

Part 1:

Values of A:	10	33	37	39	41
Total Collisions:	7450	3399	6219	6286	6236
Max Collisions:	6	32	36	36	36

If a Long value went above the max long value, it simply overflowed to a negative long value. This is not a problem since the hash table can still function with negative values.

Part 2:

Alpha/Beta	A = 10000 B = 50000	A = 10000 B = 150000	A = 100000 B = 50000	A = 100000 B = 150000	A = 200000 B = 50000	A = 200000 B = 150000
Total Collisions:	84043	84048	82611	82609	82398	82397
Max Collisions:	36	36	36	36	36	36

It makes sense that the max number of collisions for every test in Part 2 is identical, as it is using the same polynomial base of 41. As seen in part 1, there is a maximum of 36 collisions when the base is 41.

Findings:

I tested every a value between 1 and 40, and here are the results. The first number in each row is the a value, the second number is the total number of collisions, and the third number is the maximum number of collisions at any index

1	2169	1123
2	61258	66
3	56956	26
4	39437	17
5	25077	12
6	16675	11
7	12928	9
8	10029	7
9	6845	7

10	7450	6
11	4237	7
12	4482	5
13	3382	5
14	4553	5
15	2934	5
16	2864	5
17	2626	5
18	2405	6
19	1895	5
20	3013	5
21	2178	11
22	2052	11
23	1963	11
24	2069	11
25	1800	11
26	3283	32
27	3256	32
28	3340	32
29	3288	32
30	3307	32
31	3411	32
32	3332	32
33	3399	32
34	3357	32
35	6357	36
36	6256	36
37	6219	36
38	6343	36
39	6286	36
40	6242	36

Based on these results, I would recommend for the  $\alpha$  value to be 19, since it has the lowest number of collisions, and no indexes with more than 5 collisions.

I tested a wide range of alpha and beta values. The values I tested for both alpha and beta were {10000, 10007, 50000, 50777, 100000, 100003, 150000, 160009, 200000, 212203}. For the following set of data, the first column will be the alpha values, the second column will be the beta values, the third column will be the total number of collisions for these values, and the fourth column will be the maximum number of collisions at any index. I applied these values with a base of 19, since it was the best base from the previous findings. Here are the results:

10	7450	6	
33	3399	32	
37	6219	36	
39	6286	36	
41	6236	36	
10000	10000	94549	7
10000	10007	94549	7
10000	50000	94548	7
10000	50777	94548	7
10000	100000	94547	7
10000	100003	94545	7
10000	150000	94545	7
10000	160009	94546	7
10000	200000	94545	7
10000	212203	94547	7
10007	10000	94880	7
10007	10007	94880	7
10007	50000	94880	7
10007	50777	94882	7
10007	100000	94880	7
10007	100003	94880	7
10007	150000	94883	7
10007	160009	94877	7
10007	200000	94879	7
10007	212203	94878	7
50000	10000	89298	7
50000	10007	89296	7
50000	50000	89295	7
50000	50777	89294	7
50000	100000	89299	7
50000	100003	89299	7
50000	150000	89293	7
50000	160009	89293	7
50000	200000	89297	7
50000	212203	89301	7
50777	10000	88676	7
50777	10007	88677	7
50777	50000	88679	7
50777	50777	88677	7
50777	100000	88677	7
50777	100003	88677	7
50777	150000	88675	7
50777	160009	88676	7
50777	200000	88679	7

50777	212203	88680	7
100000	10000	90410	7
100000	10007	90410	7
100000	50000	90409	7
100000	50777	90411	7
100000	100000	90413	7
100000	100003	90414	7
100000	150000	90407	7
100000	160009	90407	7
100000	200000	90413	7
100000	212203	90409	7
100003	10000	90213	8
100003	10007	90211	8
100003	50000	90217	8
100003	50777	90211	8
100003	100000	90215	8
100003	100003	90213	8
100003	150000	90216	8
100003	160009	90212	8
100003	200000	90216	8
100003	212203	90215	8
150000	10000	92862	7
150000	10007	92860	7
150000	50000	92860	7
150000	50777	92859	7
150000	100000	92860	7
150000	100003	92862	7
150000	150000	92861	7
150000	160009	92861	7
150000	200000	92861	7
150000	212203	92860	7
160009	10000	90705	8
160009	10007	90705	8
160009	50000	90703	8
160009	50777	90703	8
160009	100000	90706	8
160009	100003	90706	8
160009	150000	90704	8
160009	160009	90704	9
160009	200000	90702	8
160009	212203	90704	8
200000	10000	91906	8
200000	10007	91907	8
200000	50000	91905	8

200000	50777	91908	8
200000	100000	91907	8
200000	100003	91907	8
200000	150000	91906	8
200000	160009	91905	8
200000	200000	91908	8
200000	212203	91905	8
212203	10000	91005	7
212203	10007	91004	7
212203	50000	91004	7
212203	50777	91006	7
212203	100000	91003	7
212203	100003	91003	7
212203	150000	91009	7
212203	160009	91008	7
212203	200000	91005	7
212203	212203	91005	7

Based on these results, the best alpha value would be 50777, and the best beta value would be 150000.

Conclusion. My recommendation for the values of a, alpha, and beta would be 19, 50777, and 150000 based on the testing shown above.