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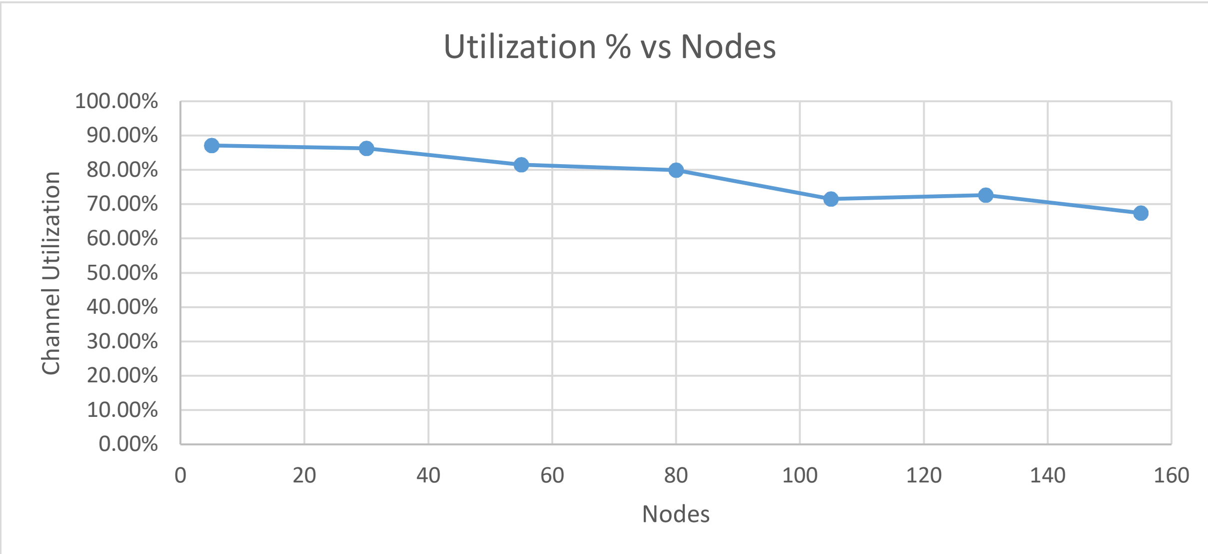
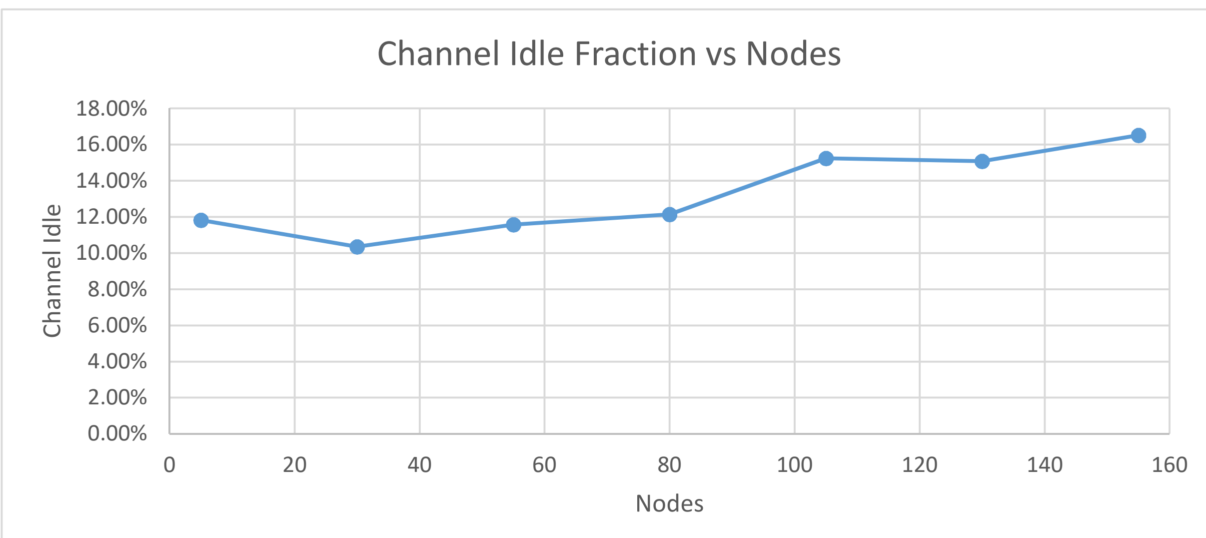
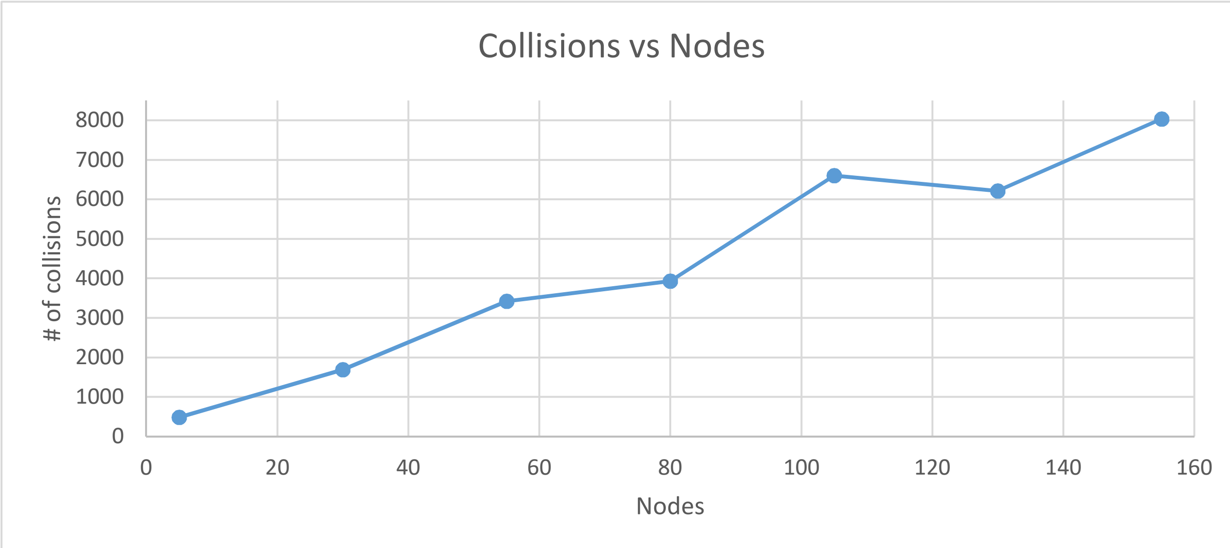
ECE/CS 438



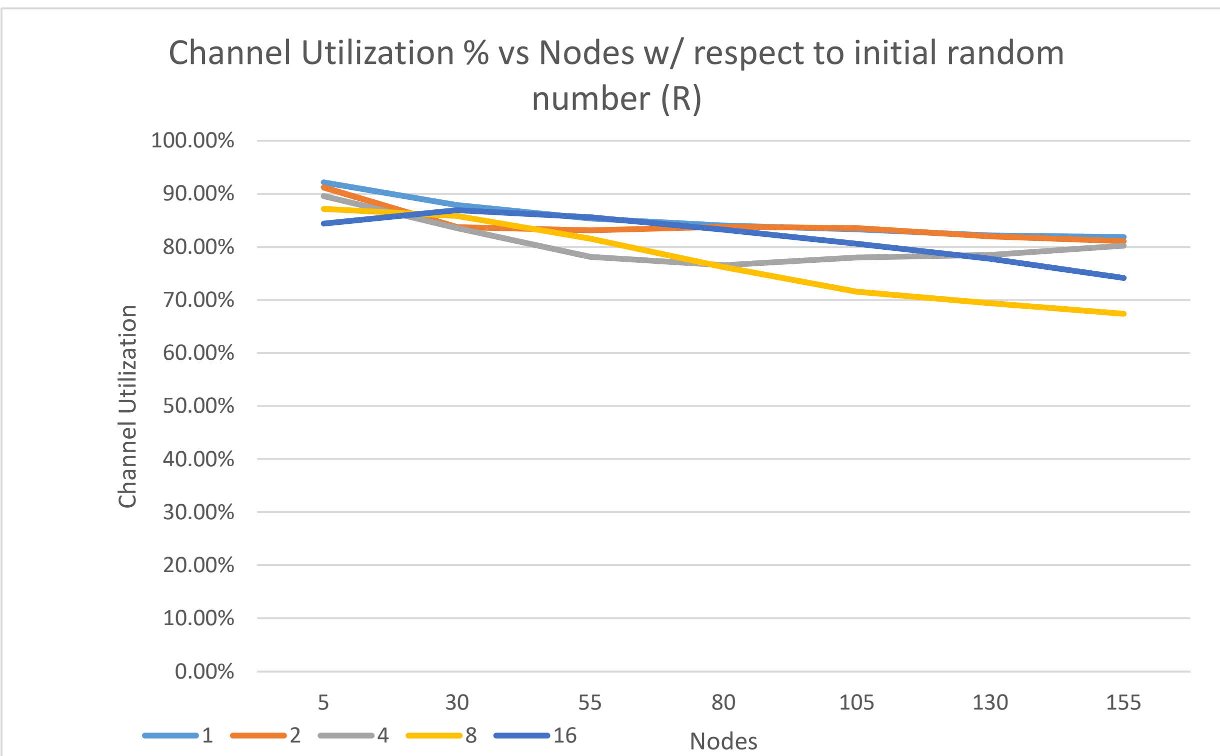
3a) As we can see from the plot, the number of nodes has a negative relation with channel utilization percentage: as we increase the number of nodes, channel utilization decreases. This is because as we increase the total number of nodes, there will be more collisions that happen. As a result, there are less successful transmissions that take up the number of clock cycles (T) while the program is running.



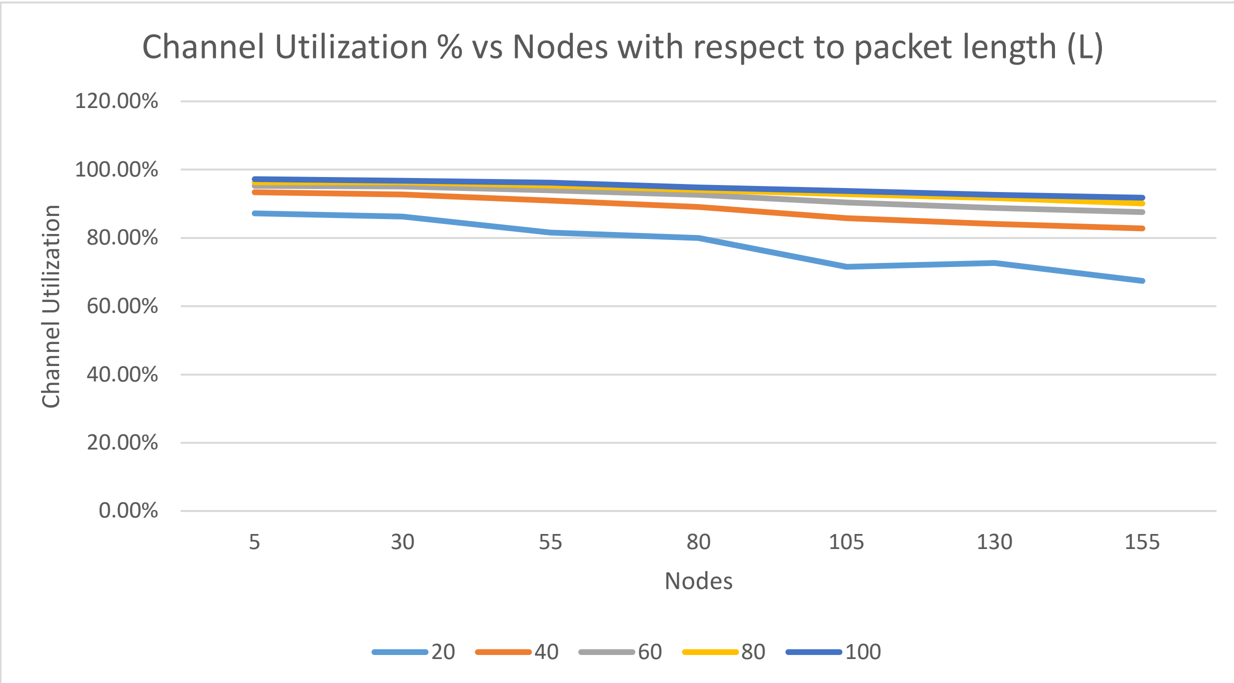
3b) As the number of nodes increases, the more collisions occur. Thus, counter to part A, there will be less clock cycles where there is nothing happening. Channel idle is the ratio of unused clock ticks to T, the total number of clock ticks. This is determined by 100 – clock ticks with collision * L / T – channel utilization.



3c) As we can see here, an increase an nodes leads to a large amount of collisions because there are more and more nodes trying to utilize the same channel. This linear-ish relationship indicates that as nodes are trying to utilize the same channel, it will lead to more nodes what count down to the transmission back off on that clock tick (causing a collision).



3d) In the beginning, we can see that the larger R values have smaller channel utilizations because of the backoff times being more spread out. With less nodes, a high enough range in the backoff times leads to unused slots which means less channel utilization. As we increase the nodes, however, we see that this behavior is reversed and more collisions happen. If we spread out the backoff numbers within a greater range, it'll decrease the chance of a collision.



3e) Increasing L, the number of clock ticks it takes to send a packet (like the size of a packet), also increases the percentage of ticks that the channel is utilized. While we know L doesn't influence the number of collisions, increasing the number of nodes increases channel utilization. So as we can see, for each respective length L, the channel utilization decreases with more nodes. We can see that with higher L, the initial channel utilization is higher and decreases from there (as seen from L = 40, 60, 80, & 100). This goes to show that the packet size plays a big role in explaining channel utilization.

3f) Increasing N (total number of nodes) means more nodes are trying to access the same slot which leads to more collisions causing smaller channel utilization. L (packet size) doesn't affect collisions because nodes don't decrease backoff values when a different node is in the process of transmitting. As a result, larger packet sizes means more transmittance (aka high channel utilization). R (initial random number range) is more dependent on N and affects channel utilization somewhat more. When we increase R, N has to be similarly high otherwise there is a lot of time where there isn't a node transmitting. Channel utilization is more optimal at higher N because collisions are prevented with larger backoff values available.