CS3 Theory Task 1

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Question 1.15

Give a sequence of input pairs that causes the weighted quick-union algorithm with path compression by halving to produce a path of length 4.

Begin with a sequence of unique integers from the range of [0,7]. Execute the following union commands to build an algorithm with a path length of 4:

- 1. union(0,1);
- 2. union(2,3);
- 3. union(4,5);
- 4. union(6,7);
- 5. union(1,2); // This union joins sequences (0,1) and (2,3).
- 6. union(5,6); // This union joins sequences (4,5) and (6,7).
- 7. union(0,4); // This union joins the two trees by unionizing (0,1)-(2,3) on "top" of (4,5)-(6,7), resulting in a path length of 4.

Question 1.22

Modify Program 1.4 (Path Compression by Halving) to generate random pairs of integers between 0 and N-1 instead of reading them from standard input, and to loop until N-1 union operations have been performed. Run your program for N = 10^3, 10^4, 10^5, and 10^6 and print out the total number of edges generated for each value of N.

Code

```
#include ¡iostream¿
#include ¡random¿

int main(int argc, char *argv[ ])
{
    const int N = 1000;
    std::default_random_engine randomNumGenerator;

}
```