University of Central Florida

Department of Computer Science

CDA 5106: Fall 2020

Machine Problem 3: Dynamic Instruction Scheduling

by

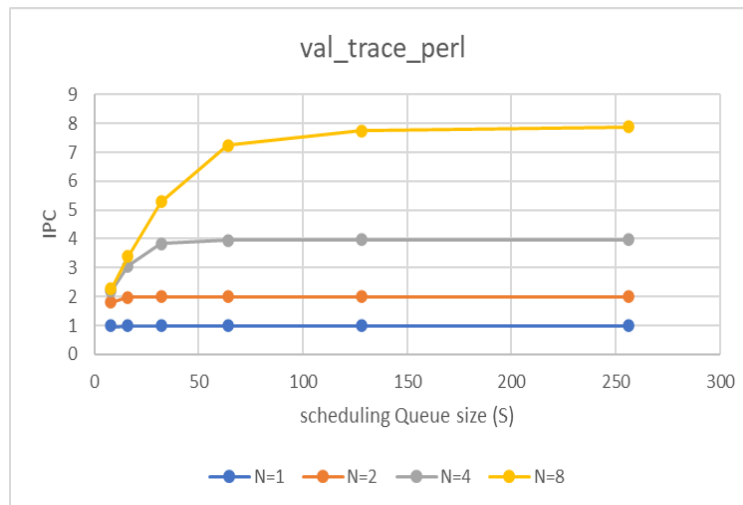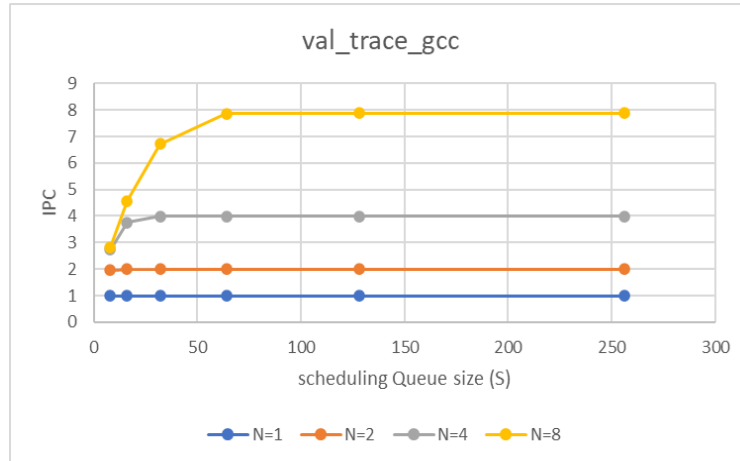## << Ren Hu>>

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Simulation Analysis of Superscalar

1) Plot IPC on the y-axis and Scheduling Queue size(S) on the x-axis. The graph contains four curves with N = 1, 2, 4 and 8. For each N, the Scheduling Queue size(S) will be 8, 16, 32, 64, 128 and 256.

2) Based on above graph, find the minimum Scheduling Queue size(S) that still achieves within 5% of the IPC of the largest Scheduling Queue size (256). List your results inside table below:

Optimized Scheduling Queue size per peak Fetch Rate		
	Benchmark = gcc	Benchmark = perl
N=1	8	8
N=2	8	16
N=4	32	32
N=8	64	128

3) Discussion. A) The goal of a superscalar processor is to achieve an IPC that is close to peak fetch rate (which is the peak theoretical IPC of the processor). Given this goal, please explain

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the relationship between S and N. B) With different benchmark (trace) files, one IPC is higher or lower than the other with the same microarchitecture configuration. What could be reason?

A) When N=1, it means only one instruction is fetched like in order processor with IPC=1. Increasing S doesn't make IPC improved when N=1. When N>=2, IPC can increase as S increases, but this improvement of IPC will get saturated shown in the table of 2). For instance, for gcc trace file, the IPC converges to 4 at S=32 when N=4 while the IPC tends to be flat with the value of 8 at S=64 when N=8.

B) From 1) we can obtain the max IPC = 7.88644 for gcc and the max IPC = 7.87402, therefore, it shows that the superscalar can fetch slightly more instructions in gcc than in perl. The reason could be that the data dependency among instructions in gcc may be less than that in perl.

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