

CS 8803: Compilers: theory and practice
Project Phase 2: Back end
Testing and output report
Team: Gang Liao, Rachna Saxena

This document describes the assembly code output of Tiger language programs. In the second phase of project, back end components like naive register allocation, control flow graph, intra block allocation, and whole function register allocation using Briggs algorithm using live range analysis is implemented. It also implements instruction selection and code generation. Bonus2 i.e. function calls are also part of this implementation.

This report contains test case results for generated assembly code executed on SPIM, MIPS based simulator. spim-keepstats is used to generate execution level details.

Test cases Output: All outputs are present in the directory testcases2. Below table describes the purpose and result of different each test cases.

Test case	Test Scenario	Status	Comments
Float.tiger	Tests for floating point parameter to a function and float addition	Pass	
Float_arr.tiger	Tests for floating point array element passed as parameter to a function and float addition	Pass	
Func.tiger	Test for function call, argument passing	Pass	
Func_ret.tiger	Test for function call, argument passing and return value implementation	Pass	
Test1.tiger	Type and variable declaration, for loop, array usage	Pass	
Test2.tiger	Type declaration, function definition, function call	Pass	
Test3.tiger	Variable declaration (float type), function definition, function call	Pass	
Test5.tiger	Variable declaration, if-then-else statement	Pass	
factorial.tiger	Calculate and print factorial of a number	Pass	

Float.tiger:

Float.tiger.naive.s:

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			Text
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0			[00400000] 8fa40000 lw \$4, 0(\$29) ; 183: lw \$a0 0(\$sp) # argc
Cause = 0			[00400004] 27a50004 addiu \$5, \$29, 4 ; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0			[00400008] 24a60004 addiu \$6, \$5, 4 ; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff0			[0040000c] 00041080 sll \$2, \$4, 2 ; 186: sll \$v0 \$a0 2
HI = 0			[00400010] 00c23021 addu \$6, \$6, \$2 ; 187: addu \$a2 \$a2 \$v0
LO = 0			[00400014] 0c100062 jal 0x00400188 [main] ; 188: jal main
			[00400018] 00000000 nop ; 189: nop
			[0040001c] 3402000a ori \$2, \$0, 10 ; 191: li \$v0 10
			[00400020] 0000000c syscall ; 192: syscall # syscall 10 (exit)
R0 [r0] = 0			[00400024] afb0ffff sw \$16, -4(\$29) ; 199: sw \$s0, -4(\$sp)
R1 [a0] = 10010000			[00400028] afb1ffff sw \$17, -8(\$29) ; 200: sw \$s1, -8(\$sp)
R2 [v0] = a			[0040002c] afb2ffff sw \$18, -12(\$29) ; 201: sw \$s2, -12(\$sp)
R3 [v1] = 0			[00400030] afb3ffff sw \$19, -16(\$29) ; 202: sw \$s3, -16(\$sp)
R4 [a0] = 1			[00400034] afb4ffec sw \$20, -20(\$29) ; 203: sw \$s4, -20(\$sp)
R5 [a1] = 7ffff23c			[00400038] afb5ffe8 sw \$21, -24(\$29) ; 204: sw \$s5, -24(\$sp)
R6 [a2] = 7ffff244			[0040003c] afb6ffe4 sw \$22, -28(\$29) ; 205: sw \$s6, -28(\$sp)
R7 [a3] = 0			[00400040] afb7ffe0 sw \$23, -32(\$29) ; 206: sw \$s7, -32(\$sp)
R8 [t0] = 1001000c			[00400044] 23bdffe0 addi \$29, \$29, -32 ; 207: addi \$sp, \$sp, -32
R9 [t1] = 0			[00400048] afbffffc sw \$31, -4(\$29) ; 208: sv \$ra, -4(\$sp)
R10 [t2] = 0			[0040004c] 23bdfffc addi \$29, \$29, -4 ; 209: addi \$sp, \$sp, -4
R11 [t3] = 0			[00400050] 34020001 ori \$2, \$0, 1 ; 210: li \$v0, 1
R12 [t4] = 0			[00400054] 0000000c syscall ; 211: syscall
R13 [t5] = 0			[00400058] 23bd0004 addi \$29, \$29, 4 ; 212: addi \$sp, \$sp, 4
R14 [t6] = 0			[0040005c] 8fbffffc lw \$31, -4(\$29) ; 213: lv \$ra, -4(\$sp)
R15 [t7] = 0			[00400060] 23bd0020 addi \$29, \$29, 32 ; 214: addi \$sp, \$sp, 32
R16 [s0] = 0			[00400064] 8fb0ffff lw \$16, -4(\$29) ; 215: lv \$s0, -4(\$sp)
R17 [s1] = 0			[00400068] 8fb1ffff lw \$17, -8(\$29) ; 216: lv \$s1, -8(\$sp)
R18 [s2] = 0			[0040006c] 8fb2ffff lw \$18, -12(\$29) ; 217: lv \$s2, -12(\$sp)
R19 [s3] = 0			[00400070] 8fb3ffff lw \$19, -16(\$29) ; 218: lv \$s3, -16(\$sp)
R20 [s4] = 0			[00400074] 8fb4ffec lw \$20, -20(\$29) ; 219: lv \$s4, -20(\$sp)
R21 [s5] = 0			[00400078] 8fb5ffe8 lw \$21, -24(\$29) ; 220: lv \$s5, -24(\$sp)
R22 [s6] = 0			[0040007c] 8fb6ffe4 lw \$22, -28(\$29) ; 221: lv \$s6, -28(\$sp)
R23 [s7] = 0			[00400080] 8fb7ffe0 lw \$23, -32(\$29) ; 222: lv \$s7, -32(\$sp)
R24 [t8] = 0			[00400084] 03e00008 jr \$31 ; 223: jr \$ra
R25 [t9] = 10010000			
R26 [k0] = 0			
R27 [k1] = 0			

Float.tiger.cfg.s:

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			Text
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0			[00400000] 8fa40000 lw \$4, 0(\$29) ; 183: lw \$a0 0(\$sp) # argc
Cause = 0			[00400004] 27a50004 addiu \$5, \$29, 4 ; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0			[00400008] 24a60004 addiu \$6, \$5, 4 ; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff0			[0040000c] 00041080 sll \$2, \$4, 2 ; 186: sll \$v0 \$a0 2
HI = 0			[00400010] 00c23021 addu \$6, \$6, \$2 ; 187: addu \$a2 \$a2 \$v0
LO = 0			[00400014] 0c100062 jal 0x00400188 [main] ; 188: jal main
			[00400018] 00000000 nop ; 189: nop
			[0040001c] 3402000a ori \$2, \$0, 10 ; 191: li \$v0 10
			[00400020] 0000000c syscall ; 192: syscall # syscall 10 (exit)
R0 [r0] = 0			[00400024] afb0ffff sw \$16, -4(\$29) ; 199: sw \$s0, -4(\$sp)
R1 [a0] = 10010000			[00400028] afb1ffff sw \$17, -8(\$29) ; 200: sw \$s1, -8(\$sp)
R2 [v0] = a			[0040002c] afb2ffff sw \$18, -12(\$29) ; 201: sw \$s2, -12(\$sp)
R3 [v1] = 0			[00400030] afb3ffff sw \$19, -16(\$29) ; 202: sw \$s3, -16(\$sp)
R4 [a0] = 1			[00400034] afb4ffec sw \$20, -20(\$29) ; 203: sw \$s4, -20(\$sp)
R5 [a1] = 7ffff23c			[00400038] afb5ffe8 sw \$21, -24(\$29) ; 204: sw \$s5, -24(\$sp)
R6 [a2] = 7ffff244			[0040003c] afb6ffe4 sw \$22, -28(\$29) ; 205: sw \$s6, -28(\$sp)
R7 [a3] = 0			[00400040] afb7ffe0 sw \$23, -32(\$29) ; 206: sw \$s7, -32(\$sp)
R8 [t0] = 1001000c			[00400044] 23bdffe0 addi \$29, \$29, -32 ; 207: addi \$sp, \$sp, -32
R9 [t1] = 0			[00400048] afbffffc sw \$31, -4(\$29) ; 208: sv \$ra, -4(\$sp)
R10 [t2] = 0			[0040004c] 23bdfffc addi \$29, \$29, -4 ; 209: addi \$sp, \$sp, -4
R11 [t3] = 0			[00400050] 34020001 ori \$2, \$0, 1 ; 210: li \$v0, 1
R12 [t4] = 0			[00400054] 0000000c syscall ; 211: syscall
R13 [t5] = 0			[00400058] 23bd0004 addi \$29, \$29, 4 ; 212: addi \$sp, \$sp, 4
R14 [t6] = 0			[0040005c] 8fbffffc lw \$31, -4(\$29) ; 213: lv \$ra, -4(\$sp)
R15 [t7] = 0			[00400060] 23bd0020 addi \$29, \$29, 32 ; 214: addi \$sp, \$sp, 32
R16 [s0] = 0			[00400064] 8fb0ffff lw \$16, -4(\$29) ; 215: lv \$s0, -4(\$sp)
R17 [s1] = 0			[00400068] 8fb1ffff lw \$17, -8(\$29) ; 216: lv \$s1, -8(\$sp)
R18 [s2] = 0			[0040006c] 8fb2ffff lw \$18, -12(\$29) ; 217: lv \$s2, -12(\$sp)
R19 [s3] = 0			[00400070] 8fb3ffff lw \$19, -16(\$29) ; 218: lv \$s3, -16(\$sp)
R20 [s4] = 0			[00400074] 8fb4ffec lw \$20, -20(\$29) ; 219: lv \$s4, -20(\$sp)
R21 [s5] = 0			[00400078] 8fb5ffe8 lw \$21, -24(\$29) ; 220: lv \$s5, -24(\$sp)
R22 [s6] = 0			[0040007c] 8fb6ffe4 lw \$22, -28(\$29) ; 221: lv \$s6, -28(\$sp)
R23 [s7] = 0			[00400080] 8fb7ffe0 lw \$23, -32(\$29) ; 222: lv \$s7, -32(\$sp)
R24 [t8] = 0			[00400084] 03e00008 jr \$31 ; 223: jr \$ra
R25 [t9] = 10010000			
R26 [k0] = 0			
R27 [k1] = 0			

Code/Files	Instructions	Read	Write	Branches	Other
Float.tiger.naive.s	132	29	28	5	70
Float.tiger.cfg.s	134	29	28	5	72

Float_arr.tiger:

Float_arr.tiger.naive.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
		[00400018] 00000000 nop	; 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R1 [at] = 1		[00400024] afb0fffc sw \$16, -4(\$29)	; 219: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	; 220: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	; 221: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	; 222: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff234		[00400034] afb4fffc sw \$20, -20(\$29)	; 223: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff23c		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 224: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 225: sw \$s6, -28(\$sp)
R8 [t0] = 10010030		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 226: sw \$s7, -32(\$sp)
R9 [t1] = 10010034		[00400044] 23bdffe0 addi \$29, \$29, -32	; 227: addi \$sp, \$sp, -32
R10 [t2] = 5		[00400048] afbffffc sw \$31, -4(\$29)	; 228: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 229: addi \$sp, \$sp, -4
R12 [t4] = 10010034		[00400050] 34020001 ori \$2, \$0, 1	; 230: li \$v0, 1
R13 [t5] = 1		[00400054] 0000000c syscall	; 231: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 232: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 233: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 234: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	; 235: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 236: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 237: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 238: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4fffc lw \$20, -20(\$29)	; 239: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 240: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 241: lw \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 242: lw \$s7, -32(\$sp)
R25 [t9] = 0		[00400084] 03e00008 jr \$31	; 243: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Float_arr.tiger.cfg.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
		[00400018] 00000000 nop	; 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R1 [at] = 1		[00400024] afb0fffc sw \$16, -4(\$29)	; 227: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	; 228: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	; 229: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	; 230: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4fffc sw \$20, -20(\$29)	; 231: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 232: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 233: sw \$s6, -28(\$sp)
R8 [t0] = 6		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 234: sw \$s7, -32(\$sp)
R9 [t1] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	; 235: addi \$sp, \$sp, -32
R10 [t2] = 0		[00400048] afbffffc sw \$31, -4(\$29)	; 236: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 237: addi \$sp, \$sp, -4
R12 [t4] = 0		[00400050] 34020001 ori \$2, \$0, 1	; 238: li \$v0, 1
R13 [t5] = 0		[00400054] 0000000c syscall	; 239: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 240: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 241: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 242: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	; 243: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 244: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 245: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 246: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4fffc lw \$20, -20(\$29)	; 247: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 248: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 249: lw \$s6, -28(\$sp)
R24 [t8] = 10010014		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 250: lw \$s7, -32(\$sp)
R25 [t9] = 5		[00400084] 03e00008 jr \$31	; 251: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Code/Files	Instructions	Read	Write	Branches	Other
Float_arr.tiger.naive.s	691	159	131	28	373
Float_arr.tiger.cfg.s	680	148	131	28	373

There is 6.92% improved in number of operations. There is 1.62% improvement in the number of instructions in cfg implementation.

func.tiger:

func.tiger.naive.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC	= 400020	User Text Segment [00400000]..[00440000]	
EPC	= 0	[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause	= 0	[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr	= 0	[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status	= 3000ff10	[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI	= 0	[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO	= 0	[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0]	= 0	[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [a5]	= 10010000	[00400024] afb0ffff sw \$16, -4(\$29)	: 145: sw \$s0, -4(\$sp)
R2 [v0]	= a	[00400028] afb1ffff sw \$17, -8(\$29)	: 146: sw \$s1, -8(\$sp)
R3 [v1]	= 0	[0040002c] afb2ffff sw \$18, -12(\$29)	: 147: sw \$s2, -12(\$sp)
R4 [a0]	= 1	[00400030] afb3ffff sw \$19, -16(\$29)	: 148: sw \$s3, -16(\$sp)
R5 [a1]	= 7ffff23c	[00400034] afb4ffec sw \$20, -20(\$29)	: 149: sw \$s4, -20(\$sp)
R6 [a2]	= 7ffff244	[00400038] afb5ffe8 sw \$21, -24(\$29)	: 150: sw \$s5, -24(\$sp)
R7 [a3]	= 0	[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 151: sw \$s6, -28(\$sp)
R8 [t0]	= 0	[00400040] afb7ffe0 sw \$23, -32(\$29)	: 152: sw \$s7, -32(\$sp)
R9 [t1]	= 0	[00400044] 23bdffe0 addi \$29, \$29, -32	: 153: addi \$sp, \$sp, -32
R10 [t2]	= 0	[00400048] afbffffc sw \$31, -4(\$29)	: 154: sw \$ra, -4(\$sp)
R11 [t3]	= 0	[0040004c] 23bdfffc addi \$29, \$29, -4	: 155: addi \$sp, \$sp, -4
R12 [t4]	= 0	[00400050] 34020001 ori \$2, \$0, 1	: 156: li \$v0, 1
R13 [t5]	= 5	[00400054] 0000000c syscall	: 157: syscall
R14 [t6]	= 0	[00400058] 23bd0004 addi \$29, \$29, 4	: 158: addi \$sp, \$sp, 4
R15 [t7]	= 0	[0040005c] 8fbffffc lw \$31, -4(\$29)	: 159: lw \$ra, -4(\$sp)
R16 [s0]	= 0	[00400060] 23bd0020 addi \$29, \$29, 32	: 160: addi \$sp, \$sp, 32
R17 [s1]	= 0	[00400064] 8fb0ffff lw \$16, -4(\$29)	: 161: lw \$s0, -4(\$sp)
R18 [s2]	= 0	[00400068] 8fb1ffff lw \$17, -8(\$29)	: 162: lw \$s1, -8(\$sp)
R19 [s3]	= 0	[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 163: lw \$s2, -12(\$sp)
R20 [s4]	= 0	[00400070] 8fb3ffff lw \$19, -16(\$29)	: 164: lw \$s3, -16(\$sp)
R21 [s5]	= 0	[00400074] 8fb4ffec lw \$20, -20(\$29)	: 165: lw \$s4, -20(\$sp)
R22 [s6]	= 0	[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 166: lw \$s5, -24(\$sp)
R23 [s7]	= 0	[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 167: lw \$s6, -28(\$sp)
R24 [t8]	= 0	[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 168: lw \$s7, -32(\$sp)
R25 [t9]	= 0	[00400084] 03e00008 jr \$31	: 169: jr \$ra
R26 [k0]	= 0		
R27 [k1]	= 0		

Console output: 5

Func.tiger.cfg.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC	= 400020	User Text Segment [00400000]..[00440000]	
EPC	= 0	[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause	= 0	[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr	= 0	[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status	= 3000ff10	[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI	= 0	[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO	= 0	[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0]	= 0	[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [a5]	= 10010000	[00400024] afb0ffff sw \$16, -4(\$29)	: 149: sw \$s0, -4(\$sp)
R2 [v0]	= a	[00400028] afb1ffff sw \$17, -8(\$29)	: 150: sw \$s1, -8(\$sp)
R3 [v1]	= 0	[0040002c] afb2ffff sw \$18, -12(\$29)	: 151: sw \$s2, -12(\$sp)
R4 [a0]	= 1	[00400030] afb3ffff sw \$19, -16(\$29)	: 152: sw \$s3, -16(\$sp)
R5 [a1]	= 7ffff23c	[00400034] afb4ffec sw \$20, -20(\$29)	: 153: sw \$s4, -20(\$sp)
R6 [a2]	= 7ffff244	[00400038] afb5ffe8 sw \$21, -24(\$29)	: 154: sw \$s5, -24(\$sp)
R7 [a3]	= 0	[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 155: sw \$s6, -28(\$sp)
R8 [t0]	= 5	[00400040] afb7ffe0 sw \$23, -32(\$29)	: 156: sw \$s7, -32(\$sp)
R9 [t1]	= 0	[00400044] 23bdffe0 addi \$29, \$29, -32	: 157: addi \$sp, \$sp, -32
R10 [t2]	= 0	[00400048] afbffffc sw \$31, -4(\$29)	: 158: sw \$ra, -4(\$sp)
R11 [t3]	= 0	[0040004c] 23bdfffc addi \$29, \$29, -4	: 159: addi \$sp, \$sp, -4
R12 [t4]	= 0	[00400050] 34020001 ori \$2, \$0, 1	: 160: li \$v0, 1
R13 [t5]	= 0	[00400054] 0000000c syscall	: 161: syscall
R14 [t6]	= 0	[00400058] 23bd0004 addi \$29, \$29, 4	: 162: addi \$sp, \$sp, 4
R15 [t7]	= 0	[0040005c] 8fbffffc lw \$31, -4(\$29)	: 163: lw \$ra, -4(\$sp)
R16 [s0]	= 0	[00400060] 23bd0020 addi \$29, \$29, 32	: 164: addi \$sp, \$sp, 32
R17 [s1]	= 0	[00400064] 8fb0ffff lw \$16, -4(\$29)	: 165: lw \$s0, -4(\$sp)
R18 [s2]	= 0	[00400068] 8fb1ffff lw \$17, -8(\$29)	: 166: lw \$s1, -8(\$sp)
R19 [s3]	= 0	[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 167: lw \$s2, -12(\$sp)
R20 [s4]	= 0	[00400070] 8fb3ffff lw \$19, -16(\$29)	: 168: lw \$s3, -16(\$sp)
R21 [s5]	= 0	[00400074] 8fb4ffec lw \$20, -20(\$29)	: 169: lw \$s4, -20(\$sp)
R22 [s6]	= 0	[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 170: lw \$s5, -24(\$sp)
R23 [s7]	= 0	[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 171: lw \$s6, -28(\$sp)
R24 [t8]	= 5	[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 172: lw \$s7, -32(\$sp)
R25 [t9]	= 10010000	[00400084] 03e00008 jr \$31	: 173: jr \$ra
R26 [k0]	= 0		
R27 [k1]	= 0		

Console output: 5

Code/Files	Instructions	Read	Write	Branches	Other
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func.tiger.naive.s	153	50	48	7	48
func.tiger.cfg.s	157	50	49	7	51

In this case, there is 2.04% improvement in the number of write operations.

Func_ret.tiger:

Func_ret.tiger.naive.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			Text
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0			[00400000] 8fa40000 lw \$4, 0(\$29) ; 183: lw \$a0 0(\$sp) # argc
Cause = 0			[00400004] 27a50004 addiu \$5, \$29, 4 ; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0			[00400008] 24a60004 addiu \$6, \$5, 4 ; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10			[0040000c] 00041080 sll \$2, \$4, 2 ; 186: sll \$v0 \$a0 2
HI = 0			[00400010] 00c23021 addu \$6, \$6, \$2 ; 187: addu \$a2 \$a2 \$v0
LO = a			[00400014] 0c100062 jal 0x00400188 [main] ; 188: jal main
			[00400018] 00000000 nop ; 189: nop
			[0040001c] 3402000a ori \$2, \$0, 10 ; 191: li \$v0 10
R0 [r0] = 0			[00400020] 0000000c syscall ; 192: syscall # syscall 10 (exit)
R1 [at] = 10010000			[00400024] afb0fffc sw \$16, -4(\$29) ; 148: sw \$s0, -4(\$sp)
R2 [v0] = a			[00400028] afb1ffff sw \$17, -8(\$29) ; 149: sw \$s1, -8(\$sp)
R3 [v1] = 0			[0040002c] afb2ffff sw \$18, -12(\$29) ; 150: sw \$s2, -12(\$sp)
R4 [a0] = 1			[00400030] afb3ffff sw \$19, -16(\$29) ; 151: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff234			[00400034] afb4ffec sw \$20, -20(\$29) ; 152: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff23c			[00400038] afb5ffe8 sw \$21, -24(\$29) ; 153: sw \$s5, -24(\$sp)
R7 [a3] = 0			[0040003c] afb6ffe4 sw \$22, -28(\$29) ; 154: sw \$s6, -28(\$sp)
R8 [t0] = 10010000			[00400040] afb7ffe0 sw \$23, -32(\$29) ; 155: sw \$s7, -32(\$sp)
R9 [t1] = a			[00400044] 23bdfef0 addi \$29, \$29, -32 ; 156: addi \$sp, \$sp, -32
R10 [t2] = 0			[00400048] afbffffc sw \$31, -4(\$29) ; 157: sw \$ra, -4(\$sp)
R11 [t3] = 0			[0040004c] 23bdfef0 addi \$29, \$29, -4 ; 158: addi \$sp, \$sp, -4
R12 [t4] = 10010000			[00400050] 34020001 ori \$2, \$0, 1 ; 159: li \$v0, 1
R13 [t5] = 5			[00400054] 0000000c syscall ; 160: syscall
R14 [t6] = 0			[00400058] 23bd0004 addi \$29, \$29, 4 ; 161: addi \$sp, \$sp, 4
R15 [t7] = 0			[0040005c] 8fbffffc lw \$31, -4(\$29) ; 162: lw \$ra, -4(\$sp)
R16 [s0] = 0			[00400060] 23bd0020 addi \$29, \$29, 32 ; 163: addi \$sp, \$sp, 32
R17 [s1] = 0			[00400064] 8fb0fffc lw \$16, -4(\$29) ; 164: lw \$s0, -4(\$sp)
R18 [s2] = 0			[00400068] 8fb1ffff lw \$17, -8(\$29) ; 165: lw \$s1, -8(\$sp)
R19 [s3] = 0			[0040006c] 8fb2ffff lw \$18, -12(\$29) ; 166: lw \$s2, -12(\$sp)
R20 [s4] = 0			[00400070] 8fb3ffff lw \$19, -16(\$29) ; 167: lw \$s3, -16(\$sp)
R21 [s5] = 0			[00400074] 8fb4ffec lw \$20, -20(\$29) ; 168: lw \$s4, -20(\$sp)
R22 [s6] = 0			[00400078] 8fb5ffe8 lw \$21, -24(\$29) ; 169: lw \$s5, -24(\$sp)
R23 [s7] = 0			[0040007c] 8fb6ffe4 lw \$22, -28(\$29) ; 170: lw \$s6, -28(\$sp)
R24 [t8] = 0			[00400080] 8fb7ffe0 lw \$23, -32(\$29) ; 171: lw \$s7, -32(\$sp)
R25 [t9] = 0			[00400084] 03e00008 jr \$31 ; 172: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Console output: 10

Func_ret.tiger.cfg.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			Text
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0			[00400000] 8fa40000 lw \$4, 0(\$29) ; 183: lw \$a0 0(\$sp) # argc
Cause = 0			[00400004] 27a50004 addiu \$5, \$29, 4 ; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0			[00400008] 24a60004 addiu \$6, \$5, 4 ; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10			[0040000c] 00041080 sll \$2, \$4, 2 ; 186: sll \$v0 \$a0 2
HI = 0			[00400010] 00c23021 addu \$6, \$6, \$2 ; 187: addu \$a2 \$a2 \$v0
LO = a			[00400014] 0c100062 jal 0x00400188 [main] ; 188: jal main
			[00400018] 00000000 nop ; 189: nop
			[0040001c] 3402000a ori \$2, \$0, 10 ; 191: li \$v0 10
R0 [r0] = 0			[00400020] 0000000c syscall ; 192: syscall # syscall 10 (exit)
R1 [at] = 10010000			[00400024] afb0fffc sw \$16, -4(\$29) ; 152: sw \$s0, -4(\$sp)
R2 [v0] = a			[00400028] afb1ffff sw \$17, -8(\$29) ; 153: sw \$s1, -8(\$sp)
R3 [v1] = 0			[0040002c] afb2ffff sw \$18, -12(\$29) ; 154: sw \$s2, -12(\$sp)
R4 [a0] = 1			[00400030] afb3ffff sw \$19, -16(\$29) ; 155: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c			[00400034] afb4ffec sw \$20, -20(\$29) ; 156: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244			[00400038] afb5ffe8 sw \$21, -24(\$29) ; 157: sw \$s5, -24(\$sp)
R7 [a3] = 0			[0040003c] afb6ffe4 sw \$22, -28(\$29) ; 158: sw \$s6, -28(\$sp)
R8 [t0] = a			[00400040] afb7ffe0 sw \$23, -32(\$29) ; 159: sw \$s7, -32(\$sp)
R9 [t1] = 0			[00400044] 23bdfef0 addi \$29, \$29, -32 ; 160: addi \$sp, \$sp, -32
R10 [t2] = 0			[00400048] afbffffc sw \$31, -4(\$29) ; 161: sw \$ra, -4(\$sp)
R11 [t3] = 0			[0040004c] 23bdfef0 addi \$29, \$29, -4 ; 162: addi \$sp, \$sp, -4
R12 [t4] = 0			[00400050] 34020001 ori \$2, \$0, 1 ; 163: li \$v0, 1
R13 [t5] = 0			[00400054] 0000000c syscall ; 164: syscall
R14 [t6] = 0			[00400058] 23bd0004 addi \$29, \$29, 4 ; 165: addi \$sp, \$sp, 4
R15 [t7] = 0			[0040005c] 8fbffffc lw \$31, -4(\$29) ; 166: lw \$ra, -4(\$sp)
R16 [s0] = 0			[00400060] 23bd0020 addi \$29, \$29, 32 ; 167: addi \$sp, \$sp, 32
R17 [s1] = 0			[00400064] 8fb0fffc lw \$16, -4(\$29) ; 168: lw \$s0, -4(\$sp)
R18 [s2] = 0			[00400068] 8fb1ffff lw \$17, -8(\$29) ; 169: lw \$s1, -8(\$sp)
R19 [s3] = 0			[0040006c] 8fb2ffff lw \$18, -12(\$29) ; 170: lw \$s2, -12(\$sp)
R20 [s4] = 0			[00400070] 8fb3ffff lw \$19, -16(\$29) ; 171: lw \$s3, -16(\$sp)
R21 [s5] = 0			[00400074] 8fb4ffec lw \$20, -20(\$29) ; 172: lw \$s4, -20(\$sp)
R22 [s6] = 0			[00400078] 8fb5ffe8 lw \$21, -24(\$29) ; 173: lw \$s5, -24(\$sp)
R23 [s7] = 0			[0040007c] 8fb6ffe4 lw \$22, -28(\$29) ; 174: lw \$s6, -28(\$sp)
R24 [t8] = 5			[00400080] 8fb7ffe0 lw \$23, -32(\$29) ; 175: lw \$s7, -32(\$sp)
R25 [t9] = 10010000			[00400084] 03e00008 jr \$31 ; 176: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Console output: 10

Code/Files	Instructions	Read	Write	Branches	Other
Func_ret.tiger.naive.s	169	53	50	7	59
Func_ret.tiger.cfg.s	170	52	50	7	61

In this case, there is 1.92% improvement in the number of read operation in the cfg implementation.

Test1.tiger:

Test1.tiger.naive.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO = 64		[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [at] = 10010000		[00400024] afb0ffff sw \$16, -4(\$29)	: 269: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	: 270: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	: 271: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	: 272: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	: 273: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	: 274: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 275: sw \$s6, -28(\$sp)
R8 [t0] = 10010000		[00400040] afb7ffe0 sw \$23, -32(\$29)	: 276: sw \$s7, -32(\$sp)
R9 [t1] = 65		[00400044] 23bdffe0 addi \$29, \$29, -32	: 277: addi \$sp, \$sp, -32
R10 [t2] = 64		[00400048] afbffffc sw \$31, -4(\$29)	: 278: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	: 279: addi \$sp, \$sp, -4
R12 [t4] = 10010008		[00400050] 34020001 ori \$2, \$0, 1	: 280: li \$v0, 1
R13 [t5] = 65		[00400054] 0000000c syscall	: 281: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	: 282: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	: 283: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	: 284: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0ffff lw \$16, -4(\$29)	: 285: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	: 286: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 287: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	: 288: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	: 289: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 290: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 291: lw \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 292: lw \$s7, -32(\$sp)
R25 [t9] = 0		[00400084] 03e00008 jr \$31	: 293: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Console output: 10000

Test1.tiger.cfg.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]			
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO = 64		[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [at] = 10010000		[00400024] afb0ffff sw \$16, -4(\$29)	: 277: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	: 278: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	: 279: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	: 280: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	: 281: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	: 282: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 283: sw \$s6, -28(\$sp)
R8 [t0] = 2710		[00400040] afb7ffe0 sw \$23, -32(\$29)	: 284: sw \$s7, -32(\$sp)
R9 [t1] = 64		[00400044] 23bdffe0 addi \$29, \$29, -32	: 285: addi \$sp, \$sp, -32
R10 [t2] = a		[00400048] afbffffc sw \$31, -4(\$29)	: 286: sw \$ra, -4(\$sp)
R11 [t3] = 64		[0040004c] 23bdfffc addi \$29, \$29, -4	: 287: addi \$sp, \$sp, -4
R12 [t4] = 2710		[00400050] 34020001 ori \$2, \$0, 1	: 288: li \$v0, 1
R13 [t5] = 65		[00400054] 0000000c syscall	: 289: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	: 290: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	: 291: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	: 292: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0ffff lw \$16, -4(\$29)	: 293: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	: 294: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 295: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	: 296: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	: 297: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 298: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 299: lw \$s6, -28(\$sp)
R24 [t8] = a		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 300: lw \$s7, -32(\$sp)
R25 [t9] = 10010010		[00400084] 03e00008 jr \$31	: 301: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Console output: 10000

Code/Files	Instructions	Read	Write	Branches	Other
Test1.tiger.naive.s	7296	1350	837	207	4902
Test1.tiger.cfg.s	7016	1053	838	207	4918

There is 0.12% improvement in the write performance in the improved implementation. There is 3.99% improvement in the number of instructions.

Test2.tiger:

Test2.tiger.naive.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lv \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
R0 [r0] = 0		[00400018] 00000000 nop	; 189: nop
R1 [at] = 10010000		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R2 [v0] = a		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R3 [v1] = 0		[00400024] afb0ffff sw \$16, -4(\$29)	; 143: sw \$s0, -4(\$sp)
R4 [a0] = 1		[00400028] afb1ffff sw \$17, -8(\$29)	; 144: sw \$s1, -8(\$sp)
R5 [a1] = 7ffff23c		[0040002c] afb2ffff sw \$18, -12(\$29)	; 145: sw \$s2, -12(\$sp)
R6 [a2] = 7ffff244		[00400030] afb3ffff sw \$19, -16(\$29)	; 146: sw \$s3, -16(\$sp)
R7 [a3] = 0		[00400034] afb4ffec sw \$20, -20(\$29)	; 147: sw \$s4, -20(\$sp)
R8 [t0] = 0		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 148: sw \$s5, -24(\$sp)
R9 [t1] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 149: sw \$s6, -28(\$sp)
R10 [t2] = 0		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 150: sw \$s7, -32(\$sp)
R11 [t3] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	; 151: addi \$sp, \$sp, -32
R12 [t4] = 0		[00400048] afbfffff sw \$31, -4(\$29)	; 152: sw \$ra, -4(\$sp)
R13 [t5] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 153: addi \$sp, \$sp, -4
R14 [t6] = 0		[00400050] 34020001 ori \$2, \$0, 1	; 154: li \$v0 1
R15 [t7] = 0		[00400054] 0000000c syscall	; 155: syscall
R16 [s0] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 156: addi \$sp, \$sp, 4
R17 [s1] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 157: lw \$ra, -4(\$sp)
R18 [s2] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 158: addi \$sp, \$sp, 32
R19 [s3] = 0		[00400064] 8fb0ffff lw \$16, -4(\$29)	; 159: lw \$s0, -4(\$sp)
R20 [s4] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 160: lw \$s1, -8(\$sp)
R21 [s5] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 161: lw \$s2, -12(\$sp)
R22 [s6] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 162: lw \$s3, -16(\$sp)
R23 [s7] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	; 163: lw \$s4, -20(\$sp)
R24 [t8] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 164: lw \$s5, -24(\$sp)
R25 [t9] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 165: lw \$s6, -28(\$sp)
R26 [k0] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 166: lw \$s7, -32(\$sp)
R27 [k1] = 0		[00400084] 03e00008 jr \$31	; 167: jr \$ra

Console output: 5

Test2.tiger.cfg.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lv \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
R0 [r0] = 0		[00400018] 00000000 nop	; 189: nop
R1 [at] = 10010000		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R2 [v0] = a		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R3 [v1] = 0		[00400024] afb0ffff sw \$16, -4(\$29)	; 147: sw \$s0, -4(\$sp)
R4 [a0] = 1		[00400028] afb1ffff sw \$17, -8(\$29)	; 148: sw \$s1, -8(\$sp)
R5 [a1] = 7ffff23c		[0040002c] afb2ffff sw \$18, -12(\$29)	; 149: sw \$s2, -12(\$sp)
R6 [a2] = 7ffff244		[00400030] afb3ffff sw \$19, -16(\$29)	; 150: sw \$s3, -16(\$sp)
R7 [a3] = 0		[00400034] afb4ffec sw \$20, -20(\$29)	; 151: sw \$s4, -20(\$sp)
R8 [t0] = 0		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 152: sw \$s5, -24(\$sp)
R9 [t1] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 153: sw \$s6, -28(\$sp)
R10 [t2] = 0		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 154: sw \$s7, -32(\$sp)
R11 [t3] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	; 155: addi \$sp, \$sp, -32
R12 [t4] = 0		[00400048] afbfffff sw \$31, -4(\$29)	; 156: sw \$ra, -4(\$sp)
R13 [t5] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 157: addi \$sp, \$sp, -4
R14 [t6] = 0		[00400050] 34020001 ori \$2, \$0, 1	; 158: li \$v0 1
R15 [t7] = 0		[00400054] 0000000c syscall	; 159: syscall
R16 [s0] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 160: addi \$sp, \$sp, 4
R17 [s1] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 161: lw \$ra, -4(\$sp)
R18 [s2] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 162: addi \$sp, \$sp, 32
R19 [s3] = 0		[00400064] 8fb0ffff lw \$16, -4(\$29)	; 163: lw \$s0, -4(\$sp)
R20 [s4] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 164: lw \$s1, -8(\$sp)
R21 [s5] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 165: lw \$s2, -12(\$sp)
R22 [s6] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 166: lw \$s3, -16(\$sp)
R23 [s7] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	; 167: lw \$s4, -20(\$sp)
R24 [t8] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 168: lw \$s5, -24(\$sp)
R25 [t9] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 169: lw \$s6, -28(\$sp)
R26 [k0] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 170: lw \$s7, -32(\$sp)
R27 [k1] = 0		[00400084] 03e00008 jr \$31	; 171: jr \$ra

Console output: 5

Code/Files	Instructions	Read	Write	Branches	Other
Test2.tiger.naive.s	149	49	47	7	46
Test2.tiger.cfg.s	151	49	47	7	48

Test3.tiger

Test3.tiger.naive.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
		[00400018] 00000000 nop	; 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R1 [at] = 10010000		[00400024] afb0fffc sw \$16, -4(\$29)	; 162: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	; 163: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	; 164: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	; 165: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	; 166: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 167: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 168: sw \$s6, -28(\$sp)
R8 [t0] = 0		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 169: sw \$s7, -32(\$sp)
R9 [t1] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	; 170: addi \$sp, \$sp, -32
R10 [t2] = 0		[00400048] afbffffc sw \$31, -4(\$29)	; 171: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 172: addi \$sp, \$sp, -4
R12 [t4] = 10010004		[00400050] 34020001 ori \$2, \$0, 1	; 173: li \$v0, 1
R13 [t5] = 0		[00400054] 0000000c syscall	; 174: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 175: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 176: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 177: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	; 178: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 179: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 180: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 181: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	; 182: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 183: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 184: lw \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 185: lw \$s7, -32(\$sp)
R25 [t9] = 0		[00400084] 03e00008 jr \$31	; 186: jr \$ra

Console output: 5

Test3.tiger.cfg.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	; 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	; 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	; 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10		[0040000c] 00041080 sll \$2, \$4, 2	; 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	; 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	; 188: jal main
		[00400018] 00000000 nop	; 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	; 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	; 192: syscall # syscall 10 (exit)
R1 [at] = 10010000		[00400024] afb0fffc sw \$16, -4(\$29)	; 166: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	; 167: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	; 168: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	; 169: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	; 170: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	; 171: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	; 172: sw \$s6, -28(\$sp)
R8 [t0] = 0		[00400040] afb7ffe0 sw \$23, -32(\$29)	; 173: sw \$s7, -32(\$sp)
R9 [t1] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	; 174: addi \$sp, \$sp, -32
R10 [t2] = 0		[00400048] afbffffc sw \$31, -4(\$29)	; 175: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	; 176: addi \$sp, \$sp, -4
R12 [t4] = 0		[00400050] 34020001 ori \$2, \$0, 1	; 177: li \$v0, 1
R13 [t5] = 0		[00400054] 0000000c syscall	; 178: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	; 179: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	; 180: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	; 181: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	; 182: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	; 183: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	; 184: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	; 185: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	; 186: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	; 187: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	; 188: lw \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	; 189: lw \$s7, -32(\$sp)
R25 [t9] = 10010004		[00400084] 03e00008 jr \$31	; 190: jr \$ra

Console output:5

Code/Files	Instructions	Read	Write	Branches	Other
Test3.tiger.naive.s	166	49	47	7	63
Test3.tiger.cfg.s	172	49	47	7	69

Test5.tiger:

Test5.tiger.naive.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]		Text	
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10		[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [a1] = 10010000		[00400024] afb0fffc sw \$16, -4(\$29)	: 241: sv \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	: 242: sv \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	: 243: sv \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	: 244: sv \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	: 245: sv \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	: 246: sv \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 247: sv \$s6, -28(\$sp)
R8 [t0] = 10010008		[00400040] afb7ffe0 sw \$23, -32(\$29)	: 248: sv \$s7, -32(\$sp)
R9 [t1] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	: 249: addi \$sp, \$sp, -32
R10 [t2] = 0		[00400048] afbffffc sw \$31, -4(\$29)	: 250: sv \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfffc addi \$29, \$29, -4	: 251: addi \$sp, \$sp, -4
R12 [t4] = 10010000		[00400050] 34020001 ori \$2, \$0, 1	: 252: li \$v0 1
R13 [t5] = fffffffb		[00400054] 0000000c syscall	: 253: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	: 254: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	: 255: lv \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	: 256: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	: 257: lv \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	: 258: lv \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 259: lv \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	: 260: lv \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	: 261: lv \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 262: lv \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 263: lv \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 264: lv \$s7, -32(\$sp)
R25 [t9] = 0		[00400084] 03e00008 jr \$31	: 265: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Console output: -5

Test5.tiger.cfg.s

FP Reqs	Int Reqs [16]	Data	Text
Int Reqs [16]		Text	
PC = 400020			User Text Segment [00400000]..[00440000]
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status = 3000fff10		[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO = 0		[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [a1] = 10010000		[00400024] afb0fffc sw \$16, -4(\$29)	: 249: sv \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	: 250: sv \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	: 251: sv \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	: 252: sv \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4ffec sw \$20, -20(\$29)	: 253: sv \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffe8 sw \$21, -24(\$29)	: 254: sv \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 255: sv \$s6, -28(\$sp)
R8 [t0] = fffffffb		[00400040] afb7ffe0 sw \$23, -32(\$29)	: 256: sv \$s7, -32(\$sp)
R9 [t1] = 0		[00400044] 23bdffe0 addi \$29, \$29, -32	: 257: addi \$sp, \$sp, -32
R10 [t2] = 0		[00400048] afbffffc sw \$31, -4(\$29)	: 258: sv \$ra, -4(\$sp)
R11 [t3] = fffffffb		[0040004c] 23bdfffc addi \$29, \$29, -4	: 259: addi \$sp, \$sp, -4
R12 [t4] = 0		[00400050] 34020001 ori \$2, \$0, 1	: 260: li \$v0 1
R13 [t5] = fffffffb		[00400054] 0000000c syscall	: 261: syscall
R14 [t6] = 0		[00400058] 23bd0004 addi \$29, \$29, 4	: 262: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	: 263: lv \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	: 264: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	: 265: lv \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1ffff lw \$17, -8(\$29)	: 266: lv \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 267: lv \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3ffff lw \$19, -16(\$29)	: 268: lv \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	: 269: lv \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 270: lv \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 271: lv \$s6, -28(\$sp)
R24 [t8] = fffffffb		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 272: lv \$s7, -32(\$sp)
R25 [t9] = 10010000		[00400084] 03e00008 jr \$31	: 273: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

Code/Files	Instructions	Read	Write	Branches	Other
Test5.tiger.naive.s	175	47	37	6	85
Test5.tiger.cfg.s	177	43	39	6	89

factorial.tiger:

FP Reqs	Int Reqs [16]	Data	Text
IntReqs [16]		Text	
PC = 400020		User Text Segment [00400000]..[00440000]	
EPC = 0		[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause = 0		[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr = 0		[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status = 3000ff10		[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI = 0		[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO = 9d80		[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
		[00400018] 00000000 nop	: 189: nop
		[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R0 [r0] = 0		[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R1 [at] = 10010000		[00400024] afb0fffc sw \$16, -4(\$29)	: 182: sw \$s0, -4(\$sp)
R2 [v0] = a		[00400028] afb1ffff sw \$17, -8(\$29)	: 183: sw \$s1, -8(\$sp)
R3 [v1] = 0		[0040002c] afb2ffff sw \$18, -12(\$29)	: 184: sw \$s2, -12(\$sp)
R4 [a0] = 1		[00400030] afb3ffff sw \$19, -16(\$29)	: 185: sw \$s3, -16(\$sp)
R5 [a1] = 7ffff23c		[00400034] afb4fffc sw \$20, -20(\$29)	: 186: sw \$s4, -20(\$sp)
R6 [a2] = 7ffff244		[00400038] afb5ffec sw \$21, -24(\$29)	: 187: sw \$s5, -24(\$sp)
R7 [a3] = 0		[0040003c] afb6ffed sw \$22, -28(\$29)	: 188: sw \$s6, -28(\$sp)
R8 [t0] = 10010000		[00400040] afb7ffe0 sw \$23, -32(\$29)	: 189: sw \$s7, -32(\$sp)
R9 [t1] = 9		[00400044] 23bdfefc addi \$29, \$29, -32	: 190: addi \$sp, \$sp, -32
R10 [t2] = 8		[00400048] afbffffc sw \$31, -4(\$29)	: 191: sw \$ra, -4(\$sp)
R11 [t3] = 0		[0040004c] 23bdfefc addi \$29, \$29, -4	: 192: addi \$sp, \$sp, -4
R12 [t4] = 10010008		[00400050] 34020001 ori \$2, \$0, 1	: 193: li \$v0, 1
R13 [t5] = 9		[00400054] 0000000c syscall	: 194: syscall
R14 [t6] = 0		[00400058] 23bd000c addi \$29, \$29, 4	: 195: addi \$sp, \$sp, 4
R15 [t7] = 0		[0040005c] 8fbffffc lw \$31, -4(\$29)	: 196: lw \$ra, -4(\$sp)
R16 [s0] = 0		[00400060] 23bd0020 addi \$29, \$29, 32	: 197: addi \$sp, \$sp, 32
R17 [s1] = 0		[00400064] 8fb0fffc lw \$16, -4(\$29)	: 198: lw \$s0, -4(\$sp)
R18 [s2] = 0		[00400068] 8fb1fffs lw \$17, -8(\$29)	: 199: lw \$s1, -8(\$sp)
R19 [s3] = 0		[0040006c] 8fb2fffd lw \$18, -12(\$29)	: 200: lw \$s2, -12(\$sp)
R20 [s4] = 0		[00400070] 8fb3fffd lw \$19, -16(\$29)	: 201: lw \$s3, -16(\$sp)
R21 [s5] = 0		[00400074] 8fb4ffec lw \$20, -20(\$29)	: 202: lw \$s4, -20(\$sp)
R22 [s6] = 0		[00400078] 8fb5ffec lw \$21, -24(\$29)	: 203: lw \$s5, -24(\$sp)
R23 [s7] = 0		[0040007c] 8fb6ffed lw \$22, -28(\$29)	: 204: lw \$s6, -28(\$sp)
R24 [t8] = 0		[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 205: lw \$s7, -32(\$sp)
R25 [t9] = 0		[00400084] 03e00008 jr \$31	: 206: jr \$ra
R26 [k0] = 0			
R27 [k1] = 0			

factorial.tiger.cfg.s

FP Regs	Int Regs [16]	Data	Text
Int Regs [16]		Text	
PC	= 400020	User Text Segment [00400000].. [00440000]	
EPC	= 0	[00400000] 8fa40000 lw \$4, 0(\$29)	: 183: lw \$a0 0(\$sp) # argc
Cause	= 0	[00400004] 27a50004 addiu \$5, \$29, 4	: 184: addiu \$a1 \$sp 4 # argv
BadVAddr	= 0	[00400008] 24a60004 addiu \$6, \$5, 4	: 185: addiu \$a2 \$a1 4 # envp
Status	= 3000ff10	[0040000c] 00041080 sll \$2, \$4, 2	: 186: sll \$v0 \$a0 2
HI	= 0	[00400010] 00c23021 addu \$6, \$6, \$2	: 187: addu \$a2 \$a2 \$v0
LO	= 9d80	[00400014] 0c100062 jal 0x00400188 [main]	: 188: jal main
R0 [r0]	= 0	[00400018] 00000000 nop	: 189: nop
R1 [a0]	= 0	[0040001c] 3402000a ori \$2, \$0, 10	: 191: li \$v0 10
R2 [v0]	= a	[00400020] 0000000c syscall	: 192: syscall # syscall 10 (exit)
R3 [v1]	= 0	[00400024] afb0fffc sw \$16, -4(\$29)	: 190: sw \$s0, -4(\$sp)
R4 [a0]	= 1	[00400028] afb1ffff sw \$17, -8(\$29)	: 191: sw \$s1, -8(\$sp)
R5 [a1]	= 7ffff23c	[0040002c] afb2ffff sw \$18, -12(\$29)	: 192: sw \$s2, -12(\$sp)
R6 [a2]	= 7ffff244	[00400030] afb3ffff sw \$19, -16(\$29)	: 193: sw \$s3, -16(\$sp)
R7 [a3]	= 0	[00400034] afb4ffec sw \$20, -20(\$29)	: 194: sw \$s4, -20(\$sp)
R8 [t0]	= 9d80	[00400038] afb5ffe8 sw \$21, -24(\$29)	: 195: sw \$s5, -24(\$sp)
R9 [t1]	= 9d80	[0040003c] afb6ffe4 sw \$22, -28(\$29)	: 196: sw \$s6, -28(\$sp)
R10 [t2]	= 8	[00400040] afb7ffe0 sw \$23, -32(\$29)	: 197: sw \$s7, -32(\$sp)
R11 [t3]	= 9	[00400044] 23bdffe0 addi \$29, \$29, -32	: 198: addi \$sp, \$sp, -32
R12 [t4]	= 0	[00400048] afbffffc sw \$31, -4(\$29)	: 199: sw \$ra, -4(\$sp)
R13 [t5]	= 0	[0040004c] 23bdfffc addi \$29, \$29, -4	: 200: addi \$sp, \$sp, -4
R14 [t6]	= 0	[00400050] 34020001 ori \$2, \$0, 1	: 201: li \$v0, 1
R15 [t7]	= 0	[00400054] 0000000c syscall	: 202: syscall
R16 [s0]	= 0	[00400058] 23bd0004 addi \$29, \$29, 4	: 203: addi \$sp, \$sp, 4
R17 [s1]	= 0	[0040005c] 8fbffffc lw \$31, -4(\$29)	: 204: lw \$ra, -4(\$sp)
R18 [s2]	= 0	[00400060] 23bd0020 addi \$29, \$29, 32	: 205: addi \$sp, \$sp, 32
R19 [s3]	= 0	[00400064] 8fb0fffc lw \$16, -4(\$29)	: 206: lw \$s0, -4(\$sp)
R20 [s4]	= 0	[00400068] 8fb1ffff lw \$17, -8(\$29)	: 207: lw \$s1, -8(\$sp)
R21 [s5]	= 0	[0040006c] 8fb2ffff lw \$18, -12(\$29)	: 208: lw \$s2, -12(\$sp)
R22 [s6]	= 0	[00400070] 8fb3ffff lw \$19, -16(\$29)	: 209: lw \$s3, -16(\$sp)
R23 [s7]	= 0	[00400074] 8fb4ffec lw \$20, -20(\$29)	: 210: lw \$s4, -20(\$sp)
R24 [t8]	= 1	[00400078] 8fb5ffe8 lw \$21, -24(\$29)	: 211: lw \$s5, -24(\$sp)
R25 [t9]	= 10010010	[0040007c] 8fb6ffe4 lw \$22, -28(\$29)	: 212: lw \$s6, -28(\$sp)
R26 [k0]	= 0	[00400080] 8fb7ffe0 lw \$23, -32(\$29)	: 213: lw \$s7, -32(\$sp)
R27 [k1]	= 0	[00400084] 03e00008 jr \$31	: 214: jr \$ra

Console output: 40320

Code/Files	Instructions	Read	Write	Branches	Other
factorial.tiger.naive.s	402	92	56	21	233
factorial.tiger.cfg.s	408	79	65	21	243

There is 16.46% improvement in the number of read operations in the cfg implementation.