Program 1	l: tr-simp	leloo	p.ref
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r rogram 1. a simpleroop.i				
FIFO	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	70.8399	72.9592	73.3516	73.4301
Hit count	7220	7436	7476	7484
Clean Eviction Count	209	45	16	12
Dirty Eviction Count	2713	2611	2550	2496
		ļ		
CLOCK	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	72.6158	73.6264	73.6754	73.6754
Hit count	7401	75.0204	7509	75.07 54
Clean Eviction Count	96	4	0	0
Dirty Eviction Count	2645	2584	2533	2483
Dirty Eviction Count	2043	2304	2333	2403
EVACELDII	. 50	. 100	. 150	. 200
EXACT LRU	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	72.7041	73.6656	73.6852	73.6852
Hit count	7410	7508	7510	7510
Clean Eviction Count	90	2	0	0
Dirty Eviction Count	2642	2582	2532	2482
OPT	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	73.9453	74.1992	74.1992	74.1992
Hit count	7572	7598	7589	7589
Clean Eviction Count	16	0	0	0
Dirty Eviction Count	2602	2542	2492	2442
Program 2: tr-blocked.ref				
FIFO	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	99.7318	99.8207	99.8253	00.0007
mit rate	33.7310	99.0207	99.0233	99.8687
	2411570	2413720	2413831	2414881
Hit count				
Hit count Clean Eviction Count	2411570	2413720	2413831	2414881
Hit count Clean Eviction Count	2411570 4181	2413720 2758	2413831 2652	2414881 1877
Hit count Clean Eviction Count Dirty Eviction Count	2411570 4181	2413720 2758 1478	2413831 2652	2414881 1877
Hit count Clean Eviction Count Dirty Eviction Count CLOCK	2411570 4181 2255 memsize = 50	2413720 2758 1478 memsize = 100	2413831 2652 1423 memsize = 150	2414881 1877 1098 memsize = 200
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate	2411570 4181 2255 memsize = 50 99.7828	2413720 2758 1478 memsize = 100 99.8339	2413831 2652 1423 memsize = 150 99.8370	2414881 1877 1098
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count	2411570 4181 2255 memsize = 50 99.7828 2412803	2413720 2758 1478 memsize = 100 99.8339 2414039	2413831 2652 1423 memsize = 150 99.8370 2414115	2414881 1877 1098 memsize = 200 99.8681
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866	2413720 2758 1478 memsize = 100 99.8339 2414039 2616	2413831 2652 1423 memsize = 150 99.8370 2414115 2574	2414881 1877 1098 memsize = 200 99.8681 2414867 1927
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803	2413720 2758 1478 memsize = 100 99.8339 2414039	2413831 2652 1423 memsize = 150 99.8370 2414115	2414881 1877 1098 memsize = 200 99.8681 2414867
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Cou	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count Hit rate EXACT LRU Hit rate Hit count Clean Eviction Count Clean Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count OPT Hit rate Hit rate Hit count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466 2414427	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Orty Eviction Count Dirty Eviction Count Hit rate Hit count Clean Eviction Count Dirty Eviction Count Hit rate Hit rate Hit rate Hit rate	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count OPT Hit rate Hit count Clean Eviction Count COPT COPT COPT COPT COPT COPT COPT COPT	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466 2414427	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count Dirty Eviction Count Clean Eviction Count Dirty Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.84466 2414427 2572	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126 1825 1085	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608 1305 1073	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608 1305
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count Dirty Eviction Count Hit rate Hit count Clean Eviction Count Dirty Eviction Count Clean Eviction Count Dirty Eviction Count Dirty Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.84466 2414427 2572	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126 1825	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608 1305	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608 1305
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Dirty Eviction Count OPT Hit rate Hit count Clean Eviction Count Dirty Eviction Count OPT Hit rate Hit count Clean Eviction Count Dirty Eviction Count Program 3: tr-matmul.ref	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466 2414427 2572 1087	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126 1825 1085	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608 1305 1073	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608 1305 1073
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count Dirty Eviction Count OPT Hit rate Hit count Clean Eviction Count OPT Clean Eviction Count OPT Hit rate Hit count Clean Eviction Count Clean Eviction Count Dirty Eviction Count	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.8466 2414427 2572 1087	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126 1825 1085	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608 1305 1073	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608 1305 1073
Hit count Clean Eviction Count Dirty Eviction Count CLOCK Hit rate Hit count Clean Eviction Count Dirty Eviction Count EXACT LRU Hit rate Hit count Clean Eviction Count OPT Hit rate	2411570 4181 2255 memsize = 50 99.7828 2412803 2866 2337 memsize = 50 99.7842 2412837 2818 2351 memsize = 50 99.84466 2414427 2572 1087	2413720 2758 1478 memsize = 100 99.8339 2414039 2616 1301 memsize = 100 99.8435 2414271 2605 1080 memsize = 100 99.8755 2415126 1825 1085 memsize = 100 62.4788	2413831 2652 1423 memsize = 150 99.8370 2414115 2574 1217 memsize = 150 99.8442 2414288 2558 1060 memsize = 150 99.8955 2415608 1305 1073 memsize = 150 98.8085	2414881 1877 1098 memsize = 200 99.8681 2414867 1927 1062 memsize = 200 99.8472 2414361 2435 1060 memsize = 200 99.8955 2415608 1305 1073 memsize = 200 98.8266

CLOCK	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	63.9437	63.9532	98.8501	98.8606
Hit count	1846588	1846861	2854625	2854929
Clean Eviction Count	1040083	1039789	31974	31623
Dirty Eviction Count	1111	1080	1083	1080
EXACT LRU	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	63.9443	65.1485	98.8613	98.8616
Hit count	1846605	1881378	2854947	2854958
Clean Eviction Count	1040070	1005275	31656	31595
Dirty Eviction Count	1107	1079	1079	1079
	•		,	<u>'</u>
OPT	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	79.6581	96.7867	99.0784	99.3329
Hit count	2300456	2795115	2861298	2868648
Clean Eviction Count	586319	91612	25379	17979
Dirty Eviction Count	1087	1085	1085	1085
		·	•	
Program 4: tr-overflow.re				
FIFO	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	97.2321	98.5185	98.7580	98.7580
Hit count	10960	11105	11132	11132
Clean Eviction Count	107	0	0	0
Dirty Eviction Count	155	67	0	0
CLOCK	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	97.7555	98.6781	98.7580	98.7580
Hit count	11019	11123	11132	11132

EXACT LRU	memsize = 50	memsize = 100	memsize = 150	memsize = 200
Hit rate	97.8886	98.7402	98.7580	98.7580
Hit count	11034	11130	11132	11132
Clean Eviction Count	65	0	0	0
Dirty Eviction Count	123	42	0	0
OPT	memsize = 50	memsize = 100	memsize = 150	memsize = 200
OPT Hit rate	memsize = 50 90.0461	memsize = 100 98.7580	memsize = 150 98.7580	memsize = 200 98.7580
	 			
Hit rate	90.0461	98.7580	98.7580	98.7580

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Reason for Choosing overflow.c:

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overflow.c is a program that constantly reaches the memory outside of declared array, which is interesting to me because those memory addresses even though calculable but their values are unpredictable. However, it appears in the result of all algorithm that if the memory size is large enough, there is no eviction count for any algorithm. Even though the output this program is random and uncertain, the addresses accessed by this program can be traced and mapped entirely with large enough memory size.

Comparison paragraph:

Clean Eviction Count

Dirty Eviction Count

The graphs above demonstrates that as memory size increases, the hit rate of all the algorithms increases, but as more and more memory is given, such decrease in hit rate becomes less and less significant. Eventually, OPT algorithm reaches a maximum hit rate that it does not vary as memory size increases. Other algorithms approaches such limit as well. Even though theoretically FIFO suffers from Belady's Anomaly, but it is not very obvious from the graphs above. In comparison, LRU has the hit rate that is the closest to OPT algorithm. CLOCK algorithm has a hit rate just a little below LRU and FIFO has the worst outcome. The running time for LRU, however, is expensive since every reference takes O(memory size) time. Since CLOCK algorithm takes O(memory size) upon eviction which is rare comparing to reference, CLOCK is the most practical algorithm of them all.

LRU Description:

It can be observed that as memory size increases, the hit rate using LRU algorithm increases. When memory size is small(50), increasing memory size would cause hit rate to increase more significantly comparing to increasing the same amount of memory when memory size is large. Also, the total eviction count decreases as more memory is used.