## MioHash: An Memory-Efficient and I/O-Optimized Hashing Index on Hybrid DRAM-PMem Memories

Zixiang Yu Zhirong Shen Xiamen University Xiamen University yuzixiang23@foxmail.com shenzr@xmu.edu.cn

Qingjie Zeng Xiamen University qjzeng503@gmail.com

Yijie Zhong Jiwu Shu
Xiamen University
yijiezhong@stu.xmu.edu.cn Jiwu Shu
Tsinghua University,Xiamen University
shujw@tsinghua.edu.cn

Experiment 1						
Experiment 1 Uniform Insert Throughput (Mops/s)	Thread=1	2	4	8	16	24
DASH	1.080309792	2.067467027	3.54139375	5.265225163	5.601201605	5.560437909
CCEH Level	0.6927915 0.517253332	1.33181725 0.566679181	2.43652025 0.706762602	4.08677525 0.864436573	5.44514925 1.014259263	5.66926275 1.056101841
Clevel	0.14161	0.272089	0.504664	0.903298	1.399661	1.716833
Plush /iper	0.438103 1.916868	0.83422125 3.51213	1.6048145 6.477029	2.4292295 9.194919	4.294831 12.335607	5.97354325 13.04946
lioHash	2.523302	4.3044485	7.770145	11.19255225	16.8236075	19.88255167
Iniform Positive Search Throughput (I		2	4	8	16	24
DASH CCEH	3.333146 2.145908	5.646048 4.352373	9.280315 9.02399	13.539036 15.176016	17.525591 19.615334	18.408078 20.702171
evel	1.050534	1.738362	3.092409	4.906786	6.404106	7.143704
Clevel	0.990972	1.81147	3.56415	6.773919	12.12053	16.35713
Plush /iper	0.66246525 2.096916	1.2985415 4.012847	2.479261 8.116097	3.4266955 12.593406	6.18491075 25.527122	9.49267075 37.48872
/lioHash	3.134054	6.22590625	12.229869	14.0550155	26.7947485	38.912764
Iniform Negative Search Throughput		2	4	8	16	24
DASH CCEH	3.33464 0.715493	5.642306 1.414038	9.312879 2.708599	13.537437 4.740526	17.621648 7.459968	18.535994 7.946879
_evel	1.051344	1.735256	3.113679	4.901411	6.449082	7.051144
Clevel	0.811196	1.542197	3.005827	5.733635	10.279313	13.616402
Plush /iper	0.92998575 4.435612	1.8471755 8.763846	3.605941 17.417176	4.82533025 21.866726	9.25337825 42.342509	13.745963 61.9225
/lioHash	3.62707425	7.2290625	14.08542675	19.298319	34.82591625	47.20718225
	Thread=1	2	4	8	16	24
DASH CCEH	1.898662 1.229131	3.598952 2.490614	5.935547 4.70361	8.094248 7.886595	7.910209 8.918177	8.000926 10.328562
evel	0.937153	1.531833	2.772285	4.398251	5.593817	5.666127
Clevel	0.299471	0.559957	1.03137	1.956335	3.418501	4.645158
Plush /iper	0.39326175 1.85327	0.77641925 3.519253	1.513762 6.853577	2.283574725 10.342089	4.14544275 15.766681	6.05539775 17.652877
nioHash	1.690429	3.293858125	6.254388	8.86109575	15.02798225	19.60113467
lipfian Insert Throughput (Mops/s)	Thread=1	2	4	8	16	24
DASH CCEH	1.053913 0.589479	2.036119 1.18045	3.449268 2.285433	5.292045 4.021246	5.805819 5.582147	5.4589 5.985942
evel	0.474362	0.757504	0.973837	1.374645	1.461386	1.382936
Clevel Plush	0.137404 0.372362	0.261074 0.757704	0.491295 1.534042	0.887227 2.734872	1.380396 3.891831	1.717355 4.608914
riusn 'iper	1.918128	3.488715	6.433229	9.637801	12.175177	12.902454
nioHash	2.516055	4.243159	7.60807025	11.10811225	17.041096	20.1762295
lipfian Positive Search Throughput (M DASH	## Thread=1 3.336167	2 5.586168	9.299656	8 13.530452	16 17.573843	24 18.276381
CCEH	2.046681	4.19717	8.781548	15.505613	19.346186	20.01743
_evel	1.032295	1.740166	3.093239	4.901955	6.396258	7.103214
Clevel Plush	0.997262 0.585573	1.877826 1.188494	3.626865 2.514597	6.997729 4.270248	13.112314 7.509008	18.246416 9.457597
/iper	2.102515	3.944174	8.176301	12.950664	24.569926	36.804304
MioHash	3.00255875	5.9849455	11.780668	13.1106245	23.660596	34.29530725
Zipfian Negative Search Throughput (I DASH	N Thread=1 3.332858	2 5.648635	9.31015	8 13.563526	16 17.526157	24 18.38305
CCEH	0.713374	1.405746	2.7034	4.67963	7.465958	7.823678
evel	1.05248	1.740997	3.098963	4.889724	6.410645	7.096786
Clevel Plush	0.812245 0.796609	1.534612 1.654961	2.948581 3.517741	5.728126 6.129173	10.174163 10.566435	12.411457 13.902013
/iper	4.47395	8.295752	17.129539	22.372177	42.177021	60.593687
MioHash	3.64170925	7.18883175	14.346825 4	19.3584845	34.70292175	47.010148
Zipfian Delete Throughput (Mops/s) DASH	Thread=1 1.607616	2 3.240823	5.494735	7.556856	16 7.241076	24 7.64346
CCEH	1.224438	2.468547	4.720928	7.922391	9.215614	10.335044
_evel Clevel	0.809582 0.295755	1.383746 0.55504	2.516669 1.008447	4.048322 2.030666	5.082029 3.581514	5.198309 4.975246
Plush	0.337059	0.711316	1.453221	2.597762	3.946841	4.739526
/iper	1.863955	3.492423	6.891585	10.442913	15.672394	17.574828
MioHash	1.66992575	3.2749535	6.235328	8.60868725	14.852254	19.423247
Experiment 2 Uniform YCSB-A Throughput (Mops/s)	) Thread=1	2	4	8	16	24
Jniform YCSB-A Throughput (Mops/s)	) Thread=1 1.941595	2 3.613314	4 6.282357	8 9.603273	16 10.940991	24 11.432127
Jniform YCSB-A Throughput (Mops/s) CCEH Clevel	1.941595 0.215008	3.613314 0.419314	6.282357 0.809303	9.603273 1.53451	10.940991 2.702261	11.432127 3.576111
Jniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush	1.941595 0.215008 0.423265	3.613314 0.419314 0.95656	6.282357 0.809303 1.878408	9.603273 1.53451 2.619554	10.940991 2.702261 5.083122	11.432127 3.576111 7.476417
Jniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush /iper MioHash	1.941595 0.215008 0.423265 1.780937 1.9295995	3.613314 0.419314 0.95656 3.28364 3.779359	6.282357 0.809303 1.878408 5.034586 7.358267	9.603273 1.53451 2.619554 5.644092 9.924119	10.940991 2.702261 5.083122 5.529003 18.3813365	11.432127 3.576111 7.476417 4.956198 25.373776
Jniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush /iper MioHash Jniform YCSB-B Throughput (Mops/s)	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1	3.613314 0.419314 0.95656 3.28364 3.779359	6.282357 0.809303 1.878408 5.034586 7.358267	9.603273 1.53451 2.619554 5.644092 9.924119 8	10.940991 2.702261 5.083122 5.529003 18.3813365	11.432127 3.576111 7.476417 4.956198 25.373776
Iniform YCSB-A Throughput (Mops/s) CCEH Clevel Clush //iper //ioHash //inform YCSB-B Throughput (Mops/s) CCEH	1.941595 0.215008 0.423265 1.780937 1.9295995	3.613314 0.419314 0.95656 3.28364 3.779359	6.282357 0.809303 1.878408 5.034586 7.358267	9.603273 1.53451 2.619554 5.644092 9.924119	10.940991 2.702261 5.083122 5.529003 18.3813365	11.432127 3.576111 7.476417 4.956198 25.373776
Jniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush //per ilioHash Jniform YCSB-B Throughput (Mops/s) CCEH Plush	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119
Jniform YCSB-A Throughput (Mops/s) CLEH CLEVEL Plush //iper //ioper	1.941595 0.215008 0.423265 1.780937 1.9295995 1.553614 0.547787 0.62971 1.778103	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824	10.940991 2.702261 5.083122 5.52903 18.3813365 16 12.110555 4.435138 6.263437 5.477951	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256
Iniform YCSB-A Throughput (Mops/s) CCEH Plush (Iper InioHash Iniform YCSB-B Throughput (Mops/s) CCEH Clevel Plush (Iper InioHash Iniform YCSB-B Throughput (Mops/s) CCEH Idea InioHash InioHash	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119
Iniform YCSB-A Throughput (Mops/s) ICEH ICEH ICEVEI IUSH I/iper IIIOHASH INIFORM YCSB-B Throughput (Mops/s) ICEH ICEVEI IUSH I/iper IIIOHASH IIIOHASH IIIOHASH IIIOHASH IIIIOHASH IIIIOHASH IIIIIOHASH IIIIIOHASH IIIIIIII	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.188723 2 4.556558	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043
Jniform YCSB-A Throughput (Mops/s) CCEH Plush (/per diioHash Jniform YCSB-B Throughput (Mops/s) CCEH Plush //iper diioHash Jniform YCSB-D Throughput (Mops/s) CABH Plush //iper diioHash Jniform YCSB-D Throughput (Mops/s) DASH CCEH	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214415 1.032996 1.225157 3.250971 5.198723	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413	11.432127 3.576111 7.476417 4.966198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323
Iniform YCSB-A Throughput (Mops/s) CCEH [leavel   Plush   Plus	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099
Jinform YCSB-A Throughput (Mops/s) CCEH Clevel Plush //per diioHash Jinform YCSB-B Throughput (Mops/s) CCEH Clevel Plush //per diioHash Jinform YCSB-B Throughput (Mops/s) ASH ASH CEH Level Clevel Clevel	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369
Jniform YCSB-A Throughput (Mops/s) CCEH Plush //iper //ioper /	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485
Uniform YCSB-A Throughput (Mops/s) CCEH Elevel Flush Fliper Fliothash Fliper Fl	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 )Thread=1	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24
Iniform YCSB-A Throughput (Mops/s) CCEH Jelevel Jelush (riper IdioHash Iniform YCSB-B Throughput (Mops/s) CCEH Clevel Jelush (riper IdioHash Iniform YCSB-D Throughput (Mops/s) ASH CCEH Level Jelevel Jelevel Jelevel Jelevel Jelosh IdioHash Iniform YCSB-F Throughput (Mops/s) ASH	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 9.25.97748067 36.5088485 24 7.086551
Iniform YCSB-A Throughput (Mops/s) CCEH Elevel Plush (fiper flioHash Iniform YCSB-B Throughput (Mops/s) CEH Elevel Plush (fiper flioHash Iniform YCSB-D Throughput (Mops/s) DASH CCEH Elevel Elevel Elevel Elevel Iniform YCSB-F Throughput (Mops/s) Elevel El	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 )Thread=1 1.361149 0.732373 0.694532	3.613314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556658 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.886576 3.537363	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918	11.432127 3.576111 7.476417 4.966198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145
Jniform YCSB-A Throughput (Mops/s) CCEH Plush //iper //ioper /	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547654 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.4334447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 811631 2.745591 2.192028 0.884652	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888
Experiment 2 Juniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush //iper dlioHash Difform YCSB-B Throughput (Mops/s) CCEH Plush //iper Disched Plush //iper Disched D	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 )Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.508805 8 7.28332 4.836576 3.537363 1.651285 2.413629	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909
Jaiform YCSB-A Throughput (Mops/s) CCEH Clevel Plush //iper //iper //ioper	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547654 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.4334447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 811631 2.745591 2.192028 0.884652	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888
Iniform YCSB-A Throughput (Mops/s) CCEH Plevel Plush P	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.894532 0.237316 0.448608 1.959922	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.7770951 1.389933 1.239523 0.453495 0.89648 4.22807	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977
Juliform YCSB-A Throughput (Mops/s) CCEH Plush //iper //ioper	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.49648 4.22807 3.55566535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.844652 1.7672565 8.227409 6.6841395	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Elevel Flush Fliper FlioHash Fliper Fliper FlioHash Fliper Flip	1.941595 0.215008 0.423265 1.780937 1.9295995 )Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 )Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 )Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Jelsvel Jelsvel Jush (riper IdioHash Iniform YCSB-B Throughput (Mops/s) CCEH Clevel Jush (riper IdioHash Iniform YCSB-D Throughput (Mops/s) ASH CCEH Level Jush (riper IdioHash Iniform YCSB-D Throughput (Mops/s) ASH CCEH Level Jush (riper IdioHash Iniform YCSB-F Throughput (Mops/s) IdioHash IdioH	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Jelvel Jelvel Jush 'irjeer IdioHash Iniform YCSB-B Throughput (Mops/s) CCEH Jelvel Jush Jelvel Jush Jelvel Jush Jelvel Jush Joseph	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.894532 0.237316 0.444808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.55566535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176881667 1.077073333	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Jelvel Jelvel Jush //iper //ioper //io	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.265503333	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.09588333 3.415083333 3.415083333	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Elevel Plush (i/joer flioHash Iniform YCSB-B Throughput (Mops/s) CEH Elevel Plush (i/joer flioHash Iniform YCSB-D Throughput (Mops/s) DASH CCEH Elevel	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.894532 0.237316 0.444808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.55566535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176881667 1.077073333	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Inition YCSB-A Throughput (Mops/s) CCEH CICEH CICEH CICH CICH CILIVAT CICH CICH CICH CICH CICH CICH CICH CIC	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.96656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556658 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.55566535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.508805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) CCEH Clevel Clev	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.444808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.7770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556635	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176881667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 3.415083333 3.415083333 3.629362 0.5745 0.6487288 Delete	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Inition YCSB-A Throughput (Mops/s) CCEH Elevel Flush Figer Floor Holder Floor Holde	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556635	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.508805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Iniform YCSB-A Throughput (Mops/s) ICEH Jelvel Jel	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 Thread=1 1.361149 0.732373 0.694532 0.237316 0.4446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 7.420722 0.625725 0.442224 Insert 1.885166667 2.24333333 3.057166667	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.500925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.527166667	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.2832 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Inform YCSB-A Throughput (Mops/s) CCEH Clevel Plush (iper dioHash Inform YCSB-B Throughput (Mops/s) CCEH Clevel Plush (iper dioHash CCEH CCEH COEH COEH COEH COEH COEH COEH	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 2.420722 0.62575 0.442224 Insert 1.835166667 2.243333333 3.057166667 2.195533333	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.265303333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.571666667 1.5710333333	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.83166667 4.414666667	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Inition YCSB-A Throughput (Mops/s) CCEH Illevel	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 Thread=1 1.361149 0.732373 0.694532 0.237316 0.4446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 7.420722 0.625725 0.442224 Insert 1.885166667 2.24333333 3.057166667	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.500925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.527166667	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.2832 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
niform YCSB-F Throughput (Mops/s) CEH level lush ipper iioHash niform YCSB-D Throughput (Mops/s) CEH level lush iipper lioHash niform YCSB-D Throughput (Mops/s) ASH CEH level lush iipper lioHash niform YCSB-F Throughput (Mops/s) ASH CEH level lush iipper lioHash niform YCSB-F Throughput (Mops/s) ASH CEH level lush iipper lioHash niform YCSB-F Throughput (Mops/s) ASH CEH level lush lipper lioHash ASH CEH level lush iipper lioHash ASH CEH level lush lipper lioHash ASH CEH level lush lipper lioHash ASH CEH level	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.894532 0.237316 0.444808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.7770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.55566535  Positive Search 0.373066833 0.386246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 1.446333333 1.446333333 1.446333333 1.446333333 1.474533333 1.475636667	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.527166667 1.527166667 1.527166667 1.710333333 1.276166667 1.527166667	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 3.415083333 3.415083333 3.415083333 3.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.833166667 4.141666667 1.322833333 1.833166667 4.414666667 261.3952	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
Inition YCSB-A Throughput (Mops/s) CCEH CICEH CICH CICH CICH CILIVATION CICH CIPH CIPH CIPH CIPH CIPH CIPH CIPH	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547634 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 2.420722 0.62575 0.442224 Insert 1.835166667 9.195833333 248.0072 41.24025	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.386246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 2.0745 3.2296 2.37875	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.577166667 1.577166667 1.577166667 1.571766667 1.571766667 1.571766667 1.571766667 1.571766667 1.571766667 1.571766667 1.57170333333 2.7224 2.37925	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.833166667 4.414666667 261.3952 4.132	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977
niform YCSB-A Throughput (Mops/s) ICEH level level lush ipper flioHash niform YCSB-B Throughput (Mops/s) ICEH level	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.444808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.7770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556635  Positive Search 0.373066833 0.386246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.710333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 3.415083333 3.415083333 3.415083333 3.415083333 3.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.833166667 4.414666667 261.3952 4.132 1.452	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977 20.028024
niform YCSB-B Throughput (Mops/s) Idea of the control of the contr	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.366246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 2.0745 3.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176821667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.77013333333 1.776166667 1.527166667 1.7703333333 1.776166667 1.57166667 1.7703333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 3.83166667 4.414666667 261.3952 4.132 1.452	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24,746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977 20.028024
niform YCSB-A Throughput (Mops/s) ICEH level level lush ipper flioHash niform YCSB-B Throughput (Mops/s) ICEH level lush ipper lioHash niform YCSB-D Throughput (Mops/s) IASH ICEH evel level	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.4446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 2.420722 0.62575 0.442224 Insert 1.835166667 9.19583333 3.057166667 9.19583333 3.057166667 9.19583333 3.057166667 9.19583333 3.057166667 9.19583333 3.057166667 9.19583333 3.057166667 9.19583333 3.48.0072 41.24025 6.6324	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.386246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 2.0745 3.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 8.11631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.500925 1.176861667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.7701333333 1.776166667 1.527166667 1.710333333 1.776166667 1.527166667 1.710333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 3.415083333 3.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.833166667 4.414666667 261.3952 4.132 1.452	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977 20.028024
Uniform YCSB-A Throughput (Mops/s) CCEH CCEH CCEH CCEH CIVEN	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547634 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 2.420722 0.62575 0.442224 Insert 1.835166667 2.195833333 248.0072 41.24025 6.6324  Thread=1 1.080309792 0.6927915 0.517253332	3.613314 0.419314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.386246 0.5450395 1.0328 0.5871938 Positive Search 0.924166667 1.098333333 1.446333333 2.0745 3.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 1.9266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.17681667 1.077073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.527166667 1.527166667 1.527166667 1.527166667 1.527166667 1.527166667 1.527166667	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 1.83166667 4.414666667 261.3952 4.132 1.452  8 5.265225163 4.08677525 0.864436573	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977 20.028024
Uniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush Piper AlioHash Piper Pilosh Pilosh Piper Pi	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.366246 0.5450395 1.033883333 1.853204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 2.0745 3.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176816667 1.77073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.77013333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 3.83166667 4.414666667 2.4132 1.452  8 5.265225163 4.08677525 0.864436573 0.903298 2.4292295	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.508485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977 20.028024
Juniform YCSB-A Throughput (Mops/s) CCEH Clevel Plush //iper MioHash Juniform YCSB-B Throughput (Mops/s) CCEH Clevel Plush //iper MioHash Juniform YCSB-D Throughput (Mops/s) DASH CCEH Level Clevel Plush //iper MioHash John Throughput (Mops/s) DASH CCEH Level Clevel Plush //iper MioHash DASH CCEH Level Clevel Clevel Plush //iper MioHash DASH CCEH Level Clevel	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135  Insert 1.044361667 1.524968333 1.570881667 7.030871667 2.420722 0.62575 0.442224 Insert 1.835166667 2.19333333 3.057166667 2.19438333 3.057166667 2.194383333 3.1570881667 2.240722 0.62575 0.442224 Insert 1.835166667 2.194383333 3.248.0072 41.24025 6.6324	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.386246 0.5450395 1.033883333 1.583204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.446333333 1.4416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.9777721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672655 8.227409 6.6841395  Negative Search 0.5000925 1.176861667 1.077073333 1.2653503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.57166667 1.5710333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 4.144666667 261.3922 4.132 1.452  8 5.265225163 4.08677525 0.864436573 0.903298 2.4292295 9.194919	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.5088485 24 7.086551 6.397954 4.501145 3.92088 6.940909 10.901977 20.028024
Iniform YCSB-A Throughput (Mops/s) ICEH Jelevel Jush Jiriper J	1.941595 0.215008 0.423265 1.780937 1.9295995 ) Thread=1 1.553614 0.547787 0.62971 1.778103 2.622453 ) Thread=1 2.547534 1.519133 0.872114 0.575072 1.16033 3.625560333 5.043314 ) Thread=1 1.361149 0.732373 0.694532 0.237316 0.446808 1.959922 1.8972135	3.613314 0.419314 0.419314 0.95656 3.28364 3.779359 2 3.214115 1.032996 1.225157 3.250971 5.198723 2 4.556558 3.087774 1.425969 1.102422 1.20241 7.433447667 5.3270765 2 2.770951 1.389933 1.239523 0.453495 0.89648 4.22807 3.5556535  Positive Search 0.373066833 0.366246 0.5450395 1.033883333 1.853204 0.328 0.5871938 Positive Search 0.924166667 1.098333333 2.0745 3.3296 2.37875 1.2416	6.282357 0.809303 1.878408 5.034586 7.358267 4 6.395054 1.977721 2.422948 4.995168 10.266235 4 7.806189 6.070746 1.972523 2.2145923 2.2662 14.772049 10.502546 4 4.811631 2.745591 2.192028 0.884652 1.7672565 8.227409 6.6841395  Negative Search 0.5000925 1.176816667 1.77073333 1.263503333 1.154294 0.327 0.348968 Negative Search 0.814833333 1.776166667 1.77013333333 2.7224 2.37925 1.0794	9.603273 1.53451 2.619554 5.644092 9.924119 8 10.17395 3.493462 3.13946 5.592824 12.136581 8 10.655705 9.841329 3.644325 4.137716 4.880244 21.772137 20.5088805 8 7.28332 4.836576 3.537363 1.651285 2.413629 10.98181 9.6083835  Delete 0.718684667 0.728425333 1.039588333 3.415083333 2.629362 0.5745 0.6487288 Delete 1.379166667 1.322833333 3.83166667 4.414666667 2.4132 1.452  8 5.265225163 4.08677525 0.864436573 0.903298 2.4292295	10.940991 2.702261 5.083122 5.529003 18.3813365 16 12.110555 4.435138 6.263437 5.477951 23.401413 16 9.969395 11.607526 4.716346 7.2416 6.240233 25.086287 24.746811 16 7.353183 6.132695 4.236918 2.836115 4.704921 11.3979743 15.8329955	11.432127 3.576111 7.476417 4.956198 25.373776 24 13.752623 5.079593 9.295119 5.06256 33.741323 24 9.275043 12.588382 5.236053 9.988099 9.361369 25.97748067 36.508485 24 7.086551 6.397954 4.501145 3.920888 6.940909 10.901977 20.028024

Experiment 6						
Storage Traffic	Write Traffic (GB)	Read Traffic (GB)				
DASH CCEH	35.11431432 21.9854815	33.44651294 128.2352502				
Level Clevel	27.12402272 41.02325344	74.41524744 102.6981823				
Plush Viper	12.37470412 7.8515625	7.149165392 0.803710938				
MioHash	6.346679688	3.326171875				
Experiment 7						
Space(GB)	Number of inserted items=10M	20M	30M	40M	50M	60M 0.250000264
Plush-DRAM Plush-PM	0.249999746 0.249999839	0.262560851 4.249999495	0.250000104 4.250000493	0.249999771 4.249998931	0.249999632 4.25000808	4.250006269
Viper-DRAM Viper-PM	0.396240234 0.150764466	0.794219971 0.301551819	1.047981263 0.452316284	1.587265016 0.603103638	2.0145607 0.753890991	2.093997956 0.904655457
MioHash-DRAM MioHash-PM	0.066098828 0.291180664	0.132199512 0.575436523	0.183785938 0.802583984	0.264400391	0.264400391 1.153710938	0.367154297 1.586894531
Space(GB)	Number of inserted items=70M	80M	90M	1.155664063 100M	110M	1.500094531 120M
Plush-DRAM Plush-PM	0.250000051 4.250008685	0.250000017 4.250005096	0.249999711 4.249994726	0.250000352 4.250002624	0.249970499 4.250003643	0.249999636 4.25000454
Viper-DRAM	2.375648499	3.173919678	3.845325471	4.030708313	4.082023621	4.193206787
Viper-PM	1.055442811	1.206207275 0.528803711	1.356994629	1.507781982	1.658546448 0.533805664	1.809333802
MioHash-DRAM MioHash-PM	0.528804688 2.282929688	2.296601563	0.528803711 2.296601563	0.529323242 2.298916016	2.333466797	0.739245117 3.203115234
Space(GB) Plush-DRAM	Number of inserted items=130M 0.250000085	140M 0.250000074	150M 0.249999896	160M 0.249999777	170M 0.249999799	180M 0.249999666
Plush-PM	4.249996225	4.250001735	4.249998959	4.250003048	4.249998202	4.250003074
Viper-DRAM Viper-PM	4.428947449 1.960116893	4.85838318 2.11088562	5.520629883 2.261672974	6.344173432 2.412437439	7.139011384 2.563224793	7.690620423 2.714005627
MioHash-DRAM	0.739245117	1.057611328	1.057610352	1.057610352	1.057609375	1.057608398
MioHash-PM Space(GB)	3.203115234 Number of inserted items=190M	4.553066406 200M	4.601894531 210M	4.595058594 220M	4.595058594 230M	4.597988281 240M
Plush-DRAM	0.250000195	0.250000172	0.24999976	0.250000245	0.249999726	0.250000213
Plush-PM Viper-DRAM	4.250001257 7.961681366	4.250002091 8.058933259	68.2499742 8.105636598	68.24978246 8.168132782	68.24991443 8.254638672	68.24981132 8.382823944
Viper-PM	2.864776611	3.015563965	3.16632843	3.317115784	3.467903137	3.618667603
MioHash-DRAM MioHash-PM	1.057608398 4.593105469	1.058648438 4.591884766	1.059292969 4.595302734	1.068192383 4.645605469	1.145938477 5.025908203	1.476976563 6.390634766
Space(GB)	Number of inserted items=250M	260M	270M	280M	290M 0.250000147	300M
Plush-DRAM Plush-PM	0.249999631 68.25001036	0.249999887 68.25005041	0.249999807 68.25025806	0.249999916 68.24994929	0.250000147 68.250072	0.250000207 68.25005004
Viper-DRAM	8.573005677	8.845458984	9.217933655	9.708759309	10.31484985	11.03757095
Viper-PM MioHash-DRAM	3.769481659 1.974335938	3.920246124 2.112382813	4.071033478 2.115224609	4.221820831 2.115224609	4.372585297 2.115224609	4.52337265 2.115224609
MioHash-PM	8.364619141	8.966396484	9.056240234	9.113857422	9.167568359	9.184169922
Experiment 8 Variable Size Throughput (Mops	/s) Value size=16B	32B	64B	128B	256B	
DASH	4.761206	4.370462	4.012544	3.648672	2.531003	
Clevel Plush	1.75256215 4.0494265	1.7737998 3.61212125	1.7562037 3.46075975	1.771669775 3.36415675	1.741172375 3.05871875	
Viper	12.55229975	12.30331375	9.808057	7.12537625	4.50371775	
MioHash	14.092812	12.9155135	10.503505	7.34719125	4.3792125	
	_					
Experiment 9 Load Factor (%)	Number of inserted items=10M	20M	30M	40M	50M	60M
DASH CCEH	66.0554 59.5719	66.0554 59.5737	53.2927 47.6062	66.0554 59.5728	82.4597 69.9493	53.3501 47.5765
Level	90.8261	90.8261	68.1196	90.8261	56.7663	68.1196
Clevel Plush	79.4729 59.6046	34.0598 7.01231	59.6046 10.5185	79.4729 14.0246	49.6705 17.308	59.6046 21.0369
Viper	37.7066	37.668	42.8273	37.7237	37.1483	42.9255
MioHash Load Factor (%)	56.0727 Number of inserted items=70M	56.0856 80M	61.5157 90M	56.092 100M	70.1151 110M	61.5264 120M
DASH						
	57.7984	66.0554	74.3123	82.434	79.1072	53.3446
CCEH	52.1537	59.5742	66.6419	70.1075	59.5115	47.6101
CCEH Level Clevel Plush	52.1537 79.4729 69.5388 24.5431	59.5742 90.8261 34.0598 28.0492	66.6419 51.0897 44.7035 31.5554	70.1075 56.7663 49.6705 35.0616	59.5115 62.443 54.6376 38.5677	47.6101 68.1196 59.6046 42.0739
CCEH Level Clevel	52.1537 79.4729 69.5388	59.5742 90.8261 34.0598	66.6419 51.0897 44.7035	70.1075 56.7663 49.6705	59.5115 62.443 54.6376	47.6101 68.1196 59.6046
CCEH Level Clevel Plush Viper MioHash Load Factor (%)	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M	59.5742 90.8261 34.0598 28.0492 37.7426 56.953	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701
CCEH Level Clevel Plush Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834	59.5742 90.8261 34.0598 28.0492 37.7426 56.953	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191	59.5115 62.443 54.6376 38.5677 40.3423 76.5192	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%)	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%)	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel CCEH Level Clevel	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Level Clevel Level Level Level Level Level Level Level Level	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Clevel Clevel Plush Viper MioHash COEH Level Clevel Clevel Plush CCEH Level Clevel	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0462 56.7663 49.6705 70.1231 37.1574	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH COEH Level Clevel Plush Viper MioHash Load Factor (%) DASH Load Factor (%) DASH CEEH Level Clevel Plush Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 53.7313 66.615	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0462 56.7663 49.6705 70.1231 37.1574	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0864 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.223997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash Viper MioHash Viper MioHash Viper MioHash Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0989 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CTEH Level Clevel Plush Viper MioHash Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-3 Thread-4 Thread-4 Thread-24 Recovery Time (s) Thread-1 Thread-1	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CTEH Level Clevel Plush Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-4	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5903 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 1000M 5.512479 3.025063 1.811582 1.289331	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash CCEH Level Clevel Plush Viper MioHash Toread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.444947 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CTEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-4 Thread-2 Thread-16 Thread-2 Thread-1 Thread-2 Thread-3 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-8 Thread-16	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0862 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.7874866 1.263118 1.017342	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Cabe Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-4 Thread-16 Thread-12 Thread-1 Thread-2 Thread-2 Thread-3 Thread-1 Thread-2 Thread-3 Thread-1 Thread-2 Thread-3 Thread-16 Thread-2 Thread-3 Thread-16 Thread-2	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704771 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332566 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-4 Thread-4 Thread-4 Thread-2 Thread-16 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-2 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 89.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.5.8497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 1000M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-12 Thread-2 Thread-1 Thread-2 Thread-3 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Threa	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.958667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-2 Thread-2 Thread-2 Thread-1 Collecting Table Throughput (Mc # of CT=4 # of CT=8 # of CT=8 # of CT=16	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704771 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.5.8497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Cabe Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-3 Thread-4 Thread-8 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-16 Thread-2 Thread-3 Thread-16 Thread-2 Thread-4 Thread-3 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-8 Thread-16 Thread-16 Thread-24  Experiment 11 Collecting Table Throughput (Mc TCT=8 # of CT=8 # of CT=8 # of CT=64 # of CT=64 # of CT=64	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.958667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-4 Thread-4 Thread-2 Thread-4 Thread-16 Thre	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44,7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532  4 7.137802 7.45585 7.621123 7.6565617	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199  8 8 8.904839 10.502003 10.505657 10.878732	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Cabe Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-3 Thread-4 Thread-8 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-16 Thread-2 Thread-3 Thread-16 Thread-2 Thread-4 Thread-3 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-8 Thread-16 Thread-16 Thread-24  Experiment 11 Collecting Table Throughput (Mc TCT=8 # of CT=8 # of CT=8 # of CT=64 # of CT=64 # of CT=64	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.12917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-2 Thread-2 Thread-3 Thread-1 Thread-2 Thread-3 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-1 Thread-2 Thread-1 Thread-5 Thread-1 Thread-1 Thread-1 Thread-5 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thr	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CTEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-2 Thread-4 Thread-2 Thread-4 Thread-2 Thread-4 Thread-2 Thread-4 Thread-2 Thread-4 Thread-4 Thread-2 Thread-4 Thread-4 Thread-4 Thread-4 Thread-5 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-4 Thread-5 Thread-4 Thread-5 Thread-4 Thread-6 Thread-6 Thread-6 Thread-16 Thread-1	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash COEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-1 Thread-2 Thread-3 Thread-1 Thread-1 Thread-2 Thread-3 Thread-1 Thread-2 Thread-3 Thread-1 Thread-3 Thread-1 Thread-5 Thread-5 Thread-5 Thread-5 Thread-5 Thread-5 Thread-5 Thread-1 Thread-5 Thread-5 Thread-5 Thread-1 Thread-5 Thread-1 Thread-5 Thread-5 Thread-1 Thread-5 Thread-1 Thread-1 Thread-5 Thread-1 Thread-5 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.444947 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.94434275 2.9541595	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-24 Recovery Time (s) Thread-17 Thread-24 Thread-24 Recovery Time (s) Thread-16 Thread-24 Thread-24 Thread-26 Thread-26 Thread-16 Thread-27 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-27 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-27 Thread-16 Thread-27 Thread-16 Thread-26 Thread-16 Thread-27 Thread-16 Thread-27 Thread-17 Thread-17 Thread-18 Thread-24 Thread-24 Thread-24 Thread-24 Thread-38 Thread-18 Thread-	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894  Deps(s) Thread=1 2.533653 2.545541 2.526699 2.529887 2.536601 2.551242	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.94434275 2.9541595 2.95428735	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Comparized Fined-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-3 Thread-1 Thread-1 Thread-3 Thread-1 Thread-2 Thread-4 Thread-5 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thread-2 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-1 Thread-2 Thread-1 Thr	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894  put (M Insert 1.85281225 2.16642825 2.42965825 2.554010175 2.50579775	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.94434275 2.9541595 2.9828735 2.980101 3.006221	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash COEH Level Clevel Plush Viper MioHash COEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-2 Thread-4 Thread-3 Thread-16 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-16 Thread-2 Thread-3 Thread-16 Thread-24 Thread-8 Thread-16 Thread-24  Experiment 11 Collecting Table Throughput (Mc # of CT=4 # of CT=4 # of CT=5 # of CT=6 # of CT=1024  Experiment 12 Variable D-Bucket Size Through D-bucket=32B D-bucket=52B D-bucket=512B Variable P-Bucket Size Through	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894  put (M Insert 1.85281225 2.16642825 2.256699 2.559887 2.536601 2.551242  put (M Insert 1.85281225 2.16642825 2.24965825 2.54010175 put (M Insert	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.94434275 2.9541595 2.9828735 2.980101 3.006221 Positive Search	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Common (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-16 Thread-2 Thread-3 Thread-16 Thread-16 Thread-16 Thread-2 Thread-8 Thread-16 Thread-16 Thread-8 Thread-16 Thread-9 Thread-16 Thread-16 Thread-16 Thread-16 Thread-16 Thread-16 Thread-2 Thread-16 Thread-24  Experiment 11 Collecting Table Throughput (Mc # of CT=26 # of CT=6 # boucket=256 # D-bucket=256 # D-bucket=256 # D-bucket=266 # D-bucket=12B P-bucket=1KB P-bucket=1KB P-bucket=2KB	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.31689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.96867 0.881894  pops/s) Thread=1 2.533663 2.545541 2.526699 2.529887 2.536601 2.551242  put (M Insert 1.85281225 2.16642825 2.42965825 2.254010175 2.50579775 put (M Insert 2.23251575 2.410912	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.9828735 2.980101 3.006221 Positive Search 3.08697575 3.08697575	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash COEH Level Clevel Plush Viper MioHash CEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-3 Thread-16 Thread-4 Thread-4 Thread-16 Thread-24 Recovery Time (s) Thread-1 Thread-2 Thread-16 Thread-24 Recovery Time (s) Thread-16 Thread-24 Thread-8 Thread-16 Thread-24 Thread-8 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-26 Thread-16 Thread-16 Thread-26 Thread-16 Thread-16 Thread-26 Thread-16 Thread-17 Thread-	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.331689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.968667 0.881894  put (M Insert 1.85281225 2.16642825 2.256699 2.529887 2.536601 2.551242  put (M Insert 1.85281225 2.16642825 2.24965825 2.554010175 2.23251575 put (M Insert 2.23251575 2.410912 2.54756875	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.94434275 2.9541595 2.9828735 2.980101 3.006221 Positive Search 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08697575 3.08692757 3.08697575 3.08697575 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.08692757 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575 3.086927575	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067
CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Load Factor (%) DASH CCEH Level Clevel Plush Viper MioHash Common (%) DASH CCEH Level Clevel Plush Viper MioHash  Experiment 10 Recovery Time (s) Thread-1 Thread-2 Thread-4 Thread-8 Thread-16 Thread-16 Thread-16 Thread-2 Thread-16 Thread-2 Thread-16 Thread-2 Thread-3 Thread-16 Thread-16 Thread-16 Thread-2 Thread-8 Thread-16 Thread-16 Thread-8 Thread-16 Thread-9 Thread-16 Thread-16 Thread-16 Thread-16 Thread-16 Thread-16 Thread-2 Thread-16 Thread-24  Experiment 11 Collecting Table Throughput (Mc # of CT=26 # of CT=6 # boucket=256 # D-bucket=256 # D-bucket=256 # D-bucket=266 # D-bucket=12B P-bucket=1KB P-bucket=1KB P-bucket=2KB	52.1537 79.4729 69.5388 24.5431 43.2452 49.0834 Number of inserted items=130M 53.6829 48.4817 73.7962 64.5717 45.58 43.9789 45.6442 Number of inserted items=190M 78.4342 69.3263 53.928 47.187 66.617 35.7313 66.615  Number of inserted items=10M 0.560193 0.31689 0.235937 0.159552 0.154403 0.122917 Number of inserted items=70M 4.971479 2.75402 1.704711 1.248624 0.96867 0.881894  pops/s) Thread=1 2.533663 2.545541 2.526699 2.529887 2.536601 2.551242  put (M Insert 1.85281225 2.16642825 2.42965825 2.254010175 2.50579775 put (M Insert 2.23251575 2.410912	59.5742 90.8261 34.0598 28.0492 37.7426 56.953 140M 57.7984 52.1525 79.4729 69.5388 49.0862 43.1678 49.0848 200M 82.4434 70.0462 56.7663 49.6705 70.1231 37.1574 70.1168  20M 1.089347 0.644957 0.416497 0.301159 0.233623 0.216846 80M 5.305649 2.958968 1.787486 1.263118 1.017342 0.923817  2 4.293149 4.268679 4.32143 4.301137 4.338474 4.373844  Positive Search 2.9828735 2.980101 3.006221 Positive Search 3.08697575 3.08697575	66.6419 51.0897 44.7035 31.5554 35.0398 63.1072 150M 61.9269 55.8725 85.1495 74.5058 52.5923 40.6975 52.5908 210M 84.9072 66.8545 59.6046 52.1541 4.58497 38.7904 73.6002  30M 1.614449 0.923353 0.614051 0.420544 0.332565 0.310919 90M 5.405138 2.966657 1.785323 1.254723 1.034704 0.944532	70.1075 56.7663 49.6705 35.0616 37.1422 70.1191 160M 66.0554 59.5756 90.8261 34.0598 56.0985 37.7694 56.0969 220M 79.1159 59.503 62.443 54.6376 4.8033 40.3647 76.5144  40M 2.549051 1.445274 0.916964 0.64551 0.494526 0.471374 100M 5.512479 3.025063 1.811582 1.289331 1.021178 0.945199	59.5115 62.443 54.6376 38.5677 40.3423 76.5192 170M 70.1838 63.2159 48.2514 42.22 59.6046 35.6577 59.6029 230M 63.3772 51.8082 65.2813 57.1211 5.02164 41.7568 74.8935  50M 2.559382 1.507391 0.923644 0.640922 0.502285 0.4684	47.6101 68.1196 59.6046 42.0739 42.8817 61.3701 180M 74.3117 66.6449 51.0897 44.7035 63.1108 35.0449 63.109 240M 53.3364 47.5918 68.1196 59.6046 5.23997 42.9049 61.2596  60M 3.447411 1.922619 1.172099 0.864405 0.743899 0.642067