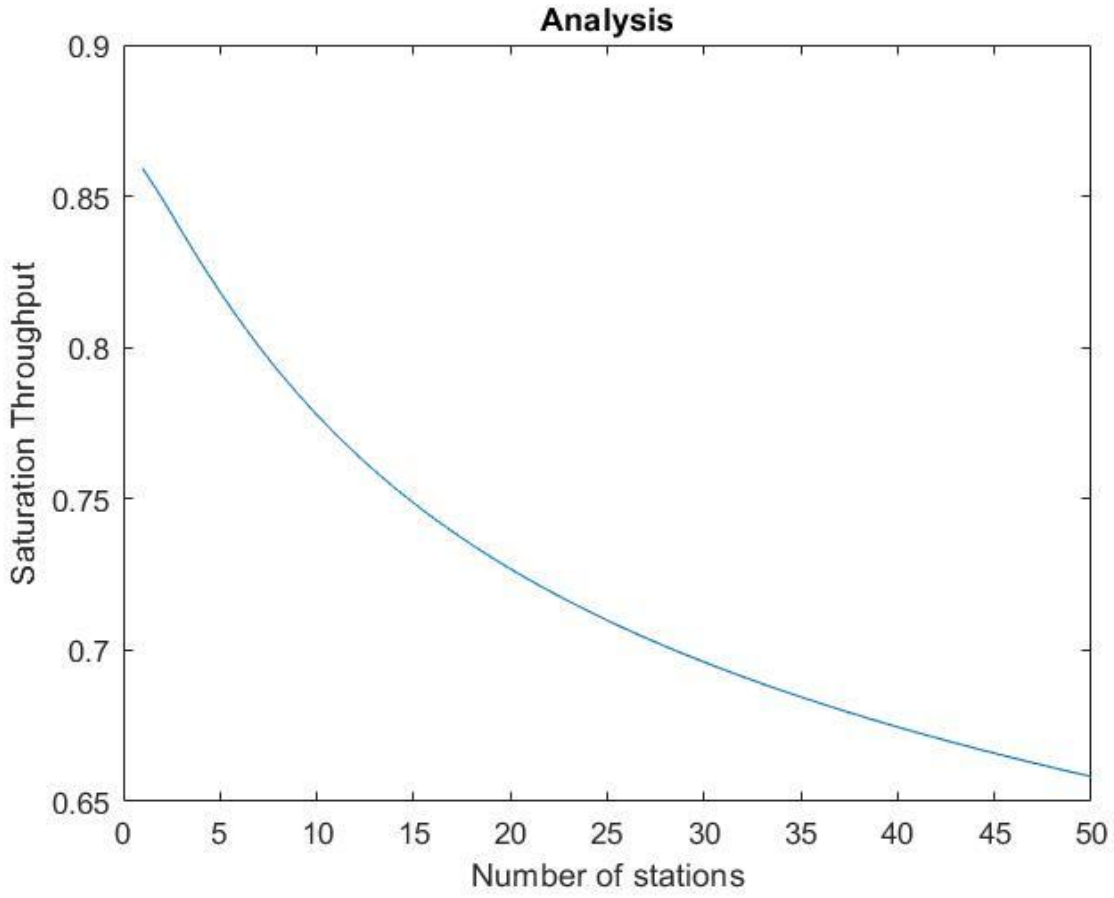
0.0090 0.0090 0.0089 0.0089 0.0088 0.0088 0.0088 0.0087 0.0087 0.0087 0.0086

Columns 45 through 50

0.0086 0.0086 0.0086 0.0085 0.0085 0.0085

}

Figure 2 : Case B: minimum backoff window size as 63 and maximum backoff window size as 127 units of slot times.



The following were the values received for the number of nodes, N = 50.

Function & output

{

[Throughput,Throughput_perNode] = bianchi_analysisCaseB(63, 50)

Throughput =

Columns 1 through 11

0.8592 0.8494 0.8386 0.8281 0.8183 0.8090 0.8004 0.7923 0.7848 0.7777 0.7711

Columns 12 through 22

0.7650 0.7592 0.7537 0.7486 0.7438 0.7392 0.7348 0.7307 0.7268 0.7231 0.7196

Columns 23 through 33

0.7162 0.7129 0.7098 0.7069 0.7040 0.7013 0.6986 0.6961 0.6936 0.6912 0.6889

Columns 34 through 44

0.6867 0.6845 0.6824 0.6804 0.6784 0.6765 0.6746 0.6728 0.6710 0.6693 0.6676

Columns 45 through 50

0.6659 0.6643 0.6627 0.6612 0.6597 0.6582

Throughput_perNode =

Columns 1 through 11

0.0172 0.0170 0.0168 0.0166 0.0164 0.0162 0.0160 0.0158 0.0157 0.0156 0.0154

Columns 12 through 22

0.0153 0.0152 0.0151 0.0150 0.0149 0.0148 0.0147 0.0146 0.0145 0.0145 0.0144

Columns 23 through 33

0.0143 0.0143 0.0142 0.0141 0.0141 0.0140 0.0140 0.0139 0.0139 0.0138 0.0138

Columns 34 through 44

0.0137 0.0137 0.0136 0.0136 0.0136 0.0135 0.0135 0.0135 0.0134 0.0134 0.0134

Columns 45 through 50

0.0133 0.0133 0.0133 0.0132 0.0132 0.0132

}

Section 2: NS-3

Figure 3: Case A E1 :Per node Throughput vs N: minimum backoff window size as 1 and maximum backoff window size as 1023 units of slot times. The plot is drawn for N values from 1 to 10. The data rate was fixed to 1Mbps

Per node Throughput vs N

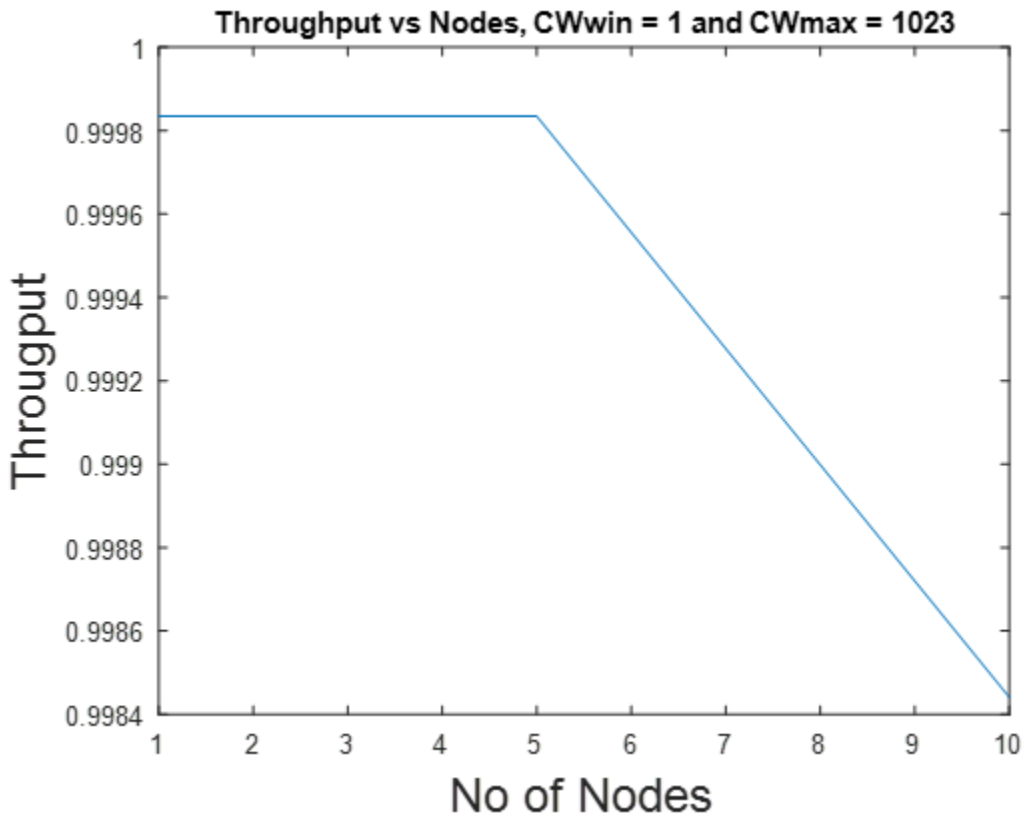
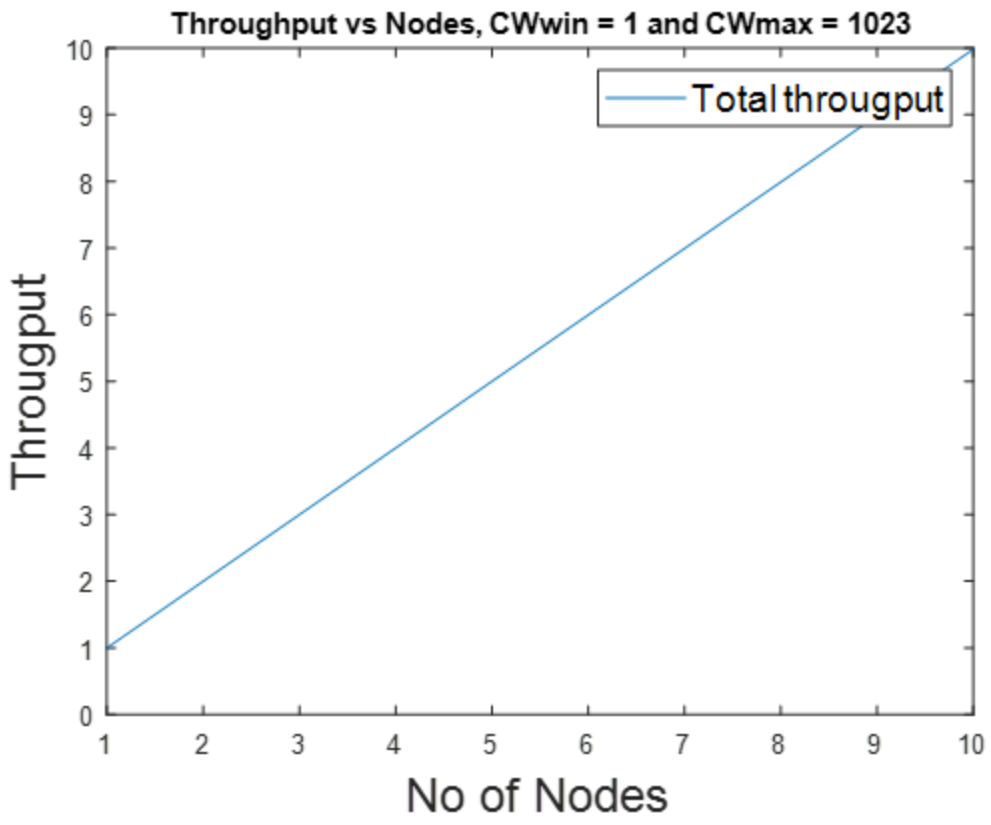


Figure 4: ***Total Throughput vs N***



N = 5

Figure 5: Case A E2: Per Throughput vs X : minimum backoff window size as 1 and maximum backoff window size as 1023 units of slot times. The N value was choose as 5 as 20 was taking long time and code was terminating with seg fault.

Per Node Throughput vs N

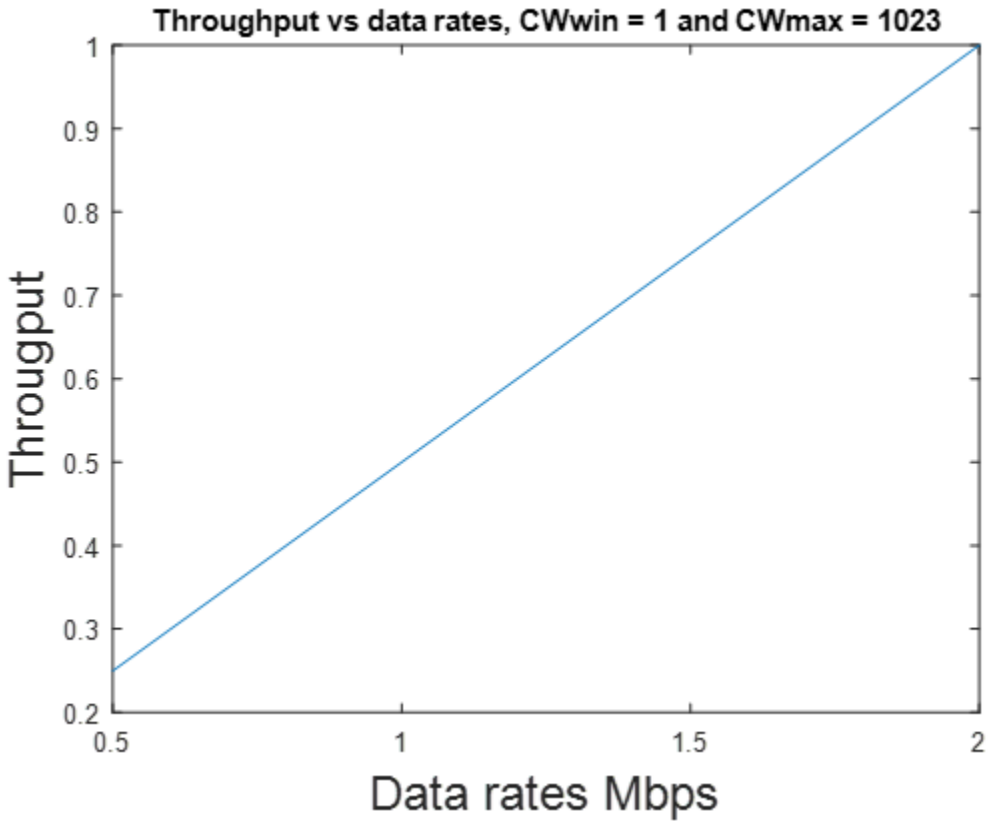

Throughput vs data rates, CWwin = 1 and CWmax = 1023
Througput
Data rates Mbps
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.5
1
1.5
2

Figure 6 ***Total Throughput vs data rate:***

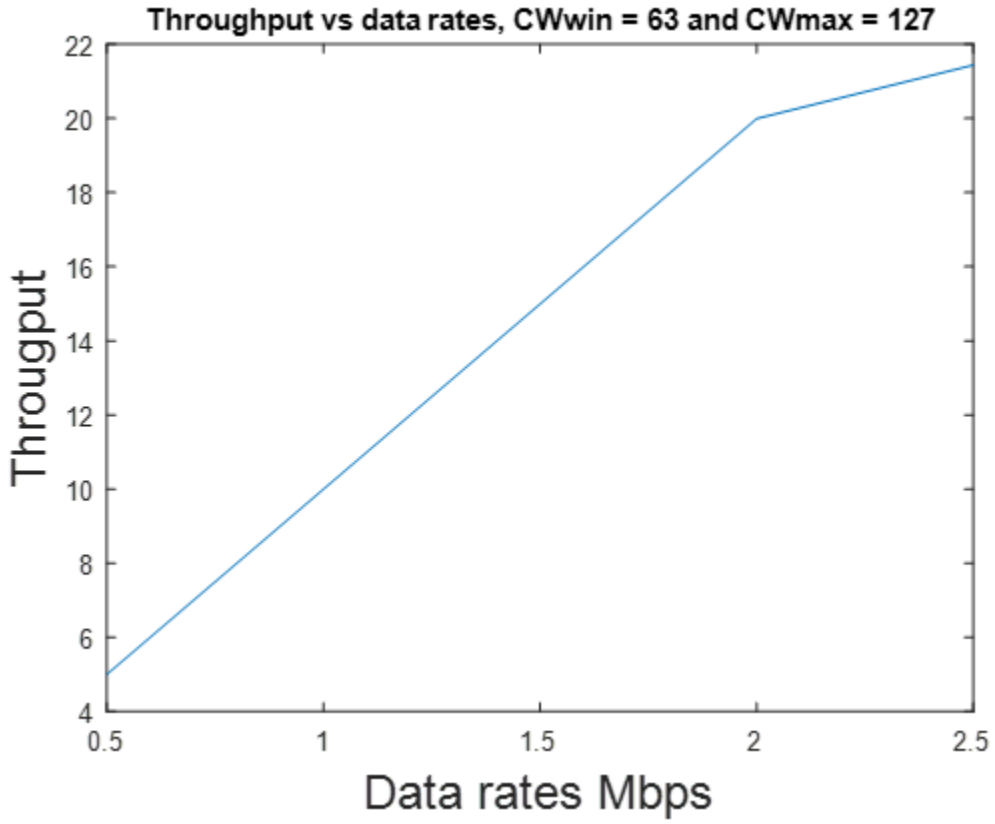


Figure 7 : Case B E1: Per Node Throughput vs N: minimum backoff window size as 63 and maximum backoff window size as 127 units of slot times. Nodes were varied from 1 to 20. The data rate was fixed to 1Mbps

Per Node Throughput vs N

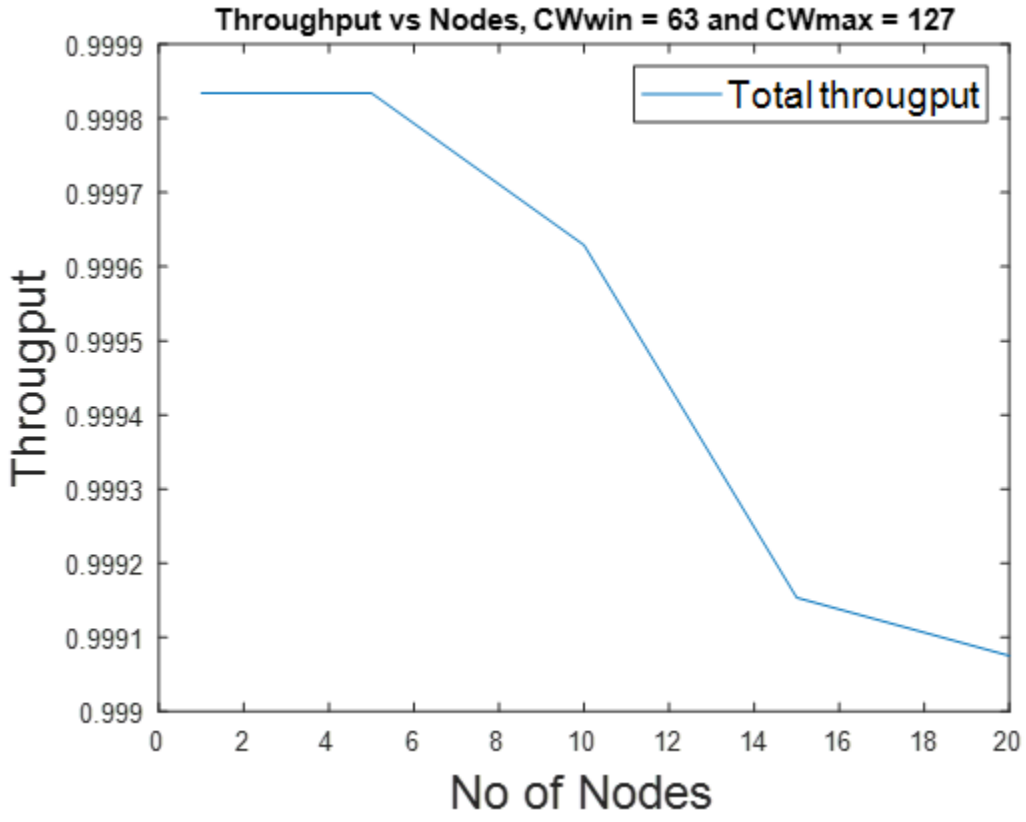


Figure 8: Total throughput vs no of Nodes

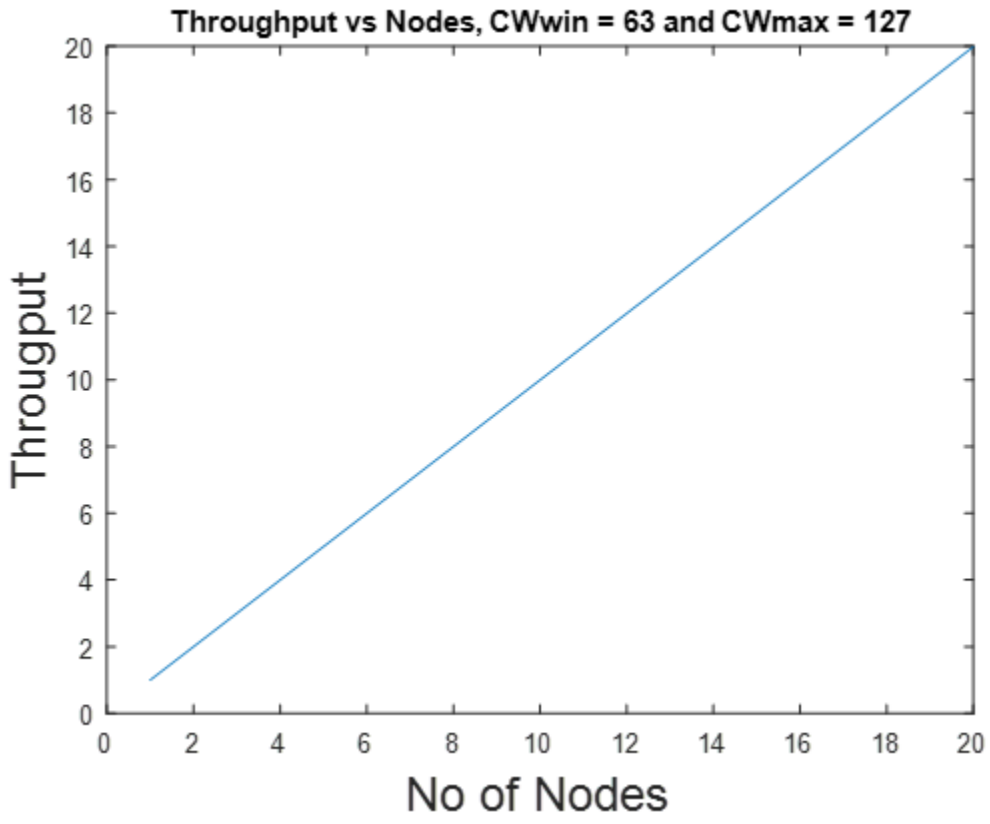
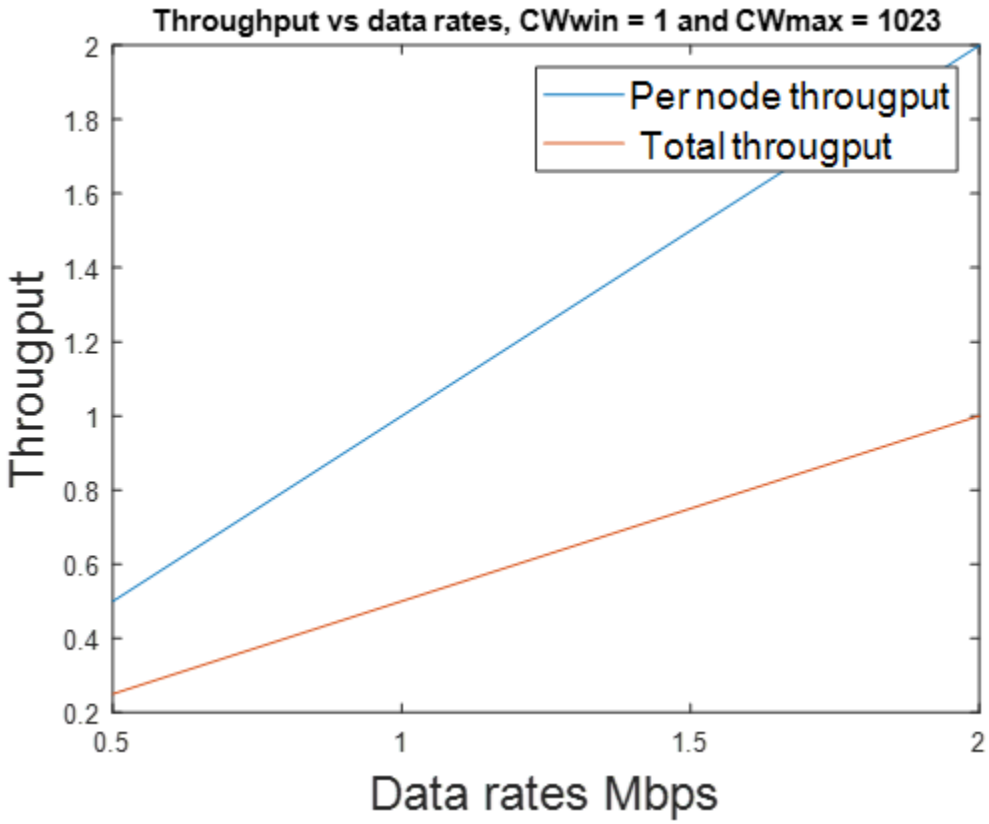


Figure 9 : Case B E2: Total and per Node Throughput vs X: minimum backoff window size as 63 and maximum backoff window size as 127 units of slot times, N was fixed as 10 as 20 was taking long time and program was terminating with seg fault



Discussion:

1. *From the figure 1 and figure 2 we can infer that, as the number of nodes increasing there's is a decline in the saturation throughput, which matches with the Bianchi's analysis. Furthermore, the figure 1 is much faster declining than figure 2 due to higher backoff window size*

2. *we can conclude that from figure 3, the throughput was closer to 1 at lower number of nodes but it keeps on decreasing as the number of nodes increases. But, the total throughput was increasing with the increase in nodes (figure 4)*
3. *Figure 5 and 6 also shows the same above behavior, one more important thing to notice is that in case B we have a lower value of m due to lower CWmax, and throughput rate is slightly higher in this case*
4. *From the figure 9, we can see that with the increase in the data rate, we have an increase in the throughput as well, both per node and total throughput.*