

CA2

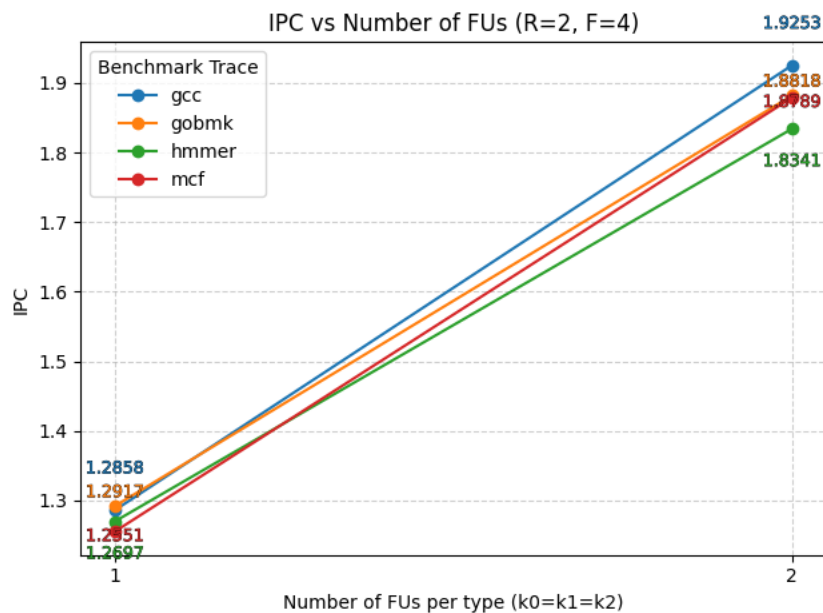
Fuyao Zhou, fuyaozhou@ucla.edu

1. Screenshots of diff output

Traces	Screenshots	Notes
gcc	<pre>fuyaozhou at Mac in ~/GitHub/CA2 (main) \$ diff result_test.output output1.1/gcc.output</pre>	match
gobmk	<pre>fuyaozhou at Mac in ~/GitHub/CA2 (main) \$ diff result_test.output output1.1/gobmk.output</pre>	match
hmmer	<pre>fuyaozhou at Mac in ~/GitHub/CA2 (main) \$ diff result_test.output output1.1/hmmer.output</pre>	match
mcf	<pre>fuyaozhou at Mac in ~/GitHub/CA2 (main) \$ diff result_test.output output1.1/mcf.output</pre>	match

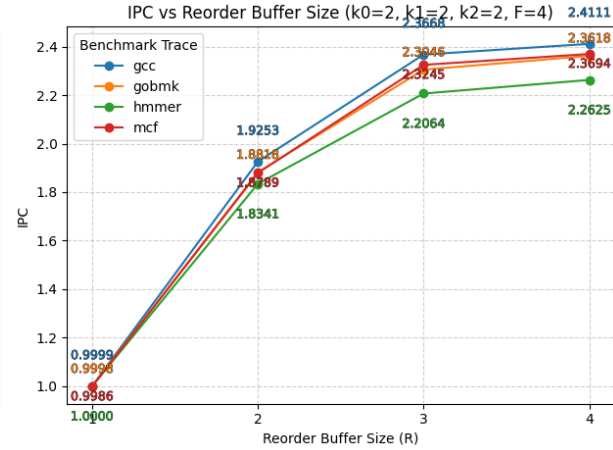
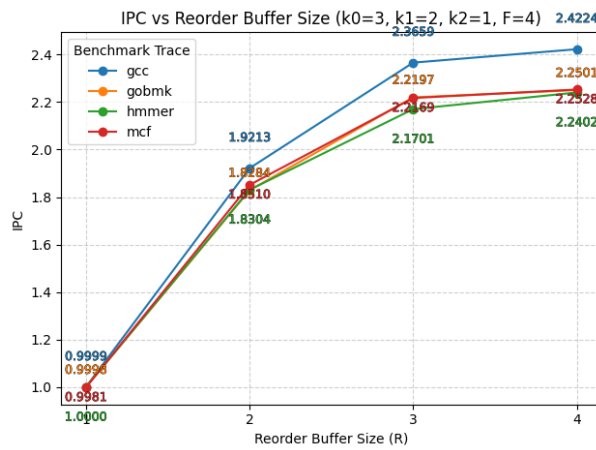
2. Vary Parameters

- a. Number of FUs of each type (k_0, k_1, k_2) of either 1 or 2 units each.



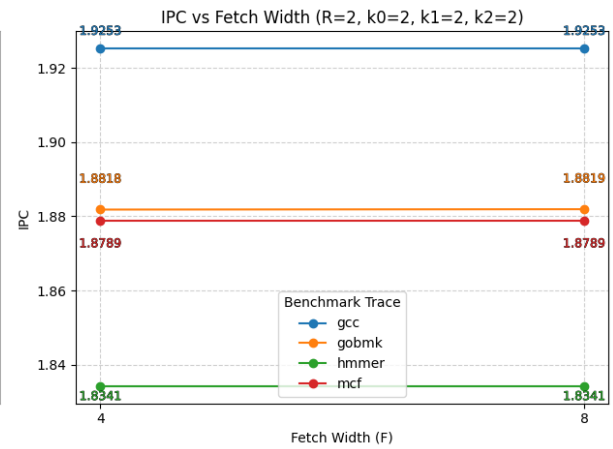
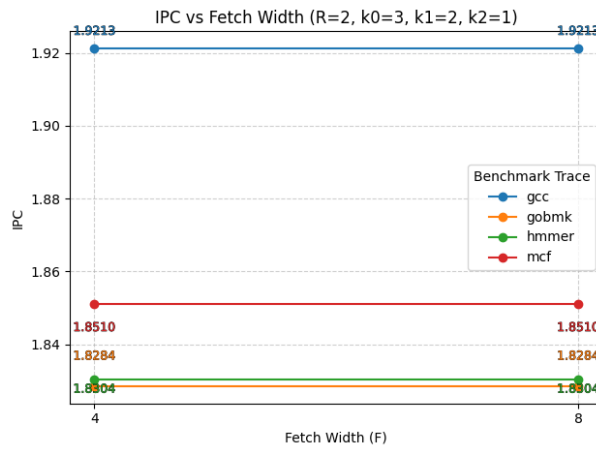
IPC increases when increasing FUs.

- b. The number of result buses, R



IPC increases when increasing R size.

c. Fetch rate, $F = 4$ or 8



IPC is almost the same between $F=4$ and $F=8$.

3. Select the least amount of hardware

Traces	Max IPC	95% Threshold	Chosen Config (k_0, k_1, k_2, R)	Chosen IPC	Total HW ($k_0+k_1+k_2+R$)
gcc	2.4224	2.3013	2,2,2,3	2.3668	9
gobmk	2.3618	2.2437	2,2,2,3	2.3046	9
hmmer	2.2625	2.1494	2,2,2,3	2.2064	9
mcf	2.3694	2.2509	2,2,2,3	2.3245	9

The configuration ($k_0=2$, $k_1=2$, $k_2=2$, $R=3$) provides IPC above 95% of the maximum for all traces, while minimizing total hardware usage (9 units). This makes it the most efficient and balanced design choice.

This configuration allocates equal numbers of functional units (2 for each type), offering good parallelism and avoiding bottlenecks in any specific functional unit type. With a reorder buffer size of 3, the pipeline can hold a sufficient number of in-flight instructions to enable out-of-order execution effectively.