

(1)before:

Int Regs [10]		Text
PC	= 0	syscall [004000a0] 0000000c syscall ; 35: syscall # Exit
EPC	= 0	
Cause	= 0	
BadVAddr	= 0	
Status	= 805371664	
HI	= 0	Kernel Text Segment [80000000]..[80010000]
LO	= 0	
R0 [r0]	= 0	[80000180] 0001d821 addu \$27, \$0, \$1 ; 90: move \$k1 \$at # Save \$at
R1 [at]	= 0	[80000184] 3c019000 lui \$1, -28672 ; 92: sw \$v0 s1 # Not re-entrant and we can't tr
R2 [v0]	= 0	\$sp
R3 [v1]	= 0	[80000188] ac220200 sw \$2, 512(\$1)
R4 [a0]	= 0	[8000018c] 3c019000 lui \$1, -28672 ; 93: sw \$a0 s2 # But we need to use these regis
R5 [a1]	= 0	[80000190] ac240204 sw \$4, 516(\$1)
R6 [a2]	= 0	[80000194] 401a6800 mfc0 \$26, \$13 ; 95: mfc0 \$k0 \$13 # Cause register
R7 [a3]	= 0	[80000198] 001a2082 srl \$4, \$26, 2 ; 96: srl \$a0 \$k0 2 # Extract ExcCode Field
R8 [t0]	= 0	[8000019c] 3084001f andi \$4, \$4, 31 ; 97: andi \$a0 \$a0 0x1f
R9 [t1]	= 0	[800001a0] 34020004 ori \$2, \$0, 4 ; 101: li \$v0 4 # syscall 4 (print_str)
R10 [t2]	= 0	[800001a4] 3c049000 lui \$4, -28672 [__m1_] ; 102: la \$a0 __m1_
R11 [t3]	= 0	[800001a8] 0000000c syscall ; 103: syscall
R12 [t4]	= 0	[800001ac] 34020001 ori \$2, \$0, 1 ; 105: li \$v0 1 # syscall 1 (print_int)
R13 [t5]	= 0	[800001b0] 001a2082 srl \$4, \$26, 2 ; 106: srl \$a0 \$k0 2 # Extract ExcCode Field
R14 [t6]	= 0	[800001b4] 3084001f andi \$4, \$4, 31 ; 107: andi \$a0 \$a0 0x1f
R15 [t7]	= 0	[800001b8] 0000000c syscall ; 108: syscall
R16 [s0]	= 0	[800001bc] 34020004 ori \$2, \$0, 4 ; 110: li \$v0 4 # syscall 4 (print_str)
R17 [s1]	= 0	[800001c0] 3344003c andi \$4, \$26, 60 ; 111: andi \$a0 \$k0 0x3c
R18 [s2]	= 0	[800001c4] 3c019000 lui \$1, -28672 ; 112: lw \$a0 __excp(\$a0)
R19 [s3]	= 0	[800001c8] 00240821 addu \$1, \$1, \$4
R20 [s4]	= 0	[800001cc] 8c240180 lw \$4, 384(\$1)
R21 [s5]	= 0	[800001d0] 00000000 nop ; 113: nop
R22 [s6]	= 0	[800001d4] 0000000c syscall ; 114: syscall
R23 [s7]	= 0	[800001d8] 34010018 ori \$1, \$0, 24 ; 116: bne \$k0 0x18 ok_pc # Bad PC exception req
		special checks
		[800001dc] 143a0008 bne \$1, \$26, 32 [ok_pc-0x800001dc]
		[800001e0] 00000000 nop ; 117: nop
		[800001e4] 40047000 mfc0 \$4, \$14 ; 119: mfc0 \$a0 \$14 # EPC
		[800001e8] 30840003 andi \$4, \$4, 3 ; 120: andi \$a0 \$a0 0x3 # Is EPC word-aligned?

Int Regs [10]		Data
PC	= 0	User data segment [10000000]..[10040000]
EPC	= 0	
Cause	= 0	
BadVAddr	= 0	
Status	= 805371664	
HI	= 0	User Stack [7ffff9bc]..[80000000]
LO	= 0	
R0 [r0]	= 0	[7ffff9bc] 00000001
R1 [at]	= 0	[7ffff9c0] 7ffffa77 00000000 7fffffd5 7fffffd4 w
R2 [v0]	= 0	[7ffff9d0] 7fffffb7 7fffffb3 7fffffa2 7fffffb8
R3 [v1]	= 0	[7ffff9e0] 7fffffa4 7fffff2e 7fffff0e 7ffffefe J
R4 [a0]	= 0	[7ffff9f0] 7ffffec8 7ffffea4 7ffffe92 7ffffe78 x
R5 [a1]	= 0	[7ffffa00] 7ffffe6a 7ffffe51 7ffffe3a 7ffffe23 j Q #
R6 [a2]	= 0	[7ffffa10] 7ffffe14 7ffffde8 7ffffd76 7ffffd08 v
R7 [a3]	= 0	[7ffffa20] 7ffffcd9 7ffffc8a 7ffffca3 7ffffc8c
R8 [t0]	= 0	[7ffffa30] 7ffffc81 7ffffc70 7ffffc4f 7ffffc34 p 0 4
R9 [t1]	= 0	[7ffffa40] 7ffffc20 7ffffbea 7ffffbc9 7ffffba0
R10 [t2]	= 0	[7ffffa50] 7ffffb90 7ffffb7d 7ffffb6b 7ffffb53) k S
R11 [t3]	= 0	[7ffffa60] 7ffffb41 7ffffb31 7ffffadc 7ffffaaf A 1
R12 [t4]	= 0	[7ffffa70] 00000000 2f000000 656d6f68 7562642f / h o m e / d b u
R13 [t5]	= 0	[7ffffa80] 622f7473 75627469 74656b63 3230322f s t / b i t b u c k e t / 2 0 2
R14 [t6]	= 0	[7ffffa90] 61665f31 655f6c6c 31657063 6c2f3037 1 _ f a l l _ e c p e 1 7 0 / 1
R15 [t7]	= 0	[7ffffaa0] 30316261 7261702f 612e3274 58006d73 a b 1 0 / p a r t 2 . a s m . X
R16 [s0]	= 0	[7ffffab0] 435f4744 49464e4f 49445f47 2f3d5352 D G _ C O N F I G _ D I R S = /
R17 [s1]	= 0	[7ffffac0] 2f637465 2d676478 2d676478 6e756275 e t c / x d g / x d g - u b u n
R18 [s2]	= 0	[7ffffad0] 2f3a7574 2d637465 00676478 5f474458 t u : / e t c / x d g . X D G _
R19 [s3]	= 0	[7ffffae0] 41544144 5249445f 752f3d53 732f7273 D A T A _ D I R S = / u s r / s
R20 [s4]	= 0	[7ffffaf0] 65726168 7562752f 3a75746e 7273752f h a r e / u b u n t u : / u s r
R21 [s5]	= 0	[7ffffb00] 636f6c2f 732f6c61 65726168 752f3a2f / l o c a l / s h a r e / : / u
R22 [s6]	= 0	[7ffffb10] 732f7273 65726168 762f3a2f 6c2f7261 s r / s h a r e / : / v a r / l
R23 [s7]	= 0	[7ffffb20] 732f6269 6470616e 7365642f 706f746b i b / s n a p d / d e s k t o p
		[7ffffb30] 44575000 6f682f3d 642f656d 74737562 . P W D = / h o m e / d b u s t
		[7ffffb40] 5f545100 4d5f4d49 4c55444f 62693d45 . Q T _ I M _ M O D U L E = i b
		[7ffffb50] 47007375 445f534a 47554245 54554f5f u s . G J S _ D E B U G _ O U T
		[7ffffb60] 3d545550 65647473 47007272 45534d44 P U T = s t d e r r . G D M S E
		[7ffffb70] 4f495353 62753d4e 75746e75 5f545100 S S I O N = u b u n t u . Q T _

(2) after:

FP Regs **Int Regs [10]** Data Text

Int Regs [10]

PC = 4194408
 EPC = 0
 Cause = 0
 BadVAddr = 0
 Status = 805371664

HI = 0
 LO = 0

R0 [r0] = 0
 R1 [at] = 268500992
 R2 [v0] = 10
 R3 [v1] = 0
 R4 [a0] = 1
 R5 [a1] = 2147482048
 R6 [a2] = 2147482056
 R7 [a3] = 0
 R8 [t0] = 25
 R9 [t1] = 5
 R10 [t2] = 15
 R11 [t3] = 8
 R12 [t4] = 30
 R13 [t5] = 7
 R14 [t6] = 0
 R15 [t7] = 0
 R16 [s0] = 15
 R17 [s1] = 10
 R18 [s2] = 7
 R19 [s3] = 2
 R20 [s4] = 18
 R21 [s5] = -3
 R22 [s6] = 37
 R23 [s7] = 0

Text

User Text Segment [00400000]..[00440000]

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[00400000] 8fa40000 lw $4, 0($29)           ; 183: lw $a0 0($sp) # argc
[00400004] 27a50004 addiu $5, $29, 4         ; 184: addiu $a1 $sp 4 # argv
[00400008] 24a60004 addiu $6, $5, 4         ; 185: addiu $a2 $a1 4 # envp
[0040000c] 00041080 sll $2, $4, 2           ; 186: sll $v0 $a0 2
[00400010] 00c23021 addu $6, $6, $2         ; 187: addu $a2 $a2 $v0
[00400014] 0c100009 jal 0x00400024 [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)
[00400024] 2010000f addi $16, $0, 15           ; 9: addi $s0, $zero, 15 #s0 = A = 15
[00400028] 2011000a addi $17, $0, 10         ; 10: addi $s1, $zero, 10 #s1 = B = 10
[0040002c] 20120007 addi $18, $0, 7           ; 11: addi $s2, $zero, 7 #s2 = C = 7
[00400030] 20130002 addi $19, $0, 2           ; 12: addi $s3, $zero, 2 #s3 = D = 15
[00400034] 20140012 addi $20, $0, 18        ; 13: addi $s4, $zero, 18 #s4 = E = 15
[00400038] 2015fffd addi $21, $0, -3        ; 14: addi $s5, $zero, -3 #s5 = F = 15
[0040003c] 20160000 addi $22, $0, 0         ; 15: addi $s6, $zero, 0 #s6 = Z = 0
[00400040] 02114020 add $8, $16, $17          ; 16: add $t0, $s0, $s1 #t0 = A+B
[00400044] 02534822 sub $9, $18, $19         ; 17: sub $t1, $s2, $s3 #t1 = C-D
[00400048] 02955020 add $10, $20, $21         ; 18: add $t2, $s4, $s5 #t2 = E+F
[0040004c] 02125822 sub $11, $16, $18        ; 19: sub $t3, $s0, $s2 #t3 = A-C
[00400050] 01096020 add $12, $8, $9           ; 20: add $t4, $t0, $t1 #t4 = (A+B) + (C-D)
[00400054] 014b6822 sub $13, $10, $11        ; 21: sub $t5, $t2, $t3 #t5 = (E+F) - (A-C)
[00400058] 018db020 add $22, $12, $13        ; 22: add $s6, $t4, $t5 #Z = (A+B) + (C-D) + (E+F) -
(A-C)
[0040005c] 3c011001 lui $1, 4097 [Z]          ; 23: sw $s6, Z
[00400060] ac360000 sw $22, 0($1) [Z]
[00400064] 3402000a ori $2, $0, 10          ; 26: li $v0, 10 # Sets $v0 to "10" to select exit
syscall
[00400068] 0000000c syscall                  ; 27: syscall # Exit

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Kernel Text Segment [80000000]..[80010000]

(3)before

The screenshot displays the MARS MIPS assembler interface. The 'Text' tab is active, showing the assembly code for a program. The code is organized into a list of instructions, each with a register number, a hexadecimal address, and the assembly instruction itself. Comments are provided for many instructions to explain their purpose. The register window on the left shows the state of registers R0 through R23, with R0-R7 containing zeros and R8-R23 containing various values.

Register	Value
R0	0
R1	0
R2	0
R3	0
R4	0
R5	0
R6	0
R7	0
R8	0
R9	0
R10	0
R11	0
R12	0
R13	0
R14	0
R15	0
R16	0
R17	0
R18	0
R19	0
R20	0
R21	0
R22	0
R23	0

```

User Text Segment [00400000]..[00440000]
[00400000] 8fa40000 lw $4, 0($29) ; 183: lw $a0 0($sp) # argc
[00400004] 27a50004 addiu $5, $29, 4 ; 184: addiu $a1 $sp 4 # argv
[00400008] 24a60004 addiu $6, $5, 4 ; 185: addiu $a2 $a1 4 # envp
[0040000c] 00041080 sll $2, $4, 2 ; 186: sll $v0 $a0 2
[00400010] 00c23021 addu $6, $6, $2 ; 187: addu $a2 $a2 $v0
[00400014] 0c100009 jal 0x00400024 [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)
[00400024] 20100010 addi $16, $0, 16 ; 6: addi $s0, $zero, 16 #s0 A=16;
[00400028] 2011000f addi $17, $0, 15 ; 7: addi $s1, $zero, 15 #s1 B=15;
[0040002c] 20120006 addi $18, $0, 6 ; 8: addi $s2, $zero, 6 #s2 C=6;
[00400030] 20130000 addi $19, $0, 0 ; 9: addi $s3, $zero, 0 #s3 Z=0;
[00400034] 0230082a slt $1, $17, $16 ; 11: bgt $s0, $s1, path1 # if(A > B ||
[00400038] 14200007 bne $1, $0, 28 [path1-0x00400038]
[0040003c] 2a410005 slti $1, $18, 5 ; 12: blt $s2, 5, path1 #C
[00400040] 14200005 bne $1, $0, 20 [path1-0x00400040]
[00400044] 0230082a slt $1, $17, $16 ; 13: bgt $s0, $s1, path2 #else if((A > B)
[00400048] 14200005 bne $1, $0, 20 [path2-0x00400048]
[0040004c] 20130003 addi $19, $0, 3 ; 14: addi $s3, $zero, 3 #else z = 3
[00400050] 0810001c j 0x00400070 [part2] ; 15: j part2
[00400054] 20130001 addi $19, $0, 1 ; 19: addi $s3, $zero, 1 #Z = 1
[00400058] 0810001c j 0x00400070 [part2] ; 20: j part2
[0040005c] 22480001 addi $8, $18, 1 ; 21: addi $t0, $s2, 1 #t0 = C+1
[00400060] 34010007 ori $1, $0, 7 ; 22: beq $t0, 7, path22 #&& ((C+1) == 7))
[00400064] 10280002 beq $1, $8, 8 [path22-0x00400064]
[00400068] 08100013 j 0x0040004c [path3] ; 23: j path3
[0040006c] 20130002 addi $19, $0, 2 ; 24: addi $s3, $zero, 2 #Z = 2
[00400070] 34010001 ori $1, $0, 1 ; 26: beq $s3, 1, case1 #switch case 1
[00400074] 10330005 beq $1, $19, 20 [case1-0x00400074]
[00400078] 34010002 ori $1, $0, 2 ; 27: beq $s3, 2, case2 #switch case 2
[0040007c] 10330005 beq $1, $19, 20 [case2-0x0040007c]
  
```

FP Regs **nt Regs [10]** Data Text

Int Regs [10]

PC = 0
EPC = 0
Cause = 0
BadVAddr = 0
Status = 805371664

HI = 0
LO = 0

R0 [r0] = 0
R1 [at] = 0
R2 [v0] = 0
R3 [v1] = 0
R4 [a0] = 0
R5 [a1] = 0
R6 [a2] = 0
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0

User data segment [10000000]..[10040000]
[10000000]..[1003ffff] 00000000

User Stack [7ffff9bc]..[80000000]

[7ffff9bc]	00000001				. . . .
[7ffff9c0]	7ffffa77	00000000	7fffffd5	7fffffd4	w
[7ffff9d0]	7fffffb3	7fffffb3	7fffffa2	7ffff8b	. . . . .
[7ffff9e0]	7fffff4a	7fffff2e	7fffff0e	7ffffefe	J
[7ffff9f0]	7ffffec8	7ffffea4	7ffffe92	7ffffe78	. . . . . x . . .
[7ffffa00]	7ffffe6a	7ffffe51	7ffffe3a	7ffffe23	j Q # . . .
[7ffffa10]	7ffffe14	7ffffde8	7ffffd76	7ffffd08	. . . . . v
[7ffffa20]	7ffffcd9	7ffffc3a	7ffffca3	7ffffc8c	. . . . .
[7ffffa30]	7ffffc81	7ffffc70	7ffffc4f	7ffffc34	. . . . p O 4 . . .
[7ffffa40]	7ffffc20	7ffffbea	7ffffbc9	7ffffba0	. . . . .
[7ffffa50]	7ffffb90	7ffffb7d	7ffffb6b	7ffffb53	. . . . } . . . . k S . . .
[7ffffa60]	7ffffb10	7ffffb31	7ffffadc	7ffffaaf	A 1
[7ffffa70]	00000000	2f000000	656d6f68	7562642f	. . . . . / h o m e / d b u
[7ffffa80]	622f7473	75627469	74656b63	3230322f	s t / b i t b u c k e t / 2 0 2
[7ffffa90]	61665f31	655f6c6c	31657063	6c2f3037	1 _ f a l l _ e c p e 1 7 0 / 1
[7ffffaa0]	30316261	7261702f	612e3274	58006d73	a b 1 0 / p a r t 2 . a s m . X
[7ffffab0]	435f4744	49464e4f	49445f47	2f3d5352	D G _ C O N F I G _ D I R S = /
[7ffffac0]	2f637465	2f676478	2d676478	6e756275	e t c / x d g / x d g - u b u n
[7ffffad0]	2f3a7574	2f637465	00676478	5f474458	t u : / e t c / x d g . X D G _
[7ffffae0]	41544144	5249445f	752f3d53	732f7273	D A T A _ D I R S = / u s r / s
[7ffffaf0]	65726168	7562752f	3a75746e	7273752f	h a r e / u b u n t u : / u s r
[7ffffb00]	636f6c2f	732f6c61	65726168	752f3a2f	/ l o c a l / s h a r e / : / u
[7ffffb10]	732f7273	65726168	762f3a2f	6c2f7261	s r / s h a r e / : / v a r / 1
[7ffffb20]	732f6269	6470616e	7365642f	706f746b	i b / s n a p d / d e s k t o p
[7ffffb30]	44575000	6f682f3d	642f656d	74737562	. P W D = / h o m e / d b u s t
[7ffffb40]	5f545100	4d5f4d49	4c55444f	62693d45	. Q T _ I M _ M O D U L E = i b
[7ffffb50]	47007375	445f534a	47554245	54554f5f	u s . G J S _ D E B U G _ O U T
[7ffffb60]	3d545550	65647473	47007272	45534d44	P U T = s t d e r r . G D M S E
[7ffffb70]	4f495353	62753d4e	75746e75	5f545100	S S I O N = u b u n t u . Q T _
[7ffffb80]	45434341	42495353	54494c49	00313d59	A C C E S S I B I L I T Y = 1 .
[7ffffb90]	4c454853	622f3d4c	622f6e69	00687361	S H E L L = / b i n / b a s h .

(4) after

FP Regs	nt Regs [10]	Data	Text
Int Regs [10]		Text	
PC	= 4194464	[00400024] 2010000a	addi \$16, \$0, 10 ; 6: addi \$s0, \$zero, 10 #s0 A=10;
EPC	= 0	[00400028] 2011000f	addi \$17, \$0, 15 ; 7: addi \$s1, \$zero, 15 #s1 B=15;
Cause	= 0	[0040002c] 20120006	addi \$18, \$0, 6 ; 8: addi \$s2, \$zero, 6 #s2 C=6;
BadVAddr	= 0	[00400030] 20130000	addi \$19, \$0, 0 ; 9: addi \$s3, \$zero, 0 #s3 Z=0;
Status	= 805371664	[00400034] 0230082a	slt \$1, \$17, \$16 ; 11: bgt \$s0, \$s1, path1 # if(A > B ||
HI	= 0	[00400038] 14200007	bne \$1, \$0, 28 [path1-0x00400038]
LO	= 0	[0040003c] 2a410005	slti \$1, \$18, 5 ; 12: blt \$s2, 5, path1 #C
R0 [r0]	= 0	[00400040] 14200005	bne \$1, \$0, 20 [path1-0x00400040]
R1 [at]	= 268500992	[00400044] 0230082a	slt \$1, \$17, \$16 ; 13: bgt \$s0, \$s1, path2 #else if((A > B)
R2 [v0]	= 10	[00400048] 14200005	bne \$1, \$0, 20 [path2-0x00400048]
R3 [v1]	= 0	[0040004c] 20130003	addi \$19, \$0, 3 ; 14: addi \$s3, \$zero, 3 #else z = 3
R4 [a0]	= 1	[00400050] 0810001c	j 0x00400070 [part2] ; 15: j part2
R5 [a1]	= 2147482048	[00400054] 20130001	addi \$19, \$0, 1 ; 19: addi \$s3, \$zero, 1 #Z = 1
R6 [a2]	= 2147482056	[00400058] 0810001c	j 0x00400070 [part2] ; 20: j part2
R7 [a3]	= 0	[0040005c] 22480001	addi \$8, \$18, 1 ; 21: addi \$t0, \$s2, 1 #t0 = C+1
R8 [t0]	= 0	[00400060] 34010007	ori \$1, \$0, 7 ; 22: beq \$t0, 7, path22 #&& ((C+1) == 7))
R9 [t1]	= 0	[00400064] 10280002	beq \$1, \$8, 8 [path22-0x00400064]
R10 [t2]	= 0	[00400068] 08100013	j 0x0040004c [path3] ; 23: j path3
R11 [t3]	= 0	[0040006c] 20130002	addi \$19, \$0, 2 ; 24: addi \$s3, \$zero, 2 #Z = 2
R12 [t4]	= 0	[00400070] 34010001	ori \$1, \$0, 1 ; 26: beq \$s3, 1, case1 #switch case 1
R13 [t5]	= 0	[00400074] 10330005	beq \$1, \$19, 20 [case1-0x00400074]
R14 [t6]	= 0	[00400078] 34010002	ori \$1, \$0, 2 ; 27: beq \$s3, 2, case2 #switch case 2
R15 [t7]	= 0	[0040007c] 10330005	beq \$1, \$19, 20 [case2-0x0040007c]
R16 [s0]	= 10	[00400080] 20130000	addi \$19, \$0, 0 ; 28: addi \$s3, \$zero, 0 #default Z = 0
R17 [s1]	= 15	[00400084] 08100025	j 0x00400094 [end] ; 29: j end
R18 [s2]	= 6	[00400088] 2013ffff	addi \$19, \$0, -1 ; 30: addi \$s3, \$zero, -1 #Z = -1
R19 [s3]	= 0	[0040008c] 08100025	j 0x00400094 [end] ; 31: j end
R20 [s4]	= 0	[00400090] 2013fffe	addi \$19, \$0, -2 ; 32: addi \$s3, \$zero, -2 #Z = -2
R21 [s5]	= 0	[00400094] 3c011001	lui \$1, 4097 [Z] ; 33: sw \$s3, Z
R22 [s6]	= 0	[00400098] ac330000	sw \$19, 0(\$1) [Z]
R23 [s7]	= 0	[0040009c] 3402000a	ori \$2, \$0, 10 ; 34: li \$v0, 10 # Sets \$v0 to "10" to select exit
		syscall	
		[004000a0] 0000000c	syscall ; 35: syscall # Exit

FP Regs **nt Regs [10]** **Data** Text

Int Regs [10]

PC = 4194464
EPC = 0
Cause = 0
BadVAddr = 0
Status = 805371664

HI = 0
LO = 0

R0 [r0] = 0
R1 [at] = 268500992
R2 [v0] = 10
R3 [v1] = 0
R4 [a0] = 1
R5 [a1] = 2147482048
R6 [a2] = 2147482056
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 10
R17 [s1] = 15
R18 [s2] = 6
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0

User data segment [10000000]..[10040000]
[10000000]..[1003ffff] 00000000

User Stack [7ffff9bc]..[80000000]

[7ffff9bc]	00000001				. . . .
[7ffff9c0]	7ffffa77	00000000	7fffffd4	7fffffd4	w
[7ffff9d0]	7ffffbb	7ffffb3	7ffffa2	7ffff8b	. . . . .
[7ffff9e0]	7ffff4a	7ffff2e	7ffff0e	7ffffefe	J
[7ffff9f0]	7ffffec8	7ffffea4	7ffffe92	7ffffe78	. . . . . x . . .
[7ffffa00]	7ffffe6a	7ffff51	7ffff3a	7ffffe23	j Q # . . .
[7ffffa10]	7ffffe14	7ffffde8	7ffffd76	7ffffd08	. . . . . v
[7ffffa20]	7ffffcd9	7ffffcba	7ffffca3	7ffffc8c	. . . . .
[7ffffa30]	7ffffc81	7ffffc70	7ffffc4f	7ffffc34	. . . . . p O 4 . . .
[7ffffa40]	7ffffc20	7ffffbea	7ffffbc9	7ffffba0	. . . . .
[7ffffa50]	7ffffb90	7ffffb7d	7ffffb6b	7ffffb53	. . . . . } . . . . . k S . . .
[7ffffa60]	7ffffb41	7ffffb31	7ffffadc	7ffffaaf	A 1
[7ffffa70]	00000000	2f000000	656d6f68	7562642f	. . . . . / h o m e / d b u
[7ffffa80]	622f7473	75627469	74656b63	3230322f	s t / b i t b u c k e t / 2 0 2
[7ffffa90]	61665f31	655f6c6c	31657063	6c2f3037	l _ f a l l _ e c p e l 7 0 / l
[7ffffaa0]	30316261	7261702f	612e3274	58006d73	a b l 0 / p a r t 2 . a s m . X
[7ffffab0]	435f4744	49464e4f	49445f47	2f3d5352	D G _ C O N F I G _ D I R S = /
[7ffffac0]	2f637465	2f676478	2d676478	6e756275	e t c / x d g / x d g - u b u n
[7ffffad0]	2f3a7574	2f637465	00676478	5f474458	t u : / e t c / x d g . X D G _
[7ffffae0]	41544144	5249445f	752f3d53	732f7273	D A T A _ D I R S = / u s r / s
[7ffffaf0]	65726168	7562752f	3a75746e	7273752f	h a r e / u b u n t u : / u s r
[7ffffb00]	636f6c2f	732f6c61	65726168	752f3a2f	/ l o c a l / s h a r e / : / u
[7ffffb10]	732f7273	65726168	762f3a2f	6c2f7261	s r / s h a r e / : / v a r / l
[7ffffb20]	732f6269	6470616e	7365642f	706f746b	i b / s n a p d / d e s k t o p
[7ffffb30]	44575000	6f682f3d	642f656d	74737562	. P W D = / h o m e / d b u s t
[7ffffb40]	5f545100	4d5f4d49	4c55444f	62693d45	. Q T _ I M _ M O D U L E = i b
[7ffffb50]	47007375	445f534a	47554245	54554f5f	u s . G J S _ D E B U G _ O U T
[7ffffb60]	3d545550	65647473	47007272	45534d44	P U T = s t d e r r . G D M S E
[7ffffb70]	4f495353	62753d4e	75746e75	5f545100	S S I O N = u b u n t u . Q T _
[7ffffb80]	45434341	42495353	54494c49	00313d59	A C C E S S I B I L I T Y = 1 .
[7ffffb90]	4c454853	622f3d4c	622f6e69	00687361	S H E L L = / b i n / b a s h .

(5)before

File Simulator Registers Text Segment Data Segment Window Help

FP Regs nt Regs [10] Data Text

Int Regs [10]

BadVAddr = 0
Status = 805371664

HI = 0
LO = 0

R0 [r0] = 0
R1 [at] = 0
R2 [v0] = 0
R3 [v1] = 0
R4 [a0] = 0
R5 [a1] = 0
R6 [a2] = 0
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0

Text

User Text Segment [00400000]..[00440000]

```
[00400000] 8fa40000 lw $4, 0($29) ; 183: lw $a0 0($sp) # argc
[00400004] 27a50004 addiu $5, $29, 4 ; 184: addiu $a1 $sp 4 # argv
[00400008] 24a60004 addiu $6, $5, 4 ; 185: addiu $a2 $a1 4 # envp
[0040000c] 00041080 sll $2, $4, 2 ; 186: sll $v0 $a0 2
[00400010] 00c23021 addu $6, $6, $2 ; 187: addu $a2 $a2 $v0
[00400014] 0c100009 jal 0x00400024 [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)
[00400024] 20100002 addi $s0, $zero, 2 # s0 = Z = 2
[00400028] 20080000 addi $8, $0, 0 ; 7: addi $t0, $zero, 0 # t0 = int i = 0
[0040002c] 29010015 slti $1, $8, 21 ; 8: bgt $t0, 20, part2 #while loop start, check if
(1 > 20)
[00400030] 10200004 beq $1, $0, 16 [part2-0x00400030]
[00400034] 22100001 addi $16, $16, 1 ; 9: addi $s0, $s0, 1 #z++
[00400038] 21080002 addi $8, $8, 2 ; 10: addi $t0, $t0, 2 #i+=2
[0040003c] 0810000b j 0x0040002c [while1] ; 11: j while1
[00400040] 2a010065 slti $1, $16, 101 ; 12: bgt $s0, 100, part3 # while(z
[00400044] 10200003 beq $1, $0, 12 [part3-0x00400044]
[00400048] 22100001 addi $16, $16, 1 ; 13: addi $s0, $s0, 1 #z++
[0040004c] 08100010 j 0x00400040 [part2] ; 14: j part2
[00400050] 29010000 slti $1, $8, 0 ; 16: blt $t0, 0, end # while( i > 0)
[00400054] 14200004 bne $1, $0, 16 [end-0x00400054]
[00400058] 2210ffff addi $16, $16, -1 ; 17: addi $s0, $s0, -1 #z--
[0040005c] 2108ffff addi $8, $8, -1 ; 18: addi $t0, $t0, -1 #i--
[00400060] 08100014 j 0x00400050 [part3] ; 19: j part3
[00400064] 3c011001 lui $1, 4097 [Z] ; 21: sw $s3, Z #write Z to our text integer Z
[00400068] ac330000 sw $19, 0($1) [Z]
[0040006c] 3402000a ori $2, $0, 10 ; 22: li $v0, 10 # Sets $v0 to "10" to select exit
syscall
[00400070] 0000000c syscall ; 23: syscall # Exit
```

FP Regs nt Regs [10] Data Text

Int Regs [10]

BadVAddr = 0
Status = 805371664

HI = 0
LO = 0

R0 [r0] = 0
R1 [at] = 0
R2 [v0] = 0
R3 [v1] = 0
R4 [a0] = 0
R5 [a1] = 0
R6 [a2] = 0
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
R24 [t8] = 0
R25 [t9] = 0
R26 [k0] = 0

Data

User data segment [10000000]..[10040000]

```
[10000000]..[1003ffff] 00000000
```

User Stack [7ffff9bc]..[80000000]

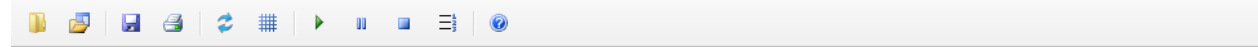
```
[7ffff9bc] 00000001 . . . .
[7ffff9c0] 7ffffa77 00000000 7fffffdf 7fffffd4 w . . . . .
[7ffff9d0] 7fffffb7 7fffffb3 7fffffa2 7fffffb8 . . . . .
[7ffff9e0] 7fffffa4 7fffffe2 7fffff0e 7fffffe8 J . . . . .
[7ffff9f0] 7fffffea 7ffffe92 7fffffe7 7fffffe8 . . . . . x . . .
[7ffffa00] 7ffffe6a 7ffffe51 7ffffe3a 7ffffe23 j . . . Q . . . : . . . # . . .
[7ffffa10] 7ffffe14 7ffffde8 7ffffd76 7ffffd08 . . . . . v . . . . .
[7ffffa20] 7ffffcd9 7ffffc8a 7ffffca3 7ffffc8c . . . . . . . . . .
[7ffffa30] 7ffffc81 7ffffc70 7ffffc4f 7ffffc34 . . . . p . . . O . . . 4 . . .
[7ffffa40] 7ffffc20 7ffffbea 7ffffbc9 7ffffba0 . . . . . . . . . .
[7ffffa50] 7ffffb90 7ffffb7d 7ffffb6b 7ffffb53 . . . . . ) . . . k . . . S . . .
[7ffffa60] 7ffffb41 7ffffb31 7ffffadc 7ffffaaf A . . . 1 . . . . . . . . .
[7ffffa70] 00000000 2f000000 656d6f68 7562642f . . . . . / h o m e / d b u
[7ffffa80] 622f7473 75627469 74656b63 3230322f s t / b i t b u c k e t / 2 0 2
[7ffffa90] 61665f31 655f6c6c 31657063 6c2f3037 1 _ f a l l _ e c p e 1 7 0 / 1
[7ffffaa0] 30316261 7261702f 612e3374 58006d73 a b 1 0 / p a r t 3 . a s m . X
[7ffffab0] 435f4744 49464e4f 49445f47 2f3d5352 D G _ C O N F I G _ D I R S = /
[7ffffac0] 2f637465 2f676478 2d676478 6e756275 e t c / x d g / x d g - u b u n
[7ffffad0] 2f3a7574 2f637465 00676478 5f474458 t u : / e t c / x d g . X D G _
[7ffffae0] 41544144 5249445f 752f3d53 732f7273 D A T A _ D I R S = / u s r / s
[7ffffaf0] 65726168 7562752f 3a75746e 7273752f h a r e / u b u n t u : / u s r
[7ffffb00] 636f6c2f 732f6c61 65726168 752f3a2f / l o c a l / s h a r e / : / u
[7ffffb10] 732f7273 65726168 762f3a2f 6c2f7261 s r / s h a r e / : / v a r / l
[7ffffb20] 732f6269 6470616e 7365642f 706f746b i b / s n a p d / d e s k t o p
[7ffffb30] 44575000 6f682f3d 642f656d 74737562 . P W D = / h o m e / d b u s t
[7ffffb40] 5f545100 4d5f4d49 4c55444f 62693d45 . Q T _ I M _ M O D U L E = i b
[7ffffb50] 47007375 445f534a 47554245 54554f5f u s . G J S _ D E B U G _ O U T
[7ffffb60] 3d545550 65647473 47007272 45534d44 P U T = s t d e r r . G D M S E
[7ffffb70] 4f495353 62753d4e 75746e75 5f545100 S S I O N = u b u n t u . Q T _
[7ffffb80] 45434341 42495353 54494c49 00313d59 A C C E S S I B I L I T Y = 1 .
[7ffffb90] 4c454853 622f3d4c 622f6e69 00687361 S H E L L = / b i n / b a s h .
```

(6) after

FP Regs	nt Regs [10]	Data	Text
Int Regs [10]			
BadVAddr	= 0		
Status	= 805371664		
HI	= 0		
LO	= 0		
R0 [r0]	= 0		
R1 [at]	= 268500992		
R2 [v0]	= 10		
R3 [v1]	= 0		
R4 [a0]	= 1		
R5 [a1]	= 2147482048		
R6 [a2]	= 2147482056		
R7 [a3]	= 0		
R8 [t0]	= -1		
R9 [t1]	= 0		
R10 [t2]	= 0		
R11 [t3]	= 0		
R12 [t4]	= 0		
R13 [t5]	= 0		
R14 [t6]	= 0		
R15 [t7]	= 0		
R16 [s0]	= 78		
R17 [s1]	= 0		
R18 [s2]	= 0		
R19 [s3]	= 0		
R20 [s4]	= 0		
R21 [s5]	= 0		
R22 [s6]	= 0		
R23 [s7]	= 0		
R24 [t8]	= 0		
R25 [t9]	= 0		
R26 [k0]	= 0		
		User Text Segment [00400000]..[00440000]	
		[00400000] 8fa40000 lw \$4, 0(\$29) ; 183: lw \$a0 0(\$sp) # argc	
		[00400004] 27a50004 addiu \$5, \$29, 4 ; 184: addiu \$a1 \$sp 4 # argv	
		[00400008] 24a60004 addiu \$6, \$5, 4 ; 185: addiu \$a2 \$a1 4 # envp	
		[0040000c] 00041080 sll \$2, \$4, 2 ; 186: sll \$v0 \$a0 2	
		[00400010] 00c23021 addu \$6, \$6, \$2 ; 187: addu \$a2 \$a2 \$v0	
		[00400014] 0c100009 jal 0x00400024 [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)	
		[00400024] 20100002 addi \$16, \$0, 2 ; 6: addi \$s0, \$zero, 2 # s0 = Z = 2	
		[00400028] 20080000 addi \$8, \$0, 0 ; 7: addi \$t0, \$zero, 0 # t0 = int i = 0	
		[0040002c] 29010015 slti \$1, \$8, 21 ; 8: bgt \$t0, 20, part2 #while loop start, check if (i > 20)	
		[00400030] 10200004 beq \$1, \$0, 16 [part2-0x00400030]	
		[00400034] 22100001 addi \$16, \$16, 1 ; 9: addi \$s0, \$s0, 1 #z++	
		[00400038] 21080002 addi \$8, \$8, 2 ; 10: addi \$t0, \$t0, 2 #i+=2	
		[0040003c] 0810000b j 0x0040002c [while1] ; 11: j while1	
		[00400040] 2a010065 slti \$1, \$16, 101 ; 12: bgt \$s0, 100, part3 # while(z	
		[00400044] 10200003 beq \$1, \$0, 12 [part3-0x00400044]	
		[00400048] 22100001 addi \$16, \$16, 1 ; 13: addi \$s0, \$s0, 1 #z++	
		[0040004c] 08100010 j 0x00400040 [part2] ; 14: j part2	
		[00400050] 29010000 slti \$1, \$8, 0 ; 16: blt \$t0, 0, end # while(i > 0)	
		[00400054] 14200004 bne \$1, \$0, 16 [end-0x00400054]	
		[00400058] 2210ffff addi \$16, \$16, -1 ; 17: addi \$s0, \$s0, -1 #z--	
		[0040005c] 2108ffff addi \$8, \$8, -1 ; 18: addi \$t0, \$t0, -1 #i--	
		[00400060] 08100014 j 0x00400050 [part3] ; 19: j part3	
		[00400064] 3c011001 lui \$1, 4097 [Z] ; 21: sw \$s3, Z #write Z to our text integer Z	
		[00400068] ac330000 sw \$19, 0(\$1) [Z]	
		[0040006c] 3402000a ori \$2, \$0, 10 ; 22: li \$v0, 10 # Sets \$v0 to "10" to select exit	
		syscall	
		[00400070] 0000000c syscall ; 23: syscall # Exit	

FP Regs	nt Regs [10]	Data	Text
Int Regs [10]		Data	
PC	= 4194424	User data segment [10000000]..[10040000]	
EPC	= 0	[10000000]..[1000ffff]	00000000
Cause	= 0	[10010000]	0000004e ffffffff 00000000 00000000 N
BadVAddr	= 0	[10010010]..[1003ffff]	00000000
Status	= 805371664		
HI	= 0	User Stack [7ffff9bc]..[80000000]	
LO	= 0		
R0 [r0]	= 0	[7ffff9bc]	00000001
R1 [at]	= 268500992	[7ffff9c0]	7ffffa77 00000000 7fffffd4 7fffffd4 w
R2 [v0]	= 10	[7ffff9d0]	7ffffbb 7ffffb3 7ffffa2 7ffff8b
R3 [v1]	= 0	[7ffff9e0]	7ffff4a 7ffff2e 7ffff0e 7ffffefe J
R4 [a0]	= 1	[7ffff9f0]	7ffffec8 7ffffea4 7ffffe92 7ffffe78 x . . .
R5 [a1]	= 2147482048	[7ffffa00]	7ffffe6a 7ffff51 7ffff3a 7ffff23 j . . . Q . . . : . . # . . .
R6 [a2]	= 2147482056	[7ffffa10]	7ffffe14 7ffffd8 7ffffd76 7ffffd08 v
R7 [a3]	= 0	[7ffffa20]	7ffffcd9 7ffffcba 7ffffca3 7ffffc8c
R8 [t0]	= -1	[7ffffa30]	7ffffc81 7ffffc70 7ffffc4f 7ffffc34 p . . . O . . . 4 . . .
R9 [t1]	= 0	[7ffffa40]	7ffffc20 7ffffbea 7ffffbc9 7ffffba0
R10 [t2]	= 0	[7ffffa50]	7ffffb90 7ffffb7d 7ffffb6b 7ffffb53 }
R11 [t3]	= 0	[7ffffa60]	7ffffb41 7ffffb31 7ffffadc 7ffffaaf A . . . 1
R12 [t4]	= 0	[7ffffa70]	00000000 2f000000 656d6f68 7562642f / h o m e / d b u
R13 [t5]	= 0	[7ffffa80]	622f7473 75627469 74656b63 3230322f s t / b i t b u c k e t / 2 0 2
R14 [t6]	= 0	[7ffffa90]	61665f31 655f6c6c 31657063 6c2f3037 1 _ f a l l _ e c p e 1 7 0 / 1
R15 [t7]	= 0	[7ffffaa0]	30316261 7261702f 612e3374 58006d73 a b 1 0 / p a r t 3 . a s m . X
R16 [s0]	= 78	[7ffffab0]	435f4744 49464e4f 49445f47 2f3d5352 D G _ C O N F I G _ D I R S = /
R17 [s1]	= 0	[7ffffac0]	2f637465 2f676478 2d676478 6e756275 e t c / x d g / x d g - u b u n
R18 [s2]	= 0	[7ffffad0]	2f3a7574 2f637465 00676478 5f474458 t u : / e t c / x d g . X D G _
R19 [s3]	= 0	[7ffffae0]	41544144 5249445f 752f3d53 732f7273 D A T A _ D I R S = / u s r / s
R20 [s4]	= 0	[7ffffaf0]	65726168 7562752f 3a75746e 7273752f h a r e / u b u n t u : / u s r
R21 [s5]	= 0	[7ffffb00]	636f6c2f 732f6c61 65726168 752f3a2f / l o c a l / s h a r e / : / u
R22 [s6]	= 0	[7ffffb10]	732f7273 65726168 762f3a2f 6c2f7261 s r / s h a r e / : / v a r / l
R23 [s7]	= 0	[7ffffb20]	732f6269 6470616e 7365642f 706f746b i b / s n a p d / d e s k t o p
		[7ffffb30]	44575000 6f682f3d 642f656d 74737562 . P W D = / h o m e / d b u s t
		[7ffffb40]	5f545100 4d5f4d49 4c55444f 62693d45 . Q T _ I M _ M O D U L E = i b
		[7ffffb50]	47007375 445f534a 47554245 54554f5f u s . G J S _ D E B U G _ O U T
		[7ffffb60]	3d545550 65647473 47007272 45534d44 P U T = s t d e r r . G D M S E
		[7ffffb70]	4f495353 62753d4e 75746e75 5f545100 S S I O N = u b u n t u . Q T

(7)before:



FP Regs **nt Regs [10]** **Data** Text

nt Regs [10] Data

```
PC = 0
EPC = 0
Cause = 0
BadVAddr = 0
Status = 805371664

HI = 0
LO = 0
```

```
x0 [r0] = 0
x1 [at] = 0
x2 [v0] = 0
x3 [v1] = 0
x4 [a0] = 0
x5 [a1] = 0
x6 [a2] = 0
x7 [a3] = 0
x8 [t0] = 0
x9 [t1] = 0
x10 [t2] = 0
x11 [t3] = 0
x12 [t4] = 0
x13 [t5] = 0
x14 [t6] = 0
x15 [t7] = 0
x16 [s0] = 0
x17 [s1] = 0
x18 [s2] = 0
x19 [s3] = 0
x20 [s4] = 0
x21 [s5] = 0
x22 [s6] = 0
x23 [s7] = 0
```

```
User data segment [10000000]..[10040000]
[10000000]..[1000ffff] 00000000
[10010000] 0000000026 0000000028 0000000030 0000000032 . . . . .
[10010010] 0000000034 0000000001 0000000002 0000000003 " . . . . .
[10010020] 0000000004 0000000005 0000000000 0000000000 . . . . .
[10010030]..[1003ffff] 00000000
```

```
User Stack [7ffff9bc]..[80000000]
[7ffff9bc] 0000000001 . . . . .
[7ffff9c0] 2147482230 0000000000 2147483615 2147483604 v . . . . .
[7ffff9d0] 2147483579 2147483571 2147483554 2147483531 . . . . .
[7ffff9e0] 2147483466 2147483438 2147483406 2147483390 J . . . . .
[7ffff9f0] 2147483336 2147483299 2147483281 2147483255 . . . . . W . . . .
[7ffffa00] 2147483241 2147483216 2147483193 2147483170 i . . . . P . . . . 9 . . . . " . . . .
[7ffffa10] 2147483155 2147483111 2147482997 2147482887 . . . . . u . . . . .
[7ffffa20] 2147482840 2147482809 2147482786 2147482763 . . . . .
[7ffffa30] 2147482752 2147482735 2147482702 2147482675 . . . . . o . . . . N . . . . 3 . . . .
[7ffffa40] 2147482655 2147482601 2147482568 2147482527 . . . . .
[7ffffa50] 2147482511 2147482492 2147482474 2147482450 . . . . . | . . . . j . . . . R . . . .
[7ffffa60] 2147482432 2147482416 2147482331 2147482286 @ . . . . 0 . . . . .
[7ffffa70] 0000000000 1747910656 0795176303 1937072740 . . . . . / h o m e / d b u s
[7ffffa80] 1768042356 1668637300 0796157291 0825372722 t / b i t b u c k e t / 2 0 2 1
[7ffffa90] 1818322527 1667587948 0925984112 1634479920 _ f a l l _ e c p e l 7 0 / l a
[7ffffaa0] 0791687522 1953653104 1935748660 1146617965 b l 0 / p a r t 4 . a s m . X D
[7ffffab0] 1329815367 1195984462 1380533343 1697594707 G _ C O N F I G _ D I R S = / e
[7ffffac0] 2016371572 2016372580 1965909860 1953396066 t c / x d g / x d g - u b u n t
[7ffffad0] 1697593973 2016371572 1476421476 1147094852 u : / e t c / x d g . X D G _ D
[7ffffae0] 1598116929 1397901636 1937059645 1752379250 A T A _ D I R S = / u s r / s h
[7ffffaf0] 0795177569 1853186677 0792360308 0796029813 a r e / u b u n t u : / u s r /
[7ffffb00] 1633906540 1752379244 0795177569 1937059642 l o c a l / s h a r e / : / u s
[7ffffb10] 1752379250 0795177569 1635135290 1768697714 r / s h a r e / : / v a r / l i
[7ffffb20] 1853042530 0795111521 1802724708 0007368564 b / s n a p d / d e s k t o p .
[7ffffb30] 1027888976 1836017711 1650732901 0007631733 P W D = / h o m e / d b u s t .
[7ffffb40] 1230984273 1330470733 1162630468 1969383741 Q T _ I M _ M O D U L E = i b u
[7ffffb50] 1246167155 1162108755 1598510402 1347704143 s . G J S D E B U G O U T P
```

nt Regs [10] Text

```
PC = 0
EPC = 0
Cause = 0
BadVAddr = 0
Status = 805371664

HI = 0
LO = 0

R0 [r0] = 0
R1 [at] = 0
R2 [v0] = 0
R3 [v1] = 0
R4 [a0] = 0
R5 [a1] = 0
R6 [a2] = 0
R7 [a3] = 0
R8 [t0] = 0
R9 [t1] = 0
R10 [t2] = 0
R11 [t3] = 0
R12 [t4] = 0
R13 [t5] = 0
R14 [t6] = 0
R15 [t7] = 0
R16 [s0] = 0
R17 [s1] = 0
R18 [s2] = 0
R19 [s3] = 0
R20 [s4] = 0
R21 [s5] = 0
R22 [s6] = 0
R23 [s7] = 0
```

```
[00400040] aec80004 sw $8, 4($22) ; 10: sw $t0, 4($s6) #B[1] = 2
[00400044] 20080003 addi $8, $0, 3 ; 11: addi $t0, $zero, 3 #load value for B[2]
[00400048] aec80008 sw $8, 8($22) ; 12: sw $t0, 8($s6) #B[2] = 3
[0040004c] 20080004 addi $8, $0, 4 ; 13: addi $t0, $zero, 4 #load value for B[3]
[00400050] aec8000c sw $8, 12($22) ; 14: sw $t0, 12($s6) #B[3] = 4
[00400054] 20080005 addi $8, $0, 5 ; 15: addi $t0, $zero, 5 #load value for B[4]
[00400058] aec80010 sw $8, 16($22) ; 16: sw $t0, 16($s6) #B[4] = 5
[0040005c] 20080000 addi $8, $0, 0 ; 17: addi $t0, $zero, 0 #int i = 0
[00400060] 2012000c addi $18, $0, 12 ; 19: addi $s2, $zero, 12 # C = 12
[00400064] 29010005 slti $1, $8, 5 ; 20: bgt $t0, 4, part2 #if i > 4 exit the loop
[00400068] 1020000a beq $1, $0, 40 [part2-0x00400068]
[0040006c] 01084820 add $9, $8, $8 ; 21: add $t1, $t0, $t0 #t1 = 2i
[00400070] 01294820 add $9, $9, $9 ; 22: add $t1, $t1, $t1 #t1 = 4i
[00400074] 0136b820 add $23, $9, $22 ; 23: add $s7, $t1, $s6 # (arrayB + i)
[00400078] 8ef70000 lw $23, 0($23) ; 24: lw $s7, 0($s7) #*(arrayB + i)
[0040007c] 02f2b820 add $23, $23, $18 ; 25: add $s7, $s7, $s2 #*(arrayB+i) + C
[00400080] 02095020 add $10, $16, $9 ; 26: add $t2, $s0, $t1 # (arrayA + i)
[00400084] ad570000 sw $23, 0($10) ; 27: sw $s7, 0($t2) #A[i] = B[i] + C
[00400088] 21080001 addi $8, $8, 1 ; 28: addi $t0, $t0, 1 #i++
[0040008c] 08100019 j 0x00400064 [for] ; 29: j for
[00400090] 2108ffff addi $8, $8, -1 ; 31: addi $t0, $t0, -1 #i--
[00400094] 29010000 slti $1, $8, 0 ; 32: blt $t0, 0, endmain
[00400098] 14200009 bne $1, $0, 36 [endmain-0x00400098]
[0040009c] 01084820 add $9, $8, $8 ; 33: add $t1, $t0, $t0 #t1 = 2i
[004000a0] 01294820 add $9, $9, $9 ; 34: add $t1, $t1, $t1 #t1 = 4i
[004000a4] 02095020 add $10, $16, $9 ; 35: add $t2, $s0, $t1 # (arrayA + i)
[004000a8] 8d4b0000 lw $11, 0($10) ; 36: lw $t3, 0($t2) # *(arrayA + i)
[004000ac] 016b5820 add $11, $11, $11 ; 37: add $t3, $t3, $t3 #t3 = 2 * A[i]
[004000b0] ad4b0000 sw $11, 0($10) ; 38: sw $t3, 0($t2) #A[i] = A[i] * 2
[004000b4] 2108ffff addi $8, $8, -1 ; 39: addi $t0, $t0, -1 #i--
[004000b8] 08100025 j 0x00400094 [while] ; 40: j while
[004000bc] 3402000a ori $2, $0, 10 ; 44: li $v0, 10
```

(8) after:

FP Regs	nt Regs [10]	Data	Text
nt Regs [10]		Text	
PC	= 4194496	[00400040] aec80004	sw \$8, 4(\$22) ; 10: sw \$t0, 4(\$s6) #B[1] = 2
EPC	= 0	[00400044] 20080003	addi \$8, \$0, 3 ; 11: addi \$t0, \$zero, 3 #load value for B[2]
Cause	= 0	[00400048] aec80008	sw \$8, 8(\$22) ; 12: sw \$t0, 8(\$s6) #B[2] = 3
BadVAddr	= 0	[0040004c] 20080004	addi \$8, \$0, 4 ; 13: addi \$t0, \$zero, 4 #load value for B[3]
Status	= 805371664	[00400050] aec8000c	sw \$8, 12(\$22) ; 14: sw \$t0, 12(\$s6) #B[3] = 4
HI	= 0	[00400054] 20080005	addi \$8, \$0, 5 ; 15: addi \$t0, \$zero, 5 #load value for B[4]
LO	= 0	[00400058] aec80010	sw \$8, 16(\$22) ; 16: sw \$t0, 16(\$s6) #B[4] = 5
		[0040005c] 20080000	addi \$8, \$0, 0 ; 17: addi \$t0, \$zero, 0 # int i = 0
		[00400060] 2012000c	addi \$18, \$0, 12 ; 19: addi \$s2, \$zero, 12 # C = 12
		[00400064] 29010005	slli \$1, \$8, 5 ; 20: bgt \$t0, 4, part2 #if i > 4 exit the loop
		[00400068] 1020000a	beq \$1, \$0, 40 [part2-0x00400068]
		[0040006c] 01084820	add \$9, \$8, \$8 ; 21: add \$t1, \$t0, \$t0 #t1 = 2i
		[00400070] 01294820	add \$9, \$9, \$9 ; 22: add \$t1, \$t1, \$t1 #t1 = 4i
		[00400074] 0136b820	add \$23, \$8, \$22 ; 23: add \$s7, \$t1, \$s6 # (arrayB + i)
		[00400078] 8ef70000	lw \$23, 0(\$23) ; 24: lw \$s7, 0(\$s7) #*(arrayB + i)
		[0040007c] 02f2b820	add \$23, \$23, \$18 ; 25: add \$s7, \$s7, \$s2 #*(arrayB+i) + C
		[00400080] 02095020	add \$10, \$16, \$9 ; 26: add \$t2, \$s0, \$t1 # (arrayA + i)
		[00400084] ad570000	sw \$23, 0(\$t2) ; 27: sw \$s7, 0(\$t2) #A[i] = B[i] + C
		[00400088] 21080001	addi \$8, \$8, 1 ; 28: addi \$t0, \$t0, 1 #i++
		[0040008c] 08100019	j 0x00400064 [for] ; 29: j for
		[00400090] 2108ffff	addi \$8, \$8, -1 ; 31: addi \$t0, \$t0, -1 #i--
		[00400094] 29010000	slli \$1, \$8, 0 ; 32: blt \$t0, 0, endmain
		[00400098] 14200009	bne \$1, \$0, 36 [endmain-0x00400098]
		[0040009c] 01084820	add \$9, \$8, \$8 ; 33: add \$t1, \$t0, \$t0 #t1 = 2i
		[004000a0] 01294820	add \$9, \$9, \$9 ; 34: add \$t1, \$t1, \$t1 #t1 = 4i
		[004000a4] 02095020	add \$10, \$16, \$9 ; 35: add \$t2, \$s0, \$t1 # (arrayA + i)
		[004000a8] 8d4b0000	lw \$11, 0(\$10) ; 36: lw \$t3, 0(\$t2) #*(arrayA + i)
		[004000ac] 016b5820	add \$11, \$11, \$11 ; 37: add \$t3, \$t3, \$t3 #t3 = 2 * A[i]
		[004000b0] ad4b0000	sw \$11, 0(\$10) ; 38: sw \$t3, 0(\$t2) #A[i] = A[i] * 2
		[004000b4] 2108ffff	addi \$8, \$8, -1 ; 39: addi \$t0, \$t0, -1 #i--
		[004000b8] 08100025	j 0x00400094 [while] ; 40: j while
		[004000bc] 3402000a	ori \$2, \$0, 10 ; 44: li \$v0, 10
		[004000c0] 0000000c	syscall ; 45: syscall

FP Regs	nt Regs [10]	Data	Text
Int Regs [10]		Data	
PC	= 4194496	User data segment [10000000]..[10040000]	
EPC	= 0	[10000000]..[1000ffff] 00000000	
Cause	= 0	[10010000] 0000000026 0000000028 0000000030 0000000032	
BadVAddr	= 0	[10010010] 0000000034 0000000001 0000000002 0000000003	
Status	= 805371664	[10010020] 0000000004 0000000005 0000000000 0000000000	
		[10010030]..[1003ffff] 00000000	
HI	= 0	User Stack [7ffff9bc]..[80000000]	
LO	= 0	[7ffff9bc] 0000000001	
R0 [r0]	= 0	[7ffff9c0] 2147482230 0000000000 2147483615 2147483604	
R1 [at]	= 1	[7ffff9d0] 2147483579 2147483571 2147483554 2147483531	
R2 [v0]	= 10	[7ffff9e0] 2147483466 2147483438 2147483406 2147483390	
R3 [v1]	= 0	[7ffff9f0] 2147483336 2147483299 2147483281 2147483255	
R4 [a0]	= 1	[7ffffa00] 2147483241 2147483216 2147483193 2147483170	
R5 [a1]	= 2147482048	[7ffffa10] 2147483155 2147483111 2147482997 2147482887	
R6 [a2]	= 2147482056	[7ffffa20] 2147482840 2147482809 2147482786 2147482763	
R7 [a3]	= 0	[7ffffa30] 2147482752 2147482735 2147482702 2147482675	
R8 [t0]	= -1	[7ffffa40] 2147482655 2147482601 2147482568 2147482527	
R9 [t1]	= 0	[7ffffa50] 2147482511 2147482492 2147482474 2147482450	
R10 [t2]	= 268500992	[7ffffa60] 2147482432 2147482416 2147482331 2147482286	
R11 [t3]	= 26	[7ffffa70] 0000000000 1747910656 0795176303 1937072740	
R12 [t4]	= 0	[7ffffa80] 1768042356 1668637300 0796157291 0825372722	
R13 [t5]	= 0	[7ffffa90] 1818322527 1667587948 0925984112 1634479920	
R14 [t6]	= 0	[7ffffaa0] 0791687522 1953653104 1935748660 1146617965	
R15 [t7]	= 0	[7ffffab0] 1329815367 1195984462 1380533343 1697594707	
R16 [s0]	= 268500992	[7ffffac0] 2016371572 2016372580 1965909860 1953396066	
R17 [s1]	= 0	[7ffffad0] 1697593973 2016371572 1476421476 1147094852	
R18 [s2]	= 12	[7ffffae0] 1598116929 1397901636 1937059645 1752379250	
R19 [s3]	= 0	[7ffffaf0] 0795177569 1853186677 0792360308 0796029813	
R20 [s4]	= 0	[7ffffb00] 1633906540 1752379244 0795177569 1937059642	
R21 [s5]	= 0	[7ffffb10] 1752379250 0795177569 1635135290 1768697714	
R22 [s6]	= 268501012	[7ffffb20] 1853042530 0795111521 1802724708 0007368564	
R23 [s7]	= 17	[7ffffb30] 1027888976 1836017711 1650732901 0007631733	
		[7ffffb40] 1230984273 1330470733 1162630468 1969383741	
		[7ffffb50] 1246167155 1162108755 1598510402 1347704143	

User data segment [10000000]..[10040000]

[10000000]..[1000ffff]	00000000				
[10010000]	686a6268	00006576	00000000	00000000	h b j h v e
[10010010]..[100100ff]	00000000				
[10010100]	65746e45	20612072	69727453	203a676e	E n t e r a S t r i n g :
[10010110]	4e002020	2065206f	6e756f46	20650064	. N o e F o u n d . e
[10010120]	6e756f66	74612064	6d656d20	20797261	f o u n d a t m e m o r y
[10010130]	72646441	3a737365	00002020	10010005	A d d r e s s :
[10010140]	0000000a	00000000	00000000	00000000	. . . . .
[10010150]..[1003ffff]	00000000				