NC State University

Department of Electrical and Computer Engineering

ECE 463/521: Fall 2014

Project #3: Dynamic Instruction Scheduling

by

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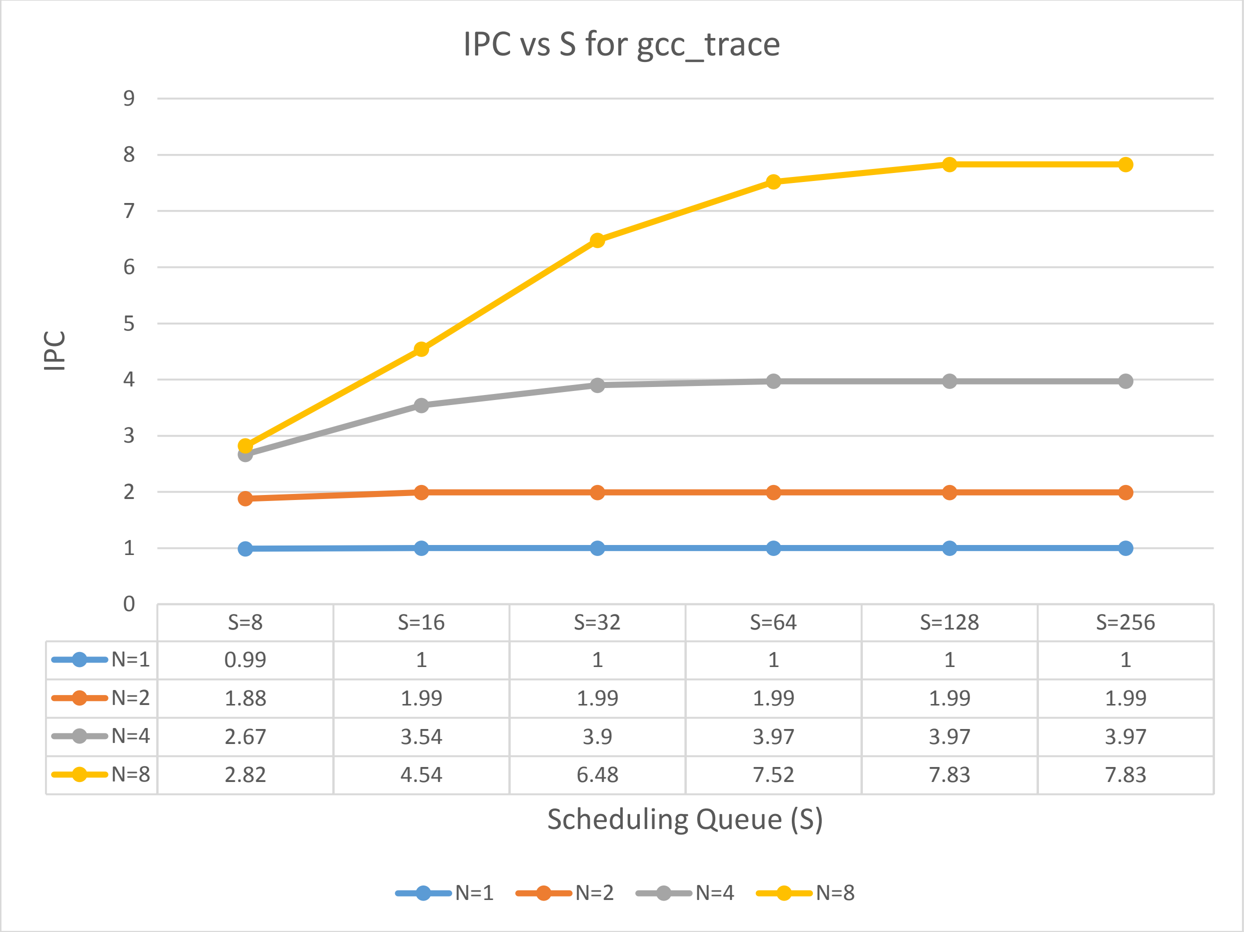
Course number: _______521_______

Analysis of Dynamic Instruction Scheduling

I. GCC_trace.txt

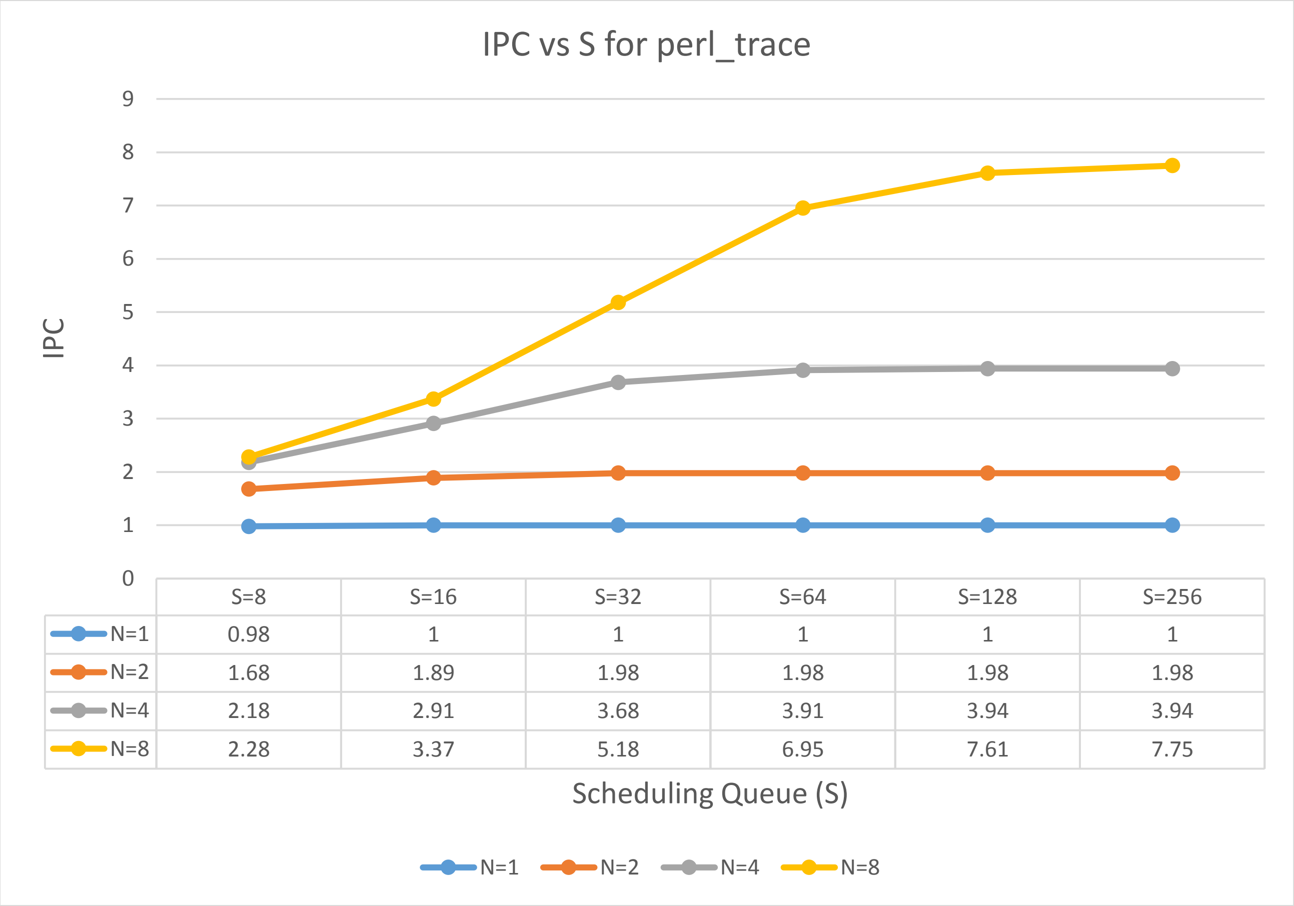


	S=8	S=16	S=32	S=64	S=128	S=256
N=1	0.99	1	1	1	1	1
N=2	1.88	1.99	1.99	1.99	1.99	1.99
N=4	2.67	3.54	3.9	3.97	3.97	3.97
N=8	2.82	4.54	6.48	7.52	7.83	7.83

From the above graph, it can be concluded that the Instructions per Cycle (IPC) count increases as we increase the value of S for a particular N, but it saturates as S becomes large. The IPC count becomes to saturate as it approaches the value of N.

Similarly, the IPC count also increases when we increase the value of N i.e. IPC increases if we increase the peak N rate as more instructions can be fetched and decoded in one cycle (Super-scalar architecture).

II. PERL_trace.txt



	S=8	S=16	S=32	S=64	S=128	S=256
N=1	0.98	1	1	1	1	1
N=2	1.68	1.89	1.98	1.98	1.98	1.98
N=4	2.18	2.91	3.68	3.91	3.94	3.94
N=8	2.28	3.37	5.18	6.95	7.61	7.75

Similar to the trends shown by gcc_trace, perl_trace also shows the same. The IPC increases as we increase S for fixed N but its value saturates after some point. Secondly, IPC also increases as we increase N for fixed S. This shows that for a super-scalar architecture, the IPC is large.

Discussion

From the two graphs, it is concluded that IPC depends on both Scheduling Queue size (S) and Instruction per cycle (IPC) executed.

Instructions per Cycle vs Scheduling Queue Size

The IPC count increases as we increase S, but it saturates after a point for a fixed N. This trend is observed because for very small values of N (N=1 ,2 etc), the IPC is constant as the number of instructions that can be fetched, decoded and put in dispatch queue are limited by peak N rate. Therefore, having large scheduling queue size for small values of N has limited effect on IPC.

Instructions per Cycle vs Peak N Rate

Similar to Scheduling Queue Size(S), IPC increases as N increases for a fixed S. The IPC increases because as N increases, more number of instructions can be fetched and decoded and put in dispatch queue. But, IPC also saturates as it approached the value of N because N limits the maximum number of instructions that can be executed per cycle.

Hence, both S and N helps to increase IPC as they increase, but the value of one limits the increase in the value pf other. Therefore, there is not much gain if we keep increasing both the values as IPC saturates and extra hardware resources would be wasted.

Parameter of Consideration	Effect on IPC
Value of N Increases (Decreases)	IPC Increases (Decreases)
Value of S Increases (Decreases)	IPC Increases (Decreases)

Comparison of Different Benchmarks

The two benchmarks, gcc_trace and perl_trace, show different IPC values. The gcc_trace has higher IPC count compared to perl_trace. This may be the case because perl_trace has more dependent instructions which are held up in Issue queue while number of instructions in gcc_trace that are completed in a cycle are more. Another reason for higher values of IPC in gcc_trace is maybe that the dependent instructions in gcc_trace are located farther apart allowing the parent instruction to be completed before the dependent instruction starts execution.