By Jesse Watson

- **What is the time complexity of each method in your implementation in the worst case in terms of Big O notation?**
  - **Insertion method :** O(log V + E)
    - **Explanation** : Operations within the method are set and map operation, which are commonly O(log V) and followed by graph's[end]key- value which is a vector so its time complexity is gonna be O(E)
  - **Page_Rank method** : O(V * E+ V+ n * V + V)
    - **Explanation** : its just a lot for loops so I'm going to keep my explanation brief :
      - Calculating Hyperlink Probabilities: O(V * E)
      - Initializing Current Ranking Matrix : O(V)
      - Performing Power Iteration:O(n * V)
      - Printing Ranks:O(V)
- **What is the time complexity of your main method in your implementation in the worst case in terms of Big O notation? [5 points]**
  - **Main method :** O(V * E + V + n * V+ V)
    - **Explanation:** the time complexity would be the most time consuming function out of the functions within main, leading us to the time complexity of O(V * E + V + n * V+ V) of the page rank function

- **Describe the data structure you used to implement the graph and why? [2.5 points] :**
  - Used a map with the "key" being whats being connected to(which is the end vertice)and the "value" being vector full of pairs of (from,1/out_degrees of from) which are vertice connecting to the end vertice.I shaped my data structure like this so we have all out information we need right next to each to make for quick and efficient operation during runtime.All I have to do is take the first information of a pair(which is the label for the rank map) and put that name inside the rank map to get the rank and just multiply it with the other information "1/out_degrees of from"

- **What did you learn from this assignment and what would you do differently if you had to start over? [2 points]**
  - Learned the utility of a set and map,found out about make_pairs which are pretty cool because a lot of data are related to each other so it will make future problem little bit more doable.If I had to do this all over again I would probably try to figure out clever ways to go through a map easier to reduce time complexity