Brenton Yiu

Experiments

Assumptions

One assumption that I made is that the run with the least amount of hardware is going to give the smallest IPC and the run with the most amount of hardware is going to give the largest IPC. I call the run with the least amount of hardware the base run and the run with the most amount of hardware the top run. When comparing runs, I compare them to the base and best runs.

Steps

First, I ran four runs for each trace with the most hardware available. The only thing I varied was the fetch rate. I did this so I could match the traces with their fetch rate since we can only use each fetch rate once. I found the IPC for each trace with each fetch rate and then used Microsoft Excel to figure out which traces have IPC's that vary the most for each fetch rate. I matched up fetch rates by minimizing the difference between the max IPC, when the fetch rate is 8, and the other three fetch rates. A table is shown below with the fetch rates, IPC, differences, and the chosen fetch rate for each trace.

Once I chose the fetch rate for each trace, I didn't vary the fetch rate when doing other test runs. I maximized the IPC for that fetch rate that I chose for each trace.

BZIP	Fetch	IPC	Difference	Choice
	2	1.999748	3.331125	
	4	3.998322	1.332551	
	6	5.330277	0.000596	
	8	5.330873	0	X
GCC	Fetch	IPC	Difference	
	2	1.99959	1.319363	
	4	3.318765	0.000188	
	6	3.318953	0	X
	8	3.318953	0	
GOBMK	Fetch	IPC	Difference	
	2	1.999619	1.249314	
	4	3.248933	0	X
	6	3.248933	0	
	8	3.248933	0	
HMMER	Fetch	IPC	Difference	
	2	1.999637	0.488282	X
	4	2.487487	0.000432	
	6	2.487919	0	
	8	2.487919	0	

Second, I varied the dispatch queue multiplier with the max hardware and the specified fetch rate and checked to see what the smallest CDB size is to still get the maximum IPC.

Third, I varied the schedule queue multiplier with the new found dispatch queue multiplier, the fetch rate, and max hardware. I found which schedule queue multiplier gave the best IPC but the least schedule queue hardware.

Fourth, I did the same with the CDB number and tried to maximize the IPC while minimizing the CDB hardware.

Fifth, I checked the trace files and parsed through a few thousand lines. I tried to see which functional units are being used the most. With this knowledge I altered the FU parameters to see if I can minimize hardware while maximizing IPC.

Finally, when I found what I think is the best FU numbers, I would vary the other parameters (CDB, Schedule Queue Multiplier, Dispatch Queue Multiplier) to see if I can further decrease any of these parameters.

BZIP.TRACE

I followed the steps listed above exactly. When I looked through the trace file, I found that FU0 and FU2 were being used the most. When I varied these two parameters separately only the FU0 changes showed considerable difference in IPC. The best effect occurred when I altered FU0 and FU2 together and set FU0 to 3 and FU2 to 2. This gave the best IPC.

Parameter	Value
D	1
F	8
M	8
K0	3
K1	1
K2	2
C	6
IPC	

GCC.TRACE

For this trace I followed the steps listed above exactly again. When I looked through the trace file, I found that FU0 is being used the most and FU2 is being used a little bit. When I looked at these two parameters, my findings were the same. I need to have 3 FU0's and can get by with 2 FU2's. If I used only 1 FU2, I still get an IPC that is very close to the best run; it is only off by about 0.016 IPC.

Also, when I looked at the C parameter the second time, I found that decrease the C parameter to 4 from 6 only gives a slight decrease in the IPC. This one is only off from the best run by 0.010 IPC. In the table below, I give two numbers for K2 and C. The first numbers (2 and 6) are the parameters to match the best run IPC of 3.318953. The second numbers are the parameters to get an IPC that is very close to the best run IPC; this value may be off by about 0.10 IPC.

Parameter	Value
D	1
F	6
M	8
K0	3
K1	1
K2	2 or 1
C	6 or 4
IPC	3.318953

GOBMK.TRACE

This trace followed the same procedure as above. When I looked at the trace file it showed a lot of use of the FU0 and FU2's and a little bit of the FU1. When I altered these parameters I found the best match to be when FU0 is 2, FU1 is 1 and FU2 is 3.

This one was fairly straightforward. I was able to decrease the hardware almost to the minimum amount and still get a very good IPC.

Parameter	Value
D	1
F	4
M	4
K0	2
K1	1
K2	3
C	4
IPC	3.248933

HMMER.TRACE

This trace followed the same procedure as above. When I looked at the trace file it showed a lot of use of the FU0 and FU2's. I found that when I set FU0 to have 3 units and the other two functional units to have 1 unit each then the IPC matched the best run IPC closely.

One thing to note is that the only the maximum hardware gave the best IPC. When using other combinations of hardware I was able to get the IPC within 0.04 IPC. The table below summarizes the hardware setup that gives the best IPC with the least amount of hardware

Parameter	Value
D	4
F	2
M	8
K0	3
K1	1
K2	1
C	4
IPC	1.969415