

Homework 2

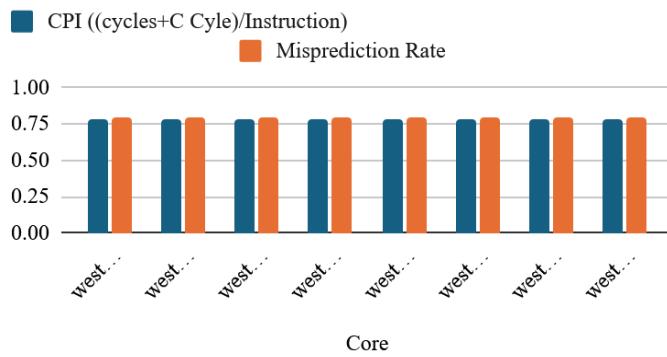
Bhushan Kiran Munoli
UIN - 837004070

A2 Benchmarks and Analysis

1) Blackscholes

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	397356927	85447	507838614	0.7826155063	242356	30583394	0.7924431147
westmere -1	397179366	85918	507826013	0.782286204	242322	30582723	0.7923493274
westmere -2	397188880	84617	507838513	0.78222831212	242499	30582523	0.7929332711
westmere -3	397218795	84717	507819013	0.7823722662	244689	30582823	0.8000863753
westmere -4	397217041	85052	507858713	0.782308313	242392	30582323	0.7925885813
westmere -5	397198105	83038	507846413	0.7822860078	243301	30582723	0.7955504812
westmere -6	397223260	83890	507837413	0.7823510829	244958	30582423	0.8009764302
westmere -7	397186984	84965	507835234	0.782285124	242668	30583626	0.7934572572
Average				0.7823484532			0.7950481048

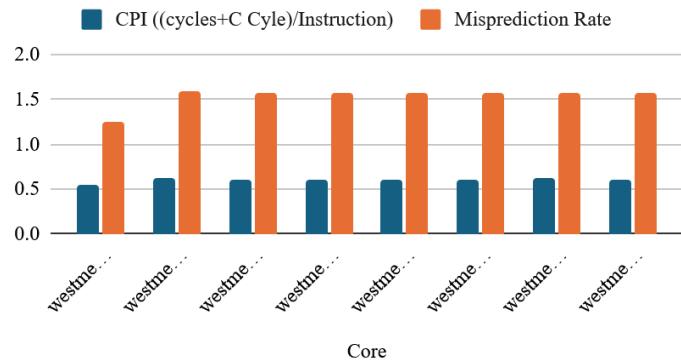
Cycles, C-Cycle, Instructions, CPI ((cycle...



2) Bodytrack

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	91532345	1066022	168626619	0.5491325601	159293	12651492	1.259084699
westmere -1	53293015	55884	86746719	0.6149961591	117076	7347168	1.593484728
westmere -2	51627984	59309	84731962	0.6100093965	113111	7205669	1.569750151
westmere -3	51746444	57592	84897171	0.6101974352	113852	7229072	1.574918606
westmere -4	51255980	60715	84093991	0.6102302244	112803	7151743	1.577279832
westmere -5	51627471	56362	84736544	0.6099355787	113174	7207246	1.570280798
westmere -6	53785441	58483	87662723	0.6142168776	116646	7425041	1.570981224
westmere -7	52976567	55904	86365946	0.6140437691	114509	7316375	1.56510567
Average				0.6040952501			1.535110714

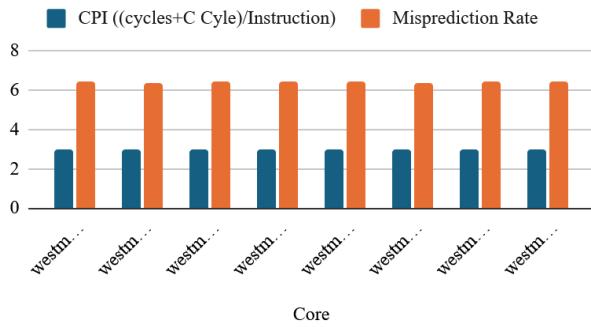
Cycles, C-Cycle, Instructions, CPI ((cycles+C...



3) Canneal

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	91769628	15271257	36065251	2.967978373	142637	2219328	6.427035571
westmere -1	91818300	15353885	35962594	2.98010163	141349	2211680	6.391024018
westmere -2	91239490	15205967	35833305	2.970573242	142119	2205227	6.44464266
westmere -3	91545523	15266347	35958961	2.970382542	141542	2210452	6.403305749
westmere -4	91720736	15244972	36036684	2.968245025	142660	2215659	6.438716427
westmere -5	92217086	15368424	36174156	2.974098691	141663	2220365	6.380167225
westmere -6	91721138	15284753	36001791	2.972237992	142190	2215838	6.416985357
westmere -7	91515072	15262910	35928931	2.971922042	142054	2209663	6.428763119
Average				2.971942442			6.416330016

Cycles, C-Cycle, Instructions, CPI ((cycles+C...

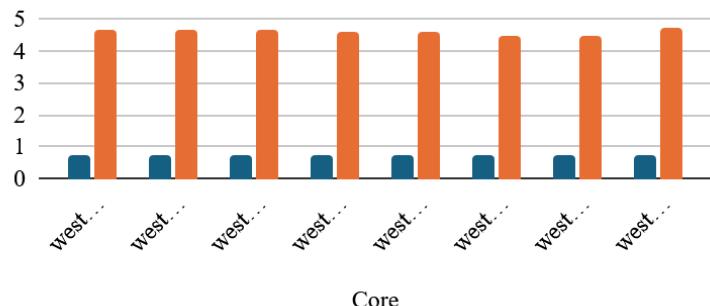


4) Fluidanimate

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westm -0	439447165	15110927	609062984	0.7463236216	3969309	84562637	4.69392765
westm -1	436898850	13959090	629936299	0.7157198922	4120470	88027725	4.68087753
westm -2	466914403	14479219	662277493	0.7268760106	4297495	92033599	4.669484891
westm -3	396911944	15000987	558639022	0.7373508022	3612566	78361467	4.61013064
westm -4	423258067	15637891	586951433	0.747755152	3762448	81914120	4.593161716
westm -5	481019745	14103414	671838943	0.7369670427	4198658	93844866	4.474041233
westm -6	509650140	14510694	702280891	0.7463692103	4374625	97381395	4.492259533
westm -7	411056599	14505211	579097152	0.7348711844	3804848	80810676	4.708348189
				0.7365291145			4.615278923

Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction), Misprediction Rate

█ CPI ((cycles+C Cycle)/Instruction)
█ Misprediction Rate

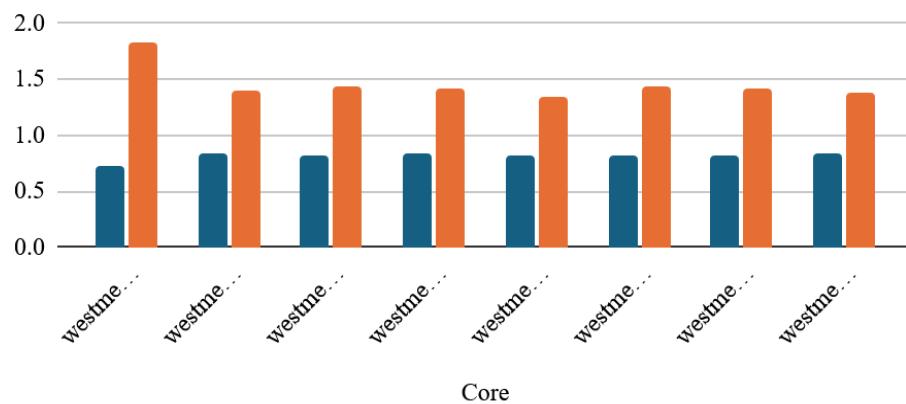


5) Freqmine

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	1593049790	41762744	2281260590	0.7166268252	9677321	530246784	1.82505982
westmere -1	307105256	12108034	382295623	0.8349907004	1654964	118118860	1.401100552
westmere -2	316402424	14821374	408678163	0.8104758903	1801109	125599915	1.434004951
westmere -3	304077719	13353164	379578653	0.8362716936	1651657	116812934	1.413933324
westmere -4	303360303	13088173	384664420	0.8226611549	1611269	119387067	1.34961771
westmere -5	302069675	13639516	382315631	0.8257815412	1690897	117694436	1.436683889
westmere -6	316385798	14424846	408363788	0.8100880972	1776355	125785992	1.412204151
westmere -7	303859523	11757438	372862637	0.8464697979	1600493	115388060	1.387052525
				0.8129207126			1.457457115

Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction), Misprediction Rate

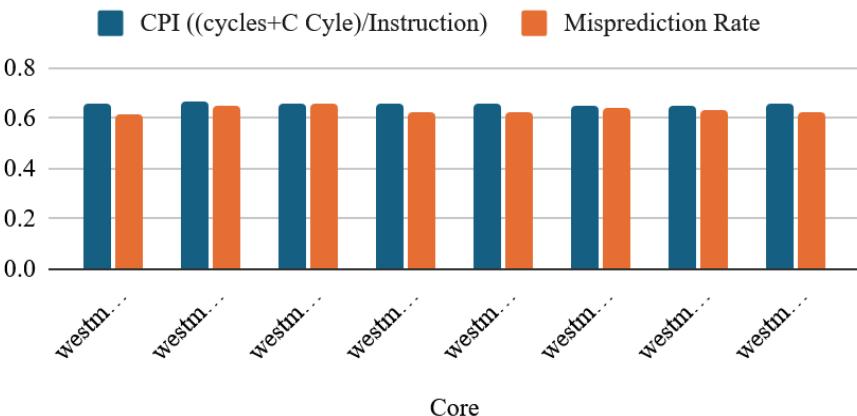
█ CPI ((cycles+C Cycle)/Instruction)
█ Misprediction Rate



6) Streamcluster

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	132248874	382702	200541845	0.6613660905	147285	23945844	0.6150754177
westmere -1	129082984	15134	193675184	0.6665702613	150892	23347155	0.6462971613
westmere -2	126998491	2028	193447602	0.6565112087	157204	23824936	0.6598296843
westmere -3	127013019	1934	193395880	0.6567614212	149022	23810259	0.6258730743
westmere -4	127064265	1628	194217394	0.6542456903	149183	24001816	0.6215488028
westmere -5	127159995	2182	194645057	0.6533028835	155060	24103807	0.6433008694
westmere -6	127235268	2155	195456505	0.6509756378	153622	24285117	0.6325767341
westmere -7	127050039	1736	194112156	0.6545276587	149918	23977101	0.6252549047
				0.6567826065			0.6337195811

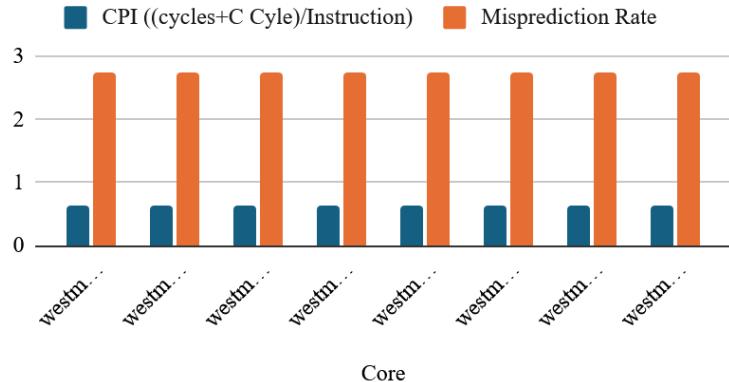
Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction), Misprediction...



7) Swaptions

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	70830914	22406	110657985	0.6402910734	316831	11486277	2.758343717
westmere -1	70827197	21698	110652022	0.6402855883	316771	11485446	2.75802089
westmere -2	70818585	21867	110652014	0.6402093323	316770	11485445	2.758012424
westmere -3	70818519	21744	110652001	0.6402076995	316769	11485444	2.758003957
westmere -4	70817776	21817	110652014	0.6402015692	316770	11485445	2.758012424
westmere -5	70815486	20202	110652001	0.6401663536	316769	11485444	2.758003957
westmere -6	70842278	26787	110656108	0.640444222	316872	11486276	2.758700905
westmere -7	70817252	22549	110652001	0.6402035242	316769	11485444	2.758003957
				0.6402511703			2.758137779

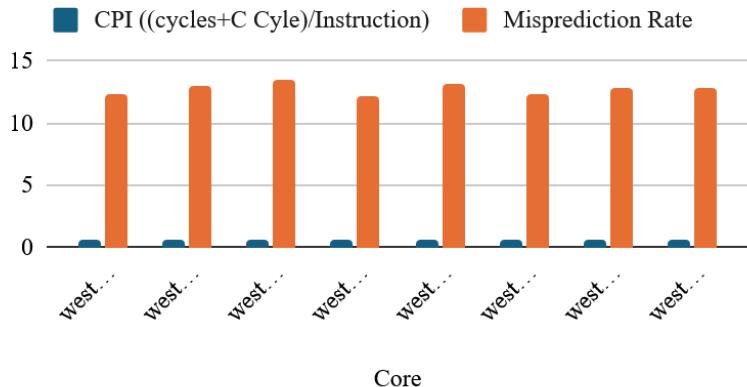
Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction) Misprediction Rate



8) X264

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	373491797	4525389	652336256	0.5794821038	3297852	26792378	12.3089186
westmere -1	366639846	2894086	635116772	0.5818362044	3360372	25832986	13.00806651
westmere -2	364828091	3689890	634605999	0.5807035887	3522387	26236092	13.42573048
westmere -3	367468272	4133254	642302690	0.5785458037	3255747	26634399	12.22384256
westmere -4	332736684	2665969	575359812	0.5829441786	3084337	23430046	13.16402452
westmere -5	395637342	4581789	693732744	0.5769067908	3580636	29024518	12.33659074
westmere -6	346279563	3168350	600136743	0.5822804837	3176991	24658315	12.88405554
westmere -7	324849004	2413530	566418327	0.5777753268	2941495	22801240	12.90059225
				0.5800593101			12.78147765

Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction) Misprediction Rate

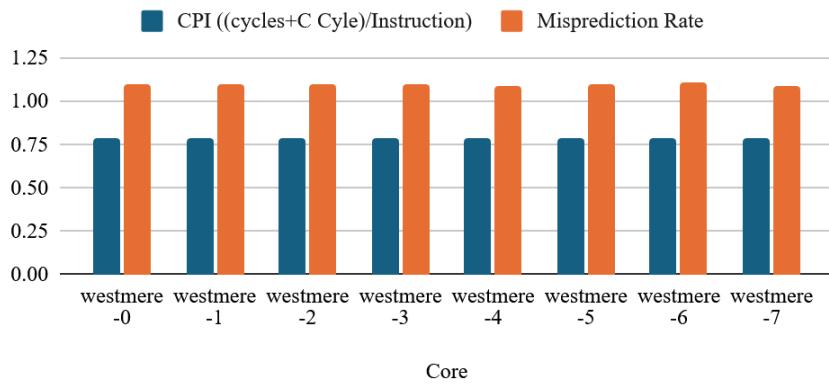


A3 Benchmarks and Analysis

1) Blackscholes

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	398525115	86101	507838614	0.7849171075	334947	30583394	1.095192378
westmere -1	398366123	84371	507826013	0.7846200939	335489	30582723	1.096988649
westmere -2	398371110	86743	507838513	0.784615272	335672	30582523	1.097594204
westmere -3	398393925	85971	507819013	0.784688808	337262	30582823	1.102782434
westmere -4	398387974	86398	507858713	0.7846165908	334658	30582323	1.094285741
westmere -5	398405310	83278	507846413	0.7846635869	336855	30582723	1.101455224
westmere -6	398401231	86018	507837413	0.7846748562	338636	30582423	1.107289635
westmere -7	398371517	87042	507835265	0.7846216804	334575	30583628	1.093967661
				0.7846772495			1.098694491

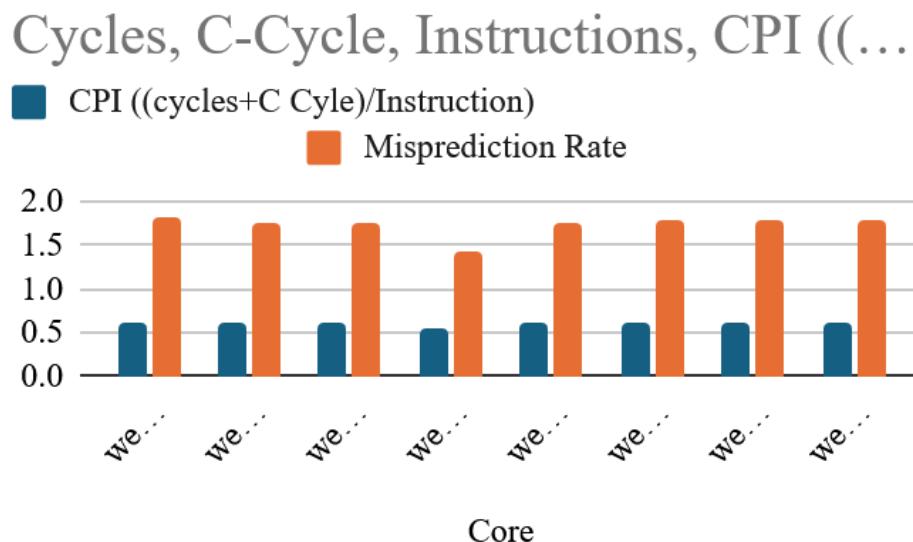
CPI ((cycles+C Cycle)/Instruction) and Misprediction...



2) Bodytrack

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	53863334	77179	87090045	0.6193648539	134597	7382112	1.823285802
westmere -1	51772573	55795	84565339	0.6128795629	125479	7190153	1.745150625
westmere -2	51323347	52758	83713956	0.613710156	126385	7120641	1.774910433
westmere -3	89441527	1008653	165532832	0.5464183685	176016	12415480	1.417714015
westmere -4	51628336	56099	84227620	0.6136281068	127101	7163781	1.774216716
westmere -5	54210315	59107	87790882	0.6181669527	133627	7436503	1.796906422

westmere -6	54491726	58480	88319117	0.6176489061	133376	7488503	1.781076939
westmere -7	53564051	89899	86624146	0.6193879245	130926	7337109	1.784435804
				0.6076506039			1.737212095

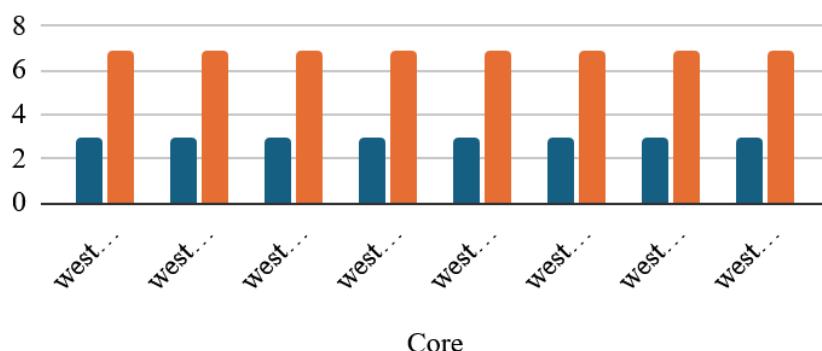


3) Canneal

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	92048 492	1526999 6	36060 483	2.976069067	152691	2218498	6.882629599
westmere -1	92125 469	1536497 0	35963 390	2.988885058	151830	2211723	6.8647837
westmere -2	91526 842	1521499 6	35833 305	2.978844346	152244	2205222	6.90379472
westmere -3	91804 711	1527320 2	35958 112	2.977851368	151566	2210394	6.856967581
westmere -4	92064 921	1528420 9	36037 424	2.978823625	153503	2215692	6.927993602
westmere -5	92542 458	1538653 3	36174 140	2.983595215	152644	2220346	6.87478438
westmere -6	92012 317	1531591 9	36001 857	2.981186109	152513	2215839	6.882855659
westmere -7	91855 635	1528567 2	35932 717	2.981720169	152664	2210438	6.906504503
				2.98087187			6.887539218

CPI ((cycles+C Cycle)/Instruction) and...

█ CPI ((cycles+C Cycle)/Instruction)
█ Misprediction Rate

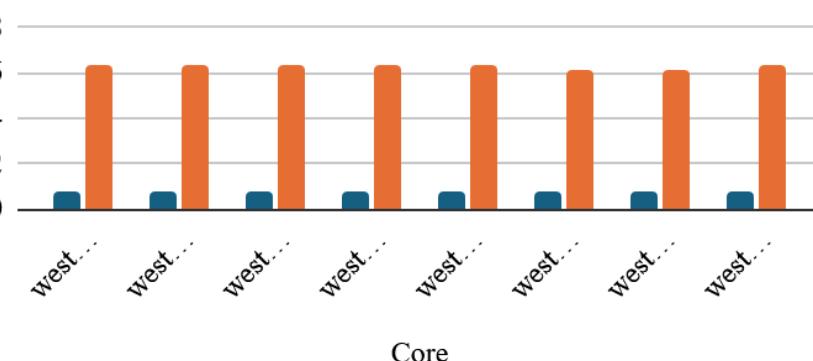


4) Fluidanimate

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	461279213	15088075	609073079	0.7821184426	5329810	84563961	6.302696724
westmere -1	459332557	13967249	629870993	0.7514234046	5570113	88015439	6.32856356
westmere -2	490567621	14453652	662319415	0.7625041054	5799865	92041765	6.301340484
westmere -3	417850527	15021821	558632449	0.7748786322	4957885	78363168	6.326805215
westmere -4	445279175	15650352	586977099	0.785259813	5154174	81919141	6.291782283
westmere -5	505657771	14191013	671822763	0.7737885833	5755107	93843480	6.132665796
westmere -6	535400053	14584136	702260767	0.7831623449	5979946	97376199	6.141075603
westmere -7	431798015	14496038	579072098	0.7707055038	5118258	80807295	6.333905868
				0.7729801037			6.269854442

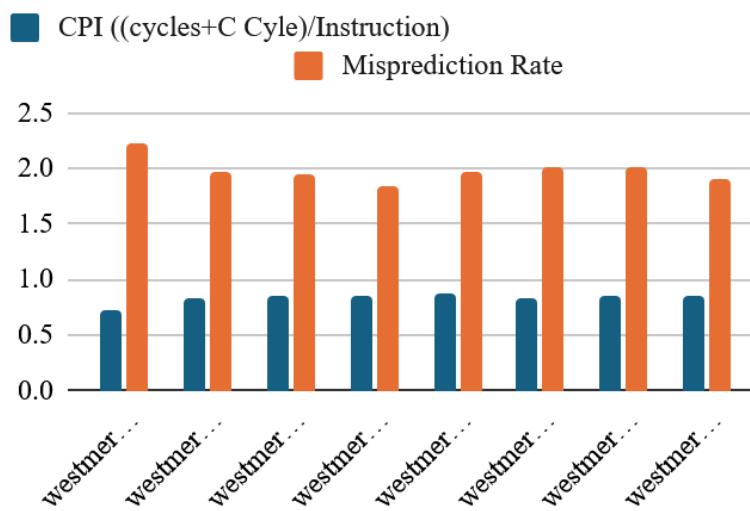
CPI ((cycles+C Cycle)/Instruction) and...

█ CPI ((cycles+C Cycle)/Instruction)
█ Misprediction Rate



5) Freqmine

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	1625320323	42167462	2284744604	0.7298355283	11782995	531141933	2.218426802
westmere -1	325072549	13580280	406746100	0.8325902301	2481150	125733228	1.973344707
westmere -2	312172448	13047698	382652847	0.849909124	2288221	118109136	1.937378494
westmere -3	312494956	13051834	385437153	0.8446170471	2211189	119781653	1.846016435
westmere -4	310176686	12742697	372702471	0.8664267294	2264206	114896105	1.970655141
westmere -5	325072458	14989878	410065098	0.8292886609	2531202	125899911	2.010487521
westmere -6	311480908	12995289	377932920	0.858554997	2337814	116149303	2.012766275
westmere -7	311904263	13314593	379734358	0.8564377943	2241198	117137645	1.913302935
				0.8334575139			1.985297289

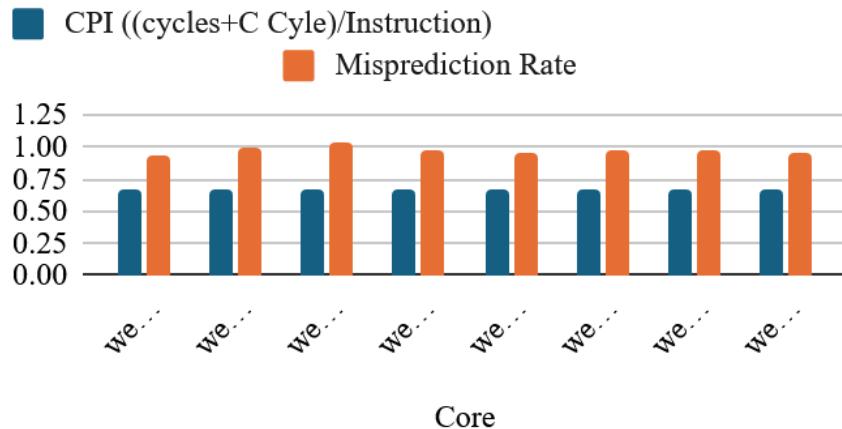


6) Streamcluster

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	132281401	383436	197972960	0.6701159441	220742	23378638	0.9442038497
westmere -1	128983324	15143	190538527	0.6770203855	228166	22651902	1.007270824
westmere -2	127020217	1892	190125029	0.6680977758	241181	23089540	1.044546578
westmere -3	127176750	1723	190732473	0.6667898287	225088	23225093	0.9691586596
westmere -4	126975469	1956	191059171	0.6645973828	223466	23302515	0.9589780331
westmere -5	127217205	1881	191406535	0.664653827	230905	23382982	0.9874916724

westmere -6	127151668	971	191974428	0.6623415437	228275	23509044	0.9710092848
westmere -7	127122390	1279	191355051	0.6643340133	223557	23364466	0.9568247783
				0.6672438376			0.97993546

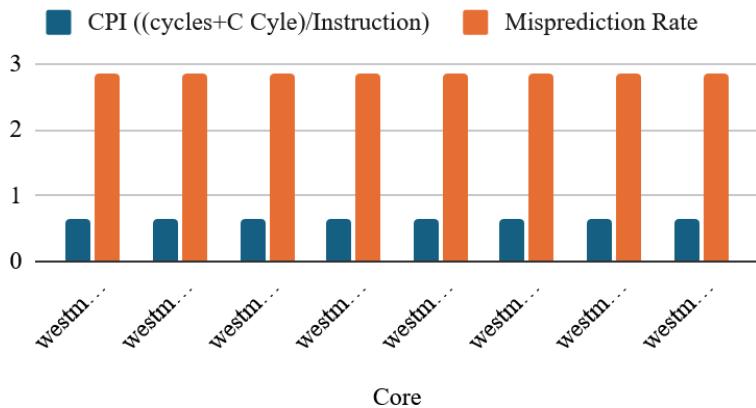
Cycles, C-Cycle, Instructions, CPI ((...)



7) Swaptions

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	71568616	23464	110657972	0.6469672153	326761	11486276	2.844794954
westmere -1	71592333	27808	110656494	0.6472294432	326846	11486318	2.845524562
westmere -2	71555223	23473	110652014	0.6468810952	326703	11485445	2.844495794
westmere -3	71555889	22065	110652001	0.6468744655	326701	11485444	2.844478629
westmere -4	71554913	23650	110651963	0.6468801914	326700	11485441	2.844470665
westmere -5	71555450	24235	110652014	0.6468900331	326703	11485445	2.844495794
westmere -6	71556429	24513	110652001	0.646901469	326701	11485444	2.844478629
westmere -7	71553009	22687	110652014	0.6468539832	326703	11485445	2.844495794
				0.646934737			2.844654353

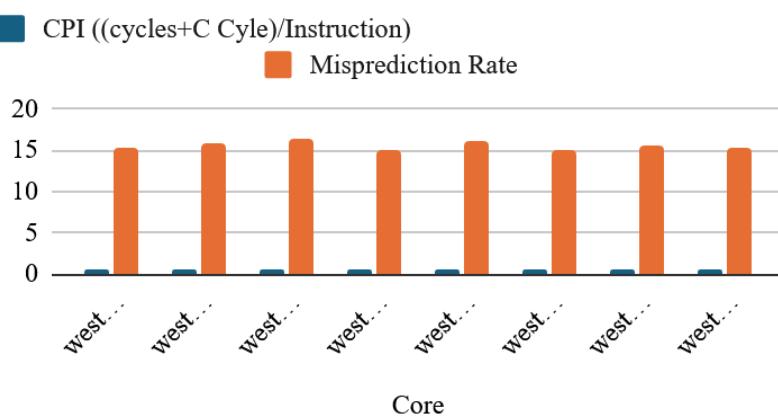
Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction), Misprediction Rate



8) X264

Core	Cycles	C-Cycle	Instructions	CPI ((cycles+C Cycle)/Instruction)	Misprediction	Condition Branch	Misprediction Rate
westmere -0	382946057	3994348	650312697	0.5950066895	4061117	26447522	15.3553781
westmere -1	374251984	2948706	631291610	0.5975062618	4080620	25713931	15.86929669
westmere -2	376062433	3644228	634996470	0.5979665698	4312773	26257029	16.42521323
westmere -3	377209326	4198047	642183871	0.5939223799	3989829	26629599	14.98268524
westmere -4	341541157	2699916	575306796	0.5983608666	3758252	23427706	16.04191208
westmere -5	405953374	4394955	692943049	0.5921818966	4383052	28891658	15.17064891
westmere -6	355143462	3298964	598395772	0.5990056126	3863540	24614421	15.69624571
westmere -7	337775316	3207147	574604371	0.5934212829	3582492	23427149	15.29205282
				0.595921445			15.6041791

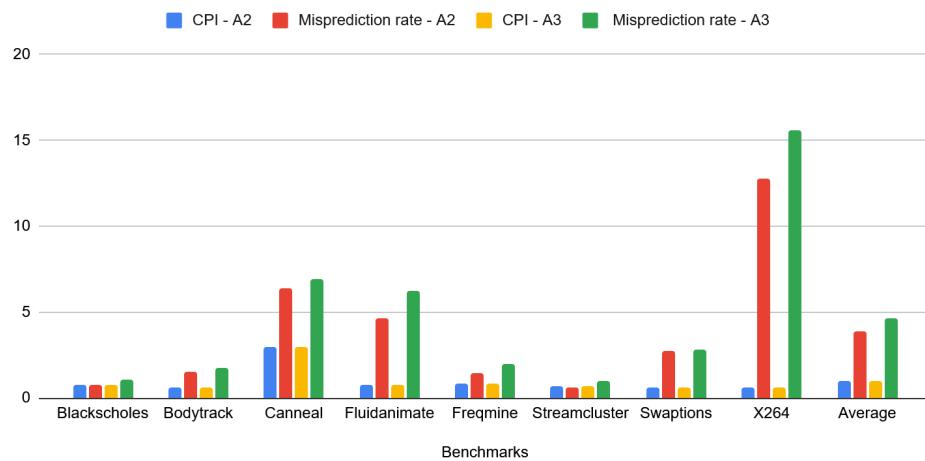
Cycles, C-Cycle, Instructions, CPI ((cycles+C Cycle)/Instruction), Misprediction Rate



Inference:

Benchmarks	A2		A3	
	CPI - A2	Misprediction rate - A2	CPI - A3	Misprediction rate - A3
Blackscholes	0.7823484532	0.7950481048	0.7846772495	1.098694491
Bodytrack	0.6040952501	1.535110714	0.6076506039	1.737212095
Canneal	2.971942442	6.416330016	2.98087187	6.887539218
Fluidanimate	0.7365291145	4.615278923	0.7729801037	6.269854442
Freqmine	0.8129207126	1.457457115	0.8334575139	1.985297289
Streamcluster	0.6567826065	0.6337195811	0.6672438376	0.97993546
Swaptions	0.6402511703	2.758137779	0.646934737	2.844654353
X264	0.5800593101	12.78147765	0.595921445	15.6041791
Average	0.9731161324	3.874069985	0.9862171701	4.675920806

A2/CPI, A2/Misprediction rate, A2/CPI and A2/ Misprediction rate



Analysis:

- As per the CPI values and Misprediction rate, for the processor used to run the particular program and benchmarks, A2 architecture is much more suitable compared to A3 architecture.
- This inference was drawn because the Average CPI of A2 across all benchmarks is less than that of A3..
- This inference can be extrapolated from the Misprediction rate as the average misprediction rate of A2 across all benchmarks is less than that of A3.
- Giving a detailed analysis of the ideal benchmark for the processor on which the experiment was conducted,
 - For A2:
 - X264 has the least CPI value.
 - Streamcluster has the least misprediction rate.
 - Blackscholes has the ideal balance between CPI and Misprediction rate.
 - Canneal has the highest value of CPI and Misprediction rate and might not be suitable for the program and processor chosen in this experiment.
 - For A3:
 - X264 has the least CPI value.
 - Streamcluster has the least misprediction rate.
 - Streamcluster has the ideal balance between CPI and Misprediction rate.

- Canneal has the highest value of CPI and Misprediction rate and might not be suitable for the program and processor chosen in this experiment.
- Finally
 - Best benchmark for A2 - Blackscholes.
 - Best benchmark for A3 - Streamcluster.

Part B:

- 1) GAg: 1 global history register and 1 global prediction table.
 - N=1
 - M=512
 - c) As per the formula W=9**
- 2) GAp: 1 global history register and 8 pre- address prediction tables.
 - N=1
 - M=512
 - Prediction per table = 64
 - d) As per the formula W=6**
- 3) PAg; 8 pre-address history registers and 1 global prediction table.
 - M=512
 - N=8
 - c) As per the formula W=9**
- 4) PAp: 8 per-address history registers and 8 per-address prediction tables.
 - M=512
 - N=8
 - c) As per the formula W=6**