Overview:

The hash table is a data structure that implements an associative array data type. In this structure, there exists a function to compute keys to values. Hash tables on on average more efficient than search trees or any other table lookup structure.

In this assignment, we were asked to create a hash table from scratch further benchmark how efficient each hashing algorithm is in comparison. In this test, I explored linear, quadratic, and double hashing techniques. Additionally this hash table implementation uses an open address scheme when allocating values.

I implemented the following functions for each hashing scheme tested:

linearHash, quadraticHash, doubleHash
linearInsert, quadraticInsert, doubleInsert
linearSearch, quadraticSearch, doubleSearch
linearDelete, quadraticDelete, doubleDelete
main

Hashing functions implemented:

For my linearHash function I implemented the following equation:
$$h(k,i) = (h'(k) + i) \; mod \; m$$

For my quadraticHash function I implemented the following equation:
$$h(k,i) = (h'(k) + c1 * i + c2 * i^2) \; mod \; m$$

For my doubleHash function I implemented the following equation:
$$h(k,i) = (h1(k) + i * h2(k)) \; mod \; m$$
$$h1(k) = k \; mod \; m$$
$$h2(k) = 1 + (key \; \% \; (size - 1))$$

Testing procedure:

As requested, for each linear, quadratic, and double hashing, I inserted 900 random numbers into a table of length 1009 using open addressing. Then I added 50 more random integers and output information regarding the number of collisions per insert, the total number of collision for the 50, and the average number of collisions per insert.

Results:

Test #1	# of collisions 900-950	Avg collision per insert 900-950
Linear	2497	49
Quadratic	494	9
Double	409	8

Test #2	# of collisions 900-950	Avg collision per insert 900-950
Linear	1573	31
Quadratic	699	13
Double	604	12

Test #3	# of collisions 900-950	Avg collision per insert 900-950
Linear	1918	38
Quadratic	646	12
Double	554	11

Test #4	# of collisions 900-950	Avg collision per insert 900-950
Linear	2076	41
Quadratic	654	13
Double	595	11

Test #5	# of collisions 900-950	Avg collision per insert 900-950
Linear	2094	41
Quadratic	419	8
Double	591	11