CMSC 221: Data Structures
Quiz #6

Name: ___________  Key ___________

1. Hash functions can be broken into two components: ______ hash code _______ that converts a key to an integer and a(n) ______ compression function _______ that maps an integer to an index in $[0, N - 1]$.

2. Consider a hash table $H$ of size $N = 11$ (i.e., array is $A[0 \rightarrow 10]$) and the hash function

$$h(k) = (1 + k) \mod (N - 1)$$

(a) The key 19 maps to location ___________ 0 ___________.

(b) True or False: With $h(k)$ each cell in the array $A$ has an equally likely chance of being selected.

3. Assume there are $N$ slots in your hash table, and that there are $n$ data items stored in your hash table.

(a) In hashing with chaining, the space usage will be $\Theta$(____ n+N ____).

(b) In hashing with chaining, the worst case performance of get takes $O$(____ n ____)-time.

(c) In open-addressing hashing, the space usage will be $\Theta$(____ N ____).

(d) In hashing with chaining, the best case performance of put takes $O$(____ 1 ____)-time.

4. A probe sequence is the order of cells visited when resolving collisions with open-addressing. The upper bound on the number of probe sequences for a hash table of size $N$ is $O(N!)$. If the number of probe sequences is much smaller, e.g., linear probing, an effect called __________ clustering __________ occurs which results in an increased number of collisions and the hash table to perform inefficiently.

5. **Bonus.** When implementing the Multi-Map ADT, a ______ Hash map with chaining ______ is the preferred implementation.