

Problem 1

(1) $n=8^3=512$

(2) Statistically, when $n=512$ Max k should be between 7 and 8

Maximum Collisions k Relative to Size N

k	$(e/k)^k$	$n=(k/e)^k/4$
6	8.65E-03	2.89E+01
7	1.33E-03	1.88E+02
8	1.78E-04	1.41E+03
9	2.09E-05	1.20E+04
10	2.20E-06	1.13E+05
11	2.10E-07	1.19E+06
12	1.83E-08	1.37E+07
13	1.46E-09	1.71E+08
14	1.08E-10	2.31E+09
15	7.47E-12	3.35E+10
16	4.82E-13	5.19E+11
17	2.92E-14	8.56E+12

(2) Simulation Result

	1st	2nd	3rd	Average	%
0	229	231	225	228.33	45%
1	150	142	146	146.00	29%
2	75	78	84	79.00	15%
3	32	39	39	36.67	7%
4	16	16	14	15.33	3%
5	8	4	1	4.33	1%
6	2	1	1	1.33	0%
7	0	1	2	1.00	0%
	512	512	512	512	100%

(3) Conclusion : Therefore, this simulation result is within the range of statistical probability.

<Attachment - Problem 1 - Simulation 1>

625, 500, 015, 201, 745, 602, 453, 752, 556, 466, 557,
523, 152, 053, 725, 267, 770, 077, 415, 555, 570, 756,
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265, 622, 677, 366, 747, 242, 505, 122, 730, 553, 432,
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715, 137, 336, 527, 472, 200, 477, 213, 050, 062, 560,
723, 746, 626, 354, 745, 275, 745, 531, 176, 220, 140,
754, 503, 160, 137, 111, 134, 474, 153, 033, 305, 641,
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#of conflict=10 : 0, 0 %

#of conflict=11 : 0, 0 %

#of conflict=12 : 0, 0 %

#of conflict=13 : 0, 0 %

<Attachment - Problem 1 - Simulation 2>

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624, 171, 276, 353, 051, 463, 112, 762, 731, 344, 443,
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102, 232, 460, 067, 074, 425, 303, 616, 132, 112, 610,
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#of conflict=10 : 0, 0 %

#of conflict=11 : 0, 0 %

#of conflict=12 : 0, 0 %

#of conflict=13 : 0, 0 %

RUN SUCCESSFUL (total time: 797ms)

<Attachment - Problem 1 - Simulation 3>

244	735	212	364	525	34	727	246	225	373	375
314	271	177	376	754	540	15	764	257	665	207
750	112	560	755	151	374	76	200	620	744	452
30	370	737	507	773	306	370	121	42	551	663
504	167	261	224	101	510	645	71	265	26	247
500	712	31	227	375	445	774	6	724	547	753
300	573	33	725	276	356	717	567	755	736	773
724	443	250	314	177	202	676	737	502	734	101
500	561	607	601	634	612	574	750	342	154	72
463	345	200	433	126	745	211	152	14	675	421
435	137	767	723	305	54	317	730	775	25	154
552	245	575	176	147	655	620	17	43	144	115
542	365	476	40	750	524	257	226	537	677	377
55	12	52	112	632	546	152	347	755	51	354
756	353	46	103	333	501	571	735	747	364	715
452	377	261	750	201	771	130	657	372	367	45
550	216	750	543	400	763	235	65	711	772	710
403	770	166	703	455	22	704	565	553	177	442
740	40	122	277	51	337	673	574	501	176	500
254	312	357	414	327	672	472	426	770	473	541
766	402	157	751	115	357	565	23	272	61	721
671	750	777	154	176	144	73	73	710	453	52
115	434	415	77	444	6	417	271	463	172	415
544	333	335	252	703	126	261	451	335	406	5
422	761	577	617	433	762	442	156	555	453	70
440	241	450	345	554	171	647	277	567	764	454
457	744	565	623	602	521	724	357	717	737	717
626	250	303	656	200	465	202	704	275	245	254
410	3	40	731	326	546	221	75	556	755	776
641	627	750	662	567	306	51	203	744	606	666
573	760	600	1	271	724	651	555	717	167	235
307	170	376	502	253	645	131	60	150	712	155
120	620	474	410	664	554	475	273	650	20	446
202	103	344	246	344	172	567	433	732	530	303
332	624	732	600	207	377	732	713	333	537	265
174	772	656	306	376	206	252	755	351	725	44
42	212	644	5	132	170	22	234	735	644	765
671	116	375	33	656	320	465	170	507	162	72
542	666	77	343	526	706	170	153	31	301	557
271	256	65	703	527	541	460	351	625	764	432
100	536	62	236	17	255	746	307	411	530	260
115	653	732	516	647	366	675	741	101	41	257
675	173	310	76	770	174	533	702	344	100	342
765	734	412	734	747	51	312	567	725	745	606
405	574	225	640	445	450	102	152	244	127	773

145	247	665	451	751	670	437	754	627	213	531
752	701	757	235	202	42					

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#of confli	225	43.95%
#of confli	146	28.52%
#of confli	84	16.41%
#of confli	39	7.62%
#of confli	14	2.73%
#of confli	1	0.20%
#of confli	1	0.20%
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#of confli	0	0%
#of confli	0	0%
#of confli	0	0%
#of confli	0	0%
#of confli	0	0%

RUN SUC(756ms)