Program Structures and Algorithms

Assignment 4 Spring 2023 (SEC – 3)

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**Task:**

1. Implement height-weighted Quick Union with Path Compression.
2. Using your implementation of UF\_HWQUPC, develop a UF ("union-find") client that takes an integer value n from the command line to determine the number of "sites."
3. Determine the relationship between the number of objects (n) and the number of pairs (m) generated to accomplish this.

**Explanation:**

To connect all n objects, (n-1) connections are needed because each connection reduces the number of connected components by one. The probability of selecting two unconnected objects in each iteration is (n-1)/n^2 because there are (n-1) unconnected objects and the probability of selecting each object is 1/n. The expected number of connections in each iteration is (n-1)/n^2, which is also the expected number of connections required to connect all n objects. Approximating (n-1)/n as ln(n), the expected number of connections required can be expressed as 𝑚 = 𝐶 × 𝑛 𝑙𝑛(𝑛), where C is a constant factor that can be estimated experimentally.

**Conclusion:**

𝑚 = 𝐶 × 𝑛 𝑙𝑛(𝑛)

**Graphical Representation**

**Unit test**

A screenshot of a computer

Description automatically generated