CS 240 Fall 2017 Hashing Activity

Name: _____ Teammates: _____

For this activity, we will be using the following polynomial hash code for strings:

$h(k) = a \cdot c_1 + a^2 \cdot c_2 + a^3 \cdot c_3 + ... + a^m \cdot c_m$ and $a = 3$.

Character values should use the following case-insensitive conversions:

A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V	W	X	Y	Z
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90

For example $h('foo') = 3 \cdot 70 + 3^2 \cdot 79 + 3^3 \cdot 79 = 3054$.

For all of the hash table examples, we will use the following compression function:

$h'(k) = h(k) \ \% \ 7$

For example, $h'("f") = h("f") \ \% \ 7 = 210 \ \% \ 7 = 0$.

Thus, the key-value pair (“f”, 3) would be hashed into bucket 0 (the first bucket).

For integers we will use the hash code $h(k) = k$.

Calculating Hash Codes

1. Calculate the hash codes for the following keys:

"C"

"BA"

"CBA"

"XYZ"

"BBB"

"BOXIAN"

Hash Table w/ Open Addressing (Chaining)

2. Insert the following key-value pairs into the following hash table. Apply chaining to resolve collisions. What is the load factor, calculated to two decimal places?

(3, 'a'), (45, 'b'), (12, 'c'), (206, 'd'), (14, 'e')

Hash Tables w/ Probing

3. Insert the following key-value pairs into the following hash table. Apply linear probing to resolve collisions. What is the load factor, calculated to two decimal places?

("C", 1), ("BA", 2), ("CBA", 3), ("XYZ", 4), ("BBB", 5), ("BOXIAN", 6)

4. Insert the following key-value pairs into the following hash table. Apply double hashing to resolve collisions. Recall that double hashing uses a probe sequence of the form $p(K,i)=i*h_2(k)$. In this case use $h_2=1+(k\%6)$. What is the load factor, calculated to two decimal places?

(45, 'a'), (206, 'b'), (38, 'c'), (14, 'd')

Challenge (Optional) – Rehashing

The hash table from problem 3 is nearly full. Assume that it is expanded to a new size of 17 buckets. Re-hash all key-value pairs from problem 3 using the following new compression function:

$h'(k) = h(k)$ % 17

Are there any collisions?

What is the new load factor?