Tomasulo Algorithm Pipelined Processor Report

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To conduct the experiment on each trace, in general, there are three parts of parameters need altering. They are the number of three FUs, the number of result bus and the fetch rate.

The first two parts is directly related to the performance and hardware resources. The last one, fetch rate, since the dispatch queue is unlimited, is nothing to do with the performance of processor and hardware resources in this simulation. Thus, in the experiment I will always use 8 as the fetch rate.

Also, since there are, at most, the number of FUs (k0+k1+k2) result waiting to write into the CDB, the number of result bus should be set at most the same number. Otherwise it would be a waist on hardware resource.

With the standards above, I take experiments on each of the trace file to find the optimal settings, in terms of the different characteristics of their instructions.

1. Set parameters to maximums:

R = 6, F = 8, k0 = k1 = k2 = 2;

2. Determine the maximum number of IPC using the maximum setting;
3. Remain R and F, decrease the number of one FU unit sequentially to determine which one is the most important according to the instruction in the trace file;
4. Leave the number of the most important FU unit to two, set others to one; if the IPC is nearly (>95%) the highest value, then use this set; if not, additionally set another FU unit to two, check again; if not, set all to two;
5. Exhaustively search R from 1 to the sum of all FU units.
6. Then optimal R, F, k0, k1, k2 are set.

For gcc.100k.trace:

IPC_{max} = 2.422070;

The most important FU is k0;

To meet "95%" bar, set k0 = k1 = k2 = 2, R = 3;

IPC = 2.366752

For gobmk.100k.trace:

IPC_{max} = 2.364457;

The most important FU is k0;

To meet "95%" bar, set k0 = k1 =k2 = 2, R = 3;

IPC = 2.304635

For hmmer.100k.trace:

IPC_{max} = 2.266854;

The most important FU is k0;

To meet "95%" bar, set k0 = k1 =k2 = 2, R = 3;

IPC = 2.206385

For mcf.100k.trace:

IPC_{max} = 2.369444;

The most important FU is k0;

To meet "95%" bar, set k0 = k1 =k2 = 2, R = 3;

IPC = 2.324554

The optimal settings are shown in the table below:

	IPC_{max}	IPC	k0	k1	k2	R	F
gcc	2.422070	2.366752	2	2	2	3	8
gobmk	2.364457	2.304635	2	2	2	3	8
hmmer	2.266854	2.206385	2	2	2	3	8
mcf	2.369444	2.324554	2	2	2	3	8