Rand -- Simpleloop						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	70.7942	7238	2986	2936	228	2708
100	72.8189	7445	2779	2679	59	2620
150	73.4546	7510	2714	2564	19	2545
200	73.4937	7514	2710	2510	17	2493

Rand -- Matmul						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	65.5265	1892331	995557	995507	956077	39430
100	88.8055	2564602	323286	323186	315773	7413
150	96.6606	2791451	96437	96287	93941	2346
200	98.0425	2831359	56529	56329	54689	1640

Rand -- Blocked						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	99.6564	2409852	8308	8258	5723	2535
100	99.7792	2412821	5339	5239	3452	1787
150	99.8167	2413727	4433	4283	2782	1501
200	99.8388	2414262	3898	3698	2350	1348

Rand – Bubblesort						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	94.6653	7240	408	358	183	175
100	97.5811	7463	185	85	7	78
150	98.1433	7506	142	0	0	0
200	98.1433	7506	142	0	0	0

Fifo – Simpleloop						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	71.0387	7263	2961	2911	199	2712
100	73.0536	7469	2755	2655	44	2611
150	73.4351	7508	2716	2566	16	2550

200	73.5133	7516	2708	2508	12	2496

Fifo – Matmul						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	60.9658	1760625	1127263	1127213	1083225	43988
100	62.4797	1804343	1083545	1083445	1061222	22223
150	98.8085	2853479	34409	34259	32944	1315
200	98.8265	2854000	33888	33688	32434	1254

Fifo – Blocked						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	99.7314	2411666	6494	6444	4173	2271
100	99.8207	2413824	4336	4236	2759	1477
150	99.8253	2413935	4225	4075	2653	1422
200	99.8688	2414987	3173	2973	1876	1097

Fifo – Bubblesort						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	95.0968	7273	375	325	153	172
100	97.7772	7478	170	70	0	70
150	98.1433	7506	142	0	0	0
200	98.1433	7506	142	0	0	0

Clock – Simpleloop						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	72.8189	7445	2779	2729	86	2643
100	73.7089	7536	2688	2588	4	2584
150	73.7578	7541	2683	2533	0	2533
200	73.7578	7541	2683	2483	0	2483

Clock – Matmul						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count

50	63.9452	1846665	1041223	1041173	1040068	1105
100	65.3104	1886092	1001796	1001696	1000615	1081
150	98.7979	2853174	34714	34564	33484	1080
200	98.8612	2855000	32888	32688	31609	1079

Clock – Blocked						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	99.7616	2412395	5765	5715	3285	2430
100	99.8218	2413850	4310	4210	2614	1596
150	99.8437	2414380	3780	3630	2571	1059
200	99.8673	2414951	3209	3009	1941	1068

Clock – Bubblesort						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	96.3651	7370	278	228	89	139
100	98.0256	7497	151	51	0	51
150	98.1433	7506	142	0	0	0
200	98.1433	7506	142	0	0	0

LRU – Simpleloop						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	72.8286	7446	2778	2728	86	2642
100	73.7480	7540	2684	2584	2	2582
150	73.7676	7542	2682	2532	0	2532
200	73.7676	7542	2682	2482	0	2482

LRU – Matmul						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	63.9451	1846663	1041225	1041175	1040067	1108
100	65.1491	1881433	1006455	1006355	1005276	1079
150	98.8612	2855002	32886	32736	31657	1079
200	98.8616	2855013	32875	32675	31596	1079

LRU – Blocked						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	99.7844	2412947	5213	5163	2812	2351
100	99.8435	2414376	3784	3684	2605	1079
150	99.8442	2414392	3768	3618	2559	1059
200	99.8472	2414465	3695	3495	2436	1059

LRU – Bubblesort						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	96.3912	7372	276	226	89	137
100	98.0518	7499	149	49	0	49
150	98.1433	7506	142	0	0	0
200	98.1433	7506	142	0	0	0

OPT– Simpleloop						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	73.9241	7558	2666	2616	17	2599
100	74.1588	7582	2642	2542	0	2542
150	74.1588	7506	2642	2492	0	2492
200	74.1588	7582	2642	2442	0	2442

OPT– Matmul						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	79.6580	2300434	587454	587404	586317	1087
100	96.7867	2795091	92797	92697	91611	1086
150	99.0784	2861274	26614	26464	25378	1086
200	99.3329	2868624	19264	19064	17978	1086

OPT– Blocked						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	99.8467	2414454	3706	3656	2571	1085
100	99.8756	2415151	3009	2909	1835	1074
150	99.8955	2415634	2526	2376	1300	1076

200	99.9059	2415884	2276	2076	1010	1066

OPT– Bubblesort						
	Hit rate	Hit count	Miss count	Overall eviction count	Clean eviction count	Dirty eviction count
50	97.7249	7474	174	124	22	102
100	98.1433	7506	142	42	0	42
150	98.1433	7506	142	0	0	0
200	98.1433	7506	142	0	0	0

Comparison Paragraph

OPT has the best hit rate for all the tests, which we expected since OPT is the optimal algorithm. Rand generally has the lowest hit rate of all the algorithms. The exception to this is for tracefile matmul with memory size 100, Rand has a hit rate of 88.8% which is much higher than FIFO, Clock, and LRU, whose hit rates are in the 60s. However, for memory sizes 150 and 200, FIFO, Clock, and LRU have higher hit rates than Rand.

Clock performs better than FIFO in most cases. LRU and Clock have roughly the same hit rate for tracefiles matmul, blocked, and bubblesort. LRU performs better than Clock for tracefile simpleloop.

Bubble-sort Description

We chose bubble-sort as our fourth program. It's interesting to see how for each page replacement algorithm, with a large enough memory size (150 and 200), the algorithms do not need to evict any frames (the overall eviction count is 0). This suggests that only a small amount of memory is needed to run bubble-sort.

LRU Description

LRU does not suffer from Belady's anomaly because the hit rate increases or stays the same as the memory size increases. We expected this to be the case because LRU behaves similarly to OPT, which never suffers from Belady's anomaly. We noticed that in some cases Rand performs better than LRU, which is unexpected because LRU is supposed to be closest to OPT in terms of performance, and Rand is generally a lower bound. For tracefile matmul with memory size 50, LRU has 63.9% hit rate whereas Rand has 65.5% hit rate, and for memory size 100, LRU has 65.1% hit rate whereas Rand has 88.8% hit rate.