CSE106 Discrete Mathematics Mini Project

- **Project description:** Using C program, randomly generate a directed graph represented by adjacency matrix and show the sum of in-degrees and sum of out-degrees are equal.

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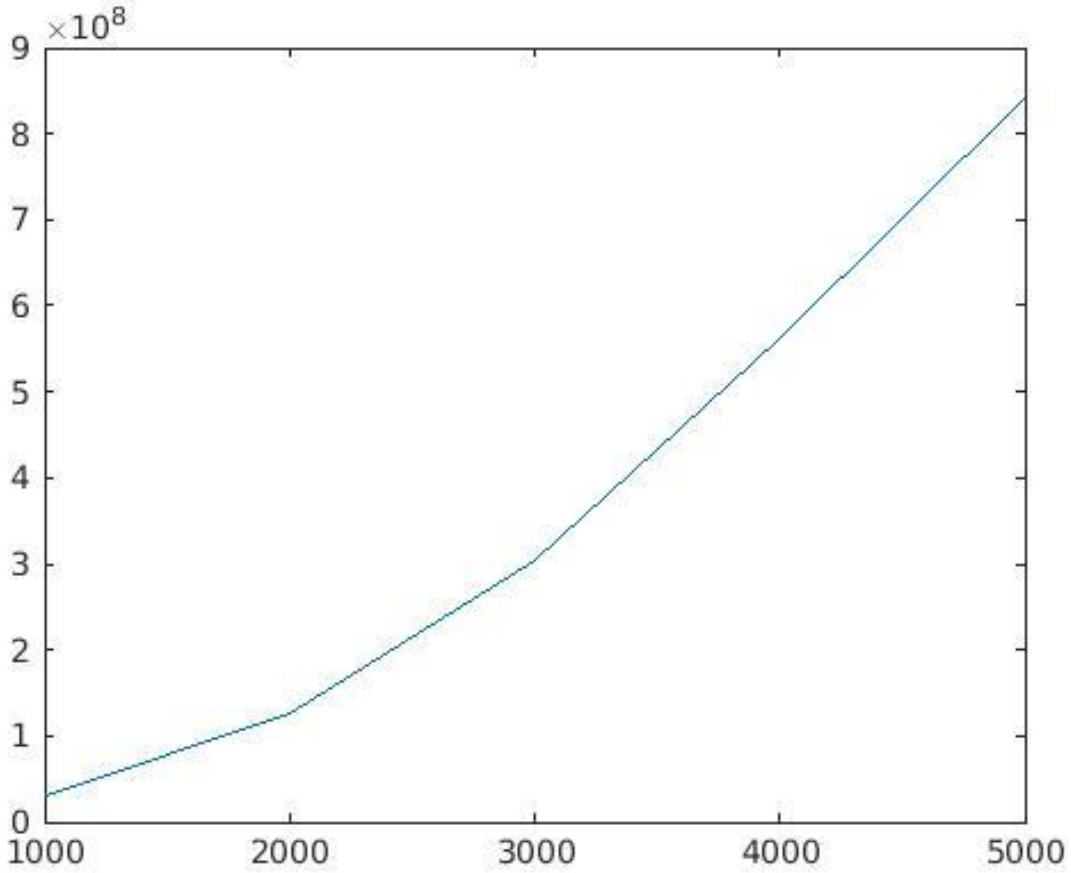
Program Explanation

Time Complexity vs Vertex



- The graph drawn from the computational time is a ***Quadratic graph***.

- The time grows linearly to the square of the number of input elements. Therefore, the approximate time complexity of the program as a function of n is $O(n^2)$

```
for(initial_vertex = 0; initial_vertex < log; initial_vertex++)
    for(terminal_vertex = 0; terminal_vertex < log; terminal_vertex++)
    {
        in_degree += adjacency_matrix[terminal_vertex][initial_vertex];
        out_degree += adjacency_matrix[initial_vertex][terminal_vertex];
    }
}
```

Theoretical Time Complexity

- The calculation of in-degrees and out-degrees is done by nested loop.
- Outer loop runs ***n*** times
- Inner also runs ***n*** times.
- So, **f(n) =** n^2
- Therefore, the time complexity of the program is, **f(n) =** $\theta(n^2)$

Conclusion

From the graph of Computational time, we can see that the Time complexity of the program is approximately $\mathbf{O}(n^2)$.

From the theoretical calculations we also obtained the average case of Time Complexity is $\boldsymbol{\theta}(n^2)$.

Since, Approximate time complexity = Theoretical time complexity

Therefore, in a directed graph using adjacency matrix, the sum of in-degrees and out-degrees runs on a time complexity $\boldsymbol{\theta}(n^2)$