CS311 Lab 6: Adding Caches

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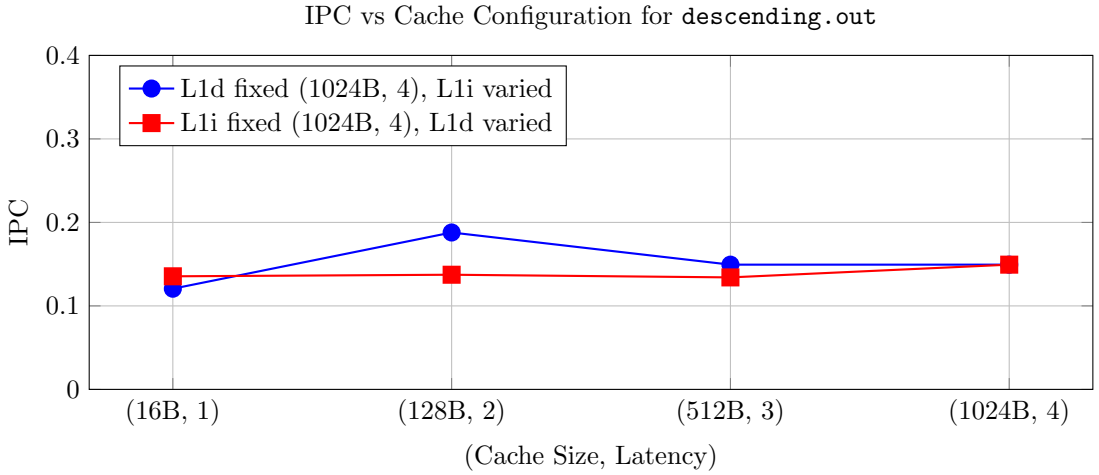
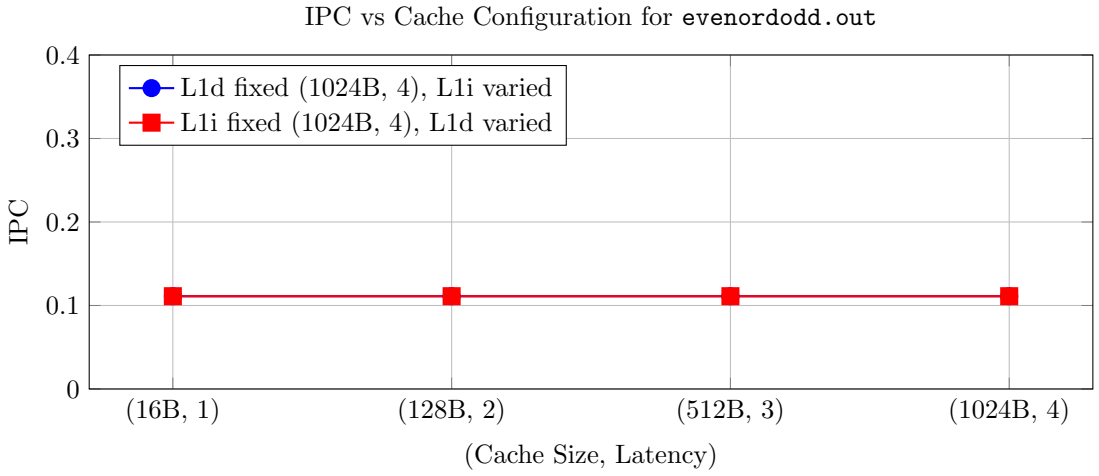
1 IPC vs Cache Configurations for Benchmark Programs

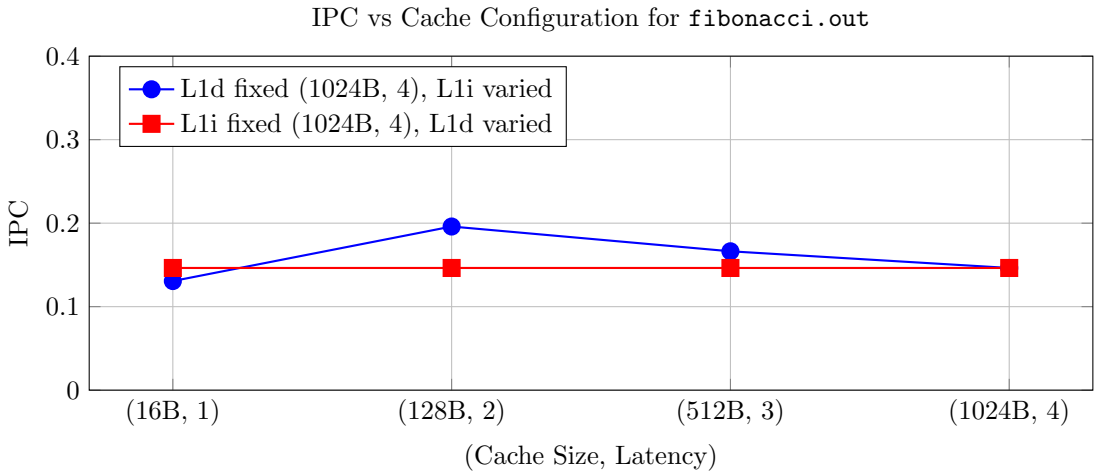
1.1 descending.out



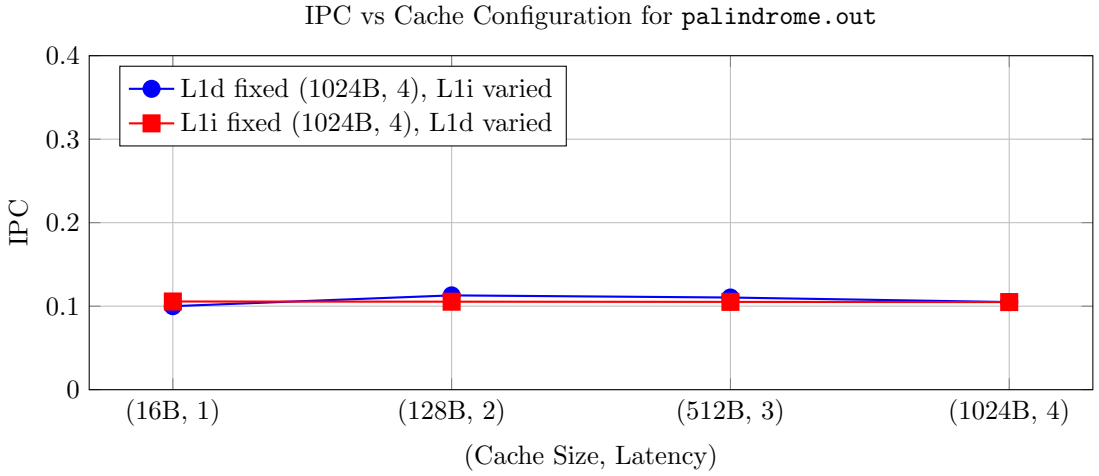
1.2 evenorodd.out



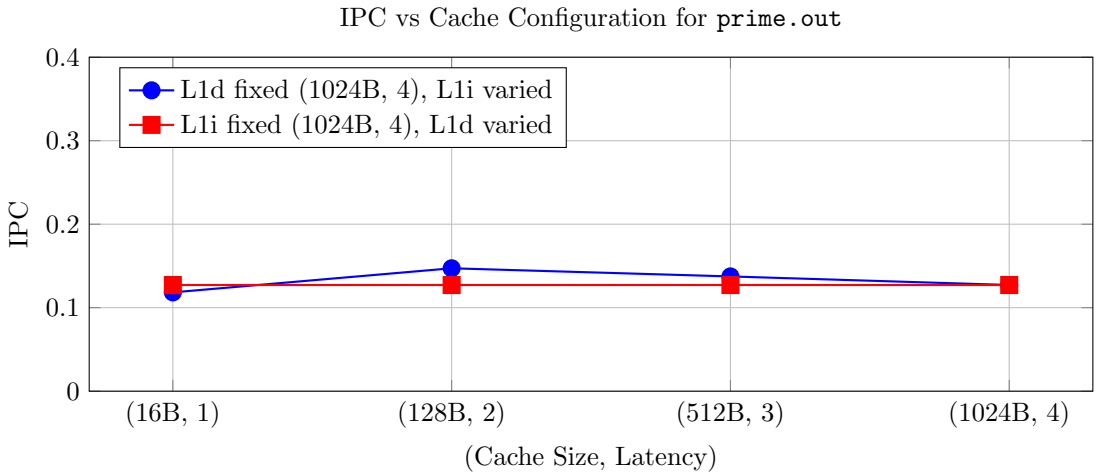
1.3 fibonacci.out



1.4 palindrome.out



1.5 prime.out



2 Toy-Benchmark: L1d Cache friendliness

Code used:

```
    .data:
n:
    1000
    .text:
main:
    load %x0, $n, %x3
loop:
    load %x0, 3, %x5
    load %x0, 4, %x5
    load %x0, 5, %x5
    load %x0, 6, %x5
    load %x0, 7, %x5
    load %x0, 8, %x5
    beq %x4, %x3, endProg
    addi %x4, 1, %x4
    jmp loop
endProg:
    end
```

Execution Statistics:

L1d Cache Size	No. of cycles	Instructions per cycle (IPC)	Data Hits	Data Misses
16B	73083	0.1232708	0	6007
128B	55083	0.16355318	6000	7

3 Toy-Benchmark: L1i Cache friendliness

```
    .data:
n:
    1000
    .text:
main:
    load %x0, $n, %x3
loop:
    load %x0, 3, %x5
    beq %x4, %x3, endProg
    addi %x4, 1, %x4
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    addi %x5, 1, %x5
    jmp loop
endProg:
    end
```

Execution Statistics:

L1i Cache Size	No. of cycles	Instructions per cycle (IPC)	Inst. Hits	Inst. Misses
16B	95036	0.12631004	0	11005
128B	66057	0.18172185	10991	14

4 Observations

Cache configurations have minimal to no effect on simple programs such as evenorodd.out or on palindrome.out.

Programs such as descending.out and fibonacci.out are cache-sensitive since they have frequent `load` and `store` operations and run efficiently on L1i cache with size 128B and latency of 2 cycles and L1d cache with size 1kB and latency of 4 cycles.