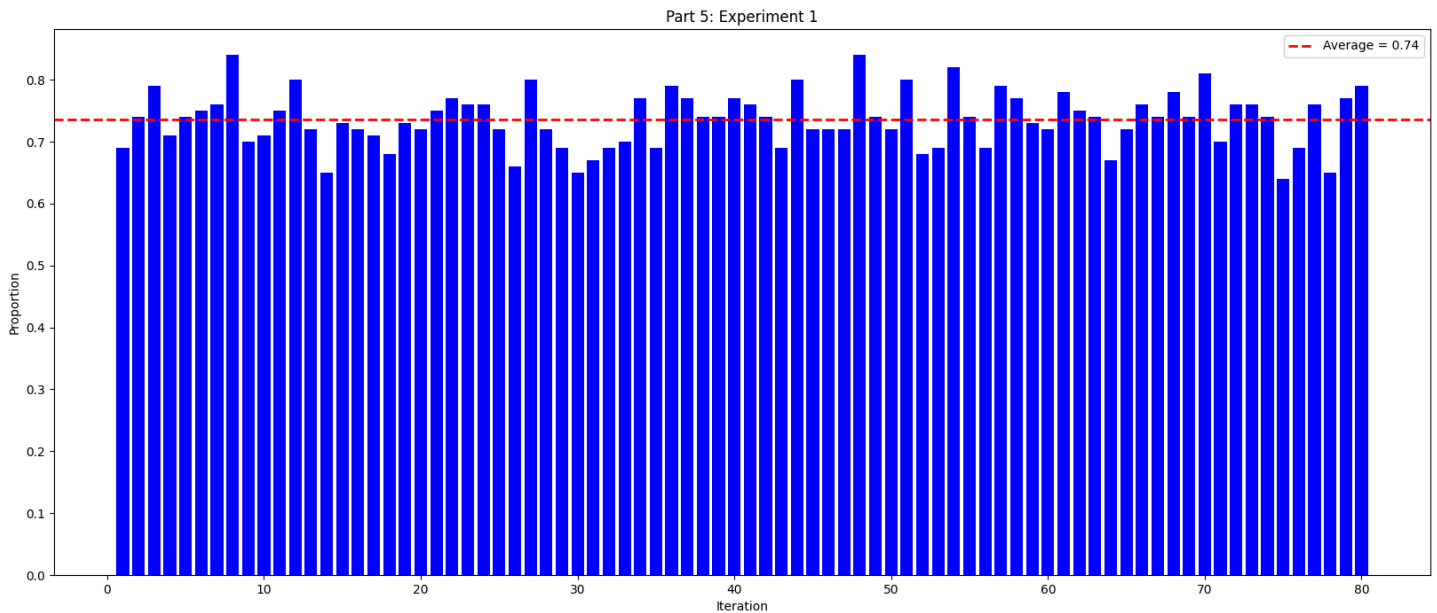


### Part 5:

For this experiment I ran it for 80 iterations on 100 graphs that had 1000 nodes and 500 edges. The average proportion or the chance that a randomly generated graph of this size had a cycle was 0.74 or 74% chance.



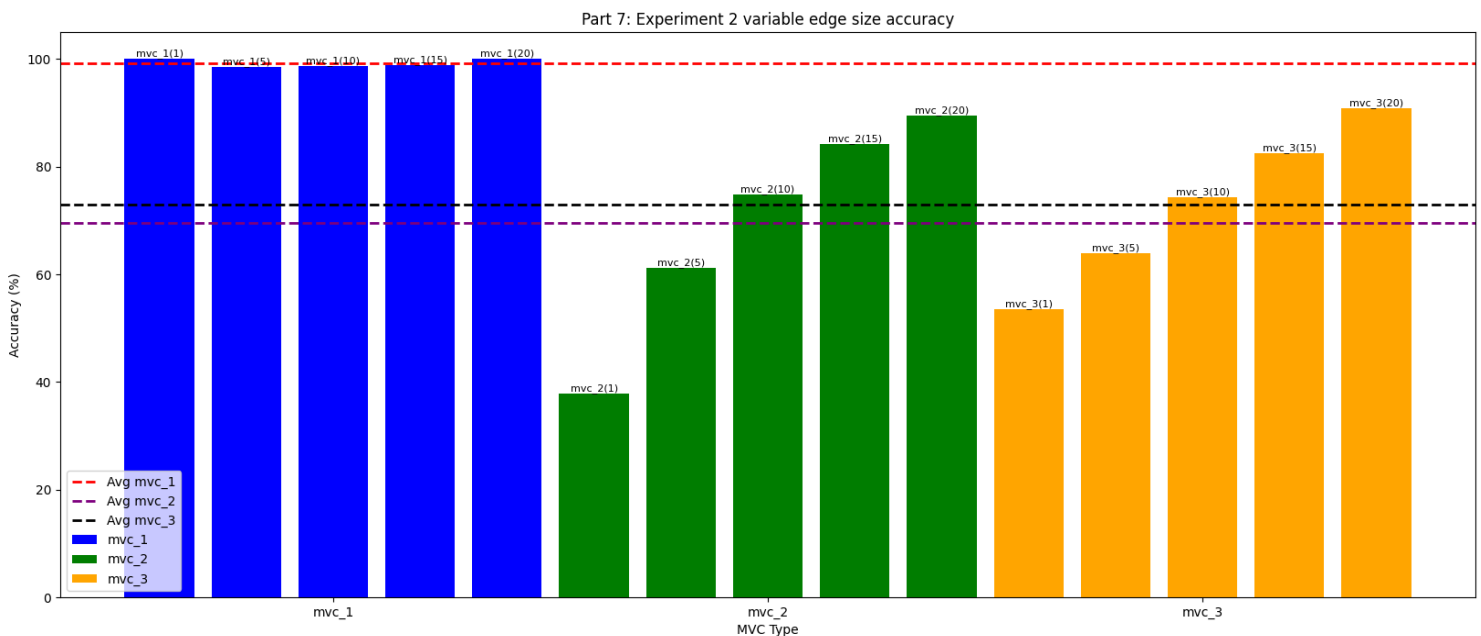
### Part 7:

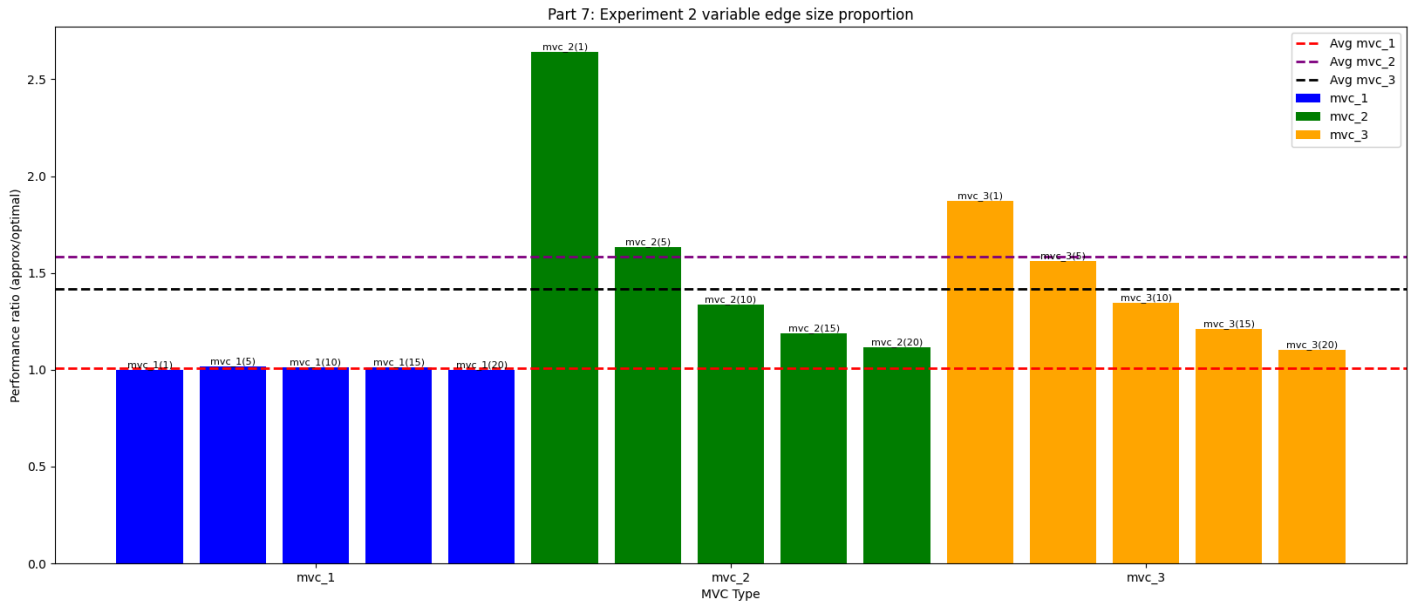
a)

Table for proportion					
MVC Type	Edge count				
	1	5	10	15	20
MVC_1	1.0	1.015	1.013	1.011	1.0
MVC_2	2.64	1.634	1.336	1.186	1.118
MVC_3	1.87	1.563	1.347	1.213	1.1005

Table for accuracy					
MVC Type	Edge Count				
	1	5	10	15	20
MVC_1	100%	98.53%	98.68%	98.92%	100%
MVC_2	37.88%	61.19%	74.85%	84.29%	89.47%
MVC_3	53.48%	63.96%	74.58%	82.46%	90.86%

- b) We can see from the table that as the number of edges in a graph increases the better the approximation is as the size of each approximation decreases as we add more edges and conversely their accuracy increases as we add more edges. The relationship can be explained by the randomness of mvc\_2 and mvc\_3 since if there are more edges in the graph, these algorithms have a higher chance of picking a vertex that has edges which are not part of the mvc. We see 100% accuracy with 1.0 proportion for mvc\_1 at one edge because the highest degree vertex contains that 1 edge of the graph so every time, it will pick the right node. In general, as edge count increases, the accuracy of these algorithms increases and their proportion compared to the optimal solution decreases therefore, the approximations get better as edges increase.





c)

Table for proportion					
MVC Type	Node count				
	5	7	9	11	13
MVC_1	1.0	1.0021	1.0189	1.0355	1.0301
MVC_2	1.0	1.3088	1.4415	1.6401	1.7357
MVC_3	1.0	1.2878	1.3830	1.5177	1.5449

For this part I designed an experiment with varying edges of 5,7,9,11,13 and a fixed number of edges which was 15. We can see that as the number of nodes increases, the proportions get larger since there will be a higher chance for the random algorithms mvc\_2 and mvc\_3 to pick nodes that don't contribute to the mvc. Hence, as node count increases, the approximations get worse.

Part 7: Experiment 3 variable node size

