

ECE429: Final Deliverable

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SimpleAdd

Register File: Before (left), After (right) Data Memory (bottom)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000003	Pack...	Inter...
[2]	00000005	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

[1048544]	xx	Pack...	Inter...
[1048545]	xx	Pack...	Inter...
[1048546]	xx	Pack...	Inter...
[1048547]	xx	Pack...	Inter...
[1048548]	xx	Pack...	Inter...
[1048549]	xx	Pack...	Inter...
[1048550]	xx	Pack...	Inter...
[1048551]	xx	Pack...	Inter...
[1048552]	00	Pack...	Inter...
[1048553]	00	Pack...	Inter...
[1048554]	00	Pack...	Inter...
[1048555]	03	Pack...	Inter...
[1048556]	00	Pack...	Inter...
[1048557]	00	Pack...	Inter...
[1048558]	00	Pack...	Inter...
[1048559]	02	Pack...	Inter...
[1048560]	00	Pack...	Inter...
[1048561]	00	Pack...	Inter...
[1048562]	00	Pack...	Inter...
[1048563]	05	Pack...	Inter...
[1048564]	xx	Pack...	Inter...
[1048565]	xx	Pack...	Inter...
[1048566]	xx	Pack...	Inter...
[1048567]	xx	Pack...	Inter...
[1048568]	xx	Pack...	Inter...
[1048569]	xx	Pack...	Inter...
[1048570]	xx	Pack...	Inter...
[1048571]	xx	Pack...	Inter...
[1048572]	00	Pack...	Inter...
[1048573]	00	Pack...	Inter...
[1048574]	00	Pack...	Inter...
[1048575]	00	Pack...	Inter...
[1048576]	xx	Pack...	Inter...

In the **SimpleAdd** benchmark, the sum of the addition is stored register 2 (v0) of the register file. In the data memory, the integers 3 and 2 are stored in Data memory at address 0x8011FFE8 and 0x8011FFEC, respectively. The sum of integer 2 and 3, which is 5 is stored in memory location 0x8011FFF0. **Note:** In all of the benchmarks, the return address (rA) is stored as 0xdeadbeef in register 31 and the stack pointer (sp) 0x80120000 is stored in register 29.

Simplelf

Register File: Before (left), After (right) **Data Memory** (bottom)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000005	Pack...	Inter...
[2]	00000007	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

[1048551]	xx	Pack...	Inter...
[1048552]	00	Pack...	Inter...
[1048553]	00	Pack...	Inter...
[1048554]	00	Pack...	Inter...
[1048555]	05	Pack...	Inter...
[1048556]	00	Pack...	Inter...
[1048557]	00	Pack...	Inter...
[1048558]	00	Pack...	Inter...
[1048559]	02	Pack...	Inter...
[1048560]	00	Pack...	Inter...
[1048561]	00	Pack...	Inter...
[1048562]	00	Pack...	Inter...
[1048563]	07	Pack...	Inter...
[1048564]	xx	Pack...	Inter...
[1048565]	xx	Pack...	Inter...
[1048566]	xx	Pack...	Inter...
[1048567]	xx	Pack...	Inter...
[1048568]	xx	Pack...	Inter...
[1048569]	xx	Pack...	Inter...
[1048570]	xx	Pack...	Inter...
[1048571]	xx	Pack...	Inter...
[1048572]	00	Pack...	Inter...
[1048573]	00	Pack...	Inter...
[1048574]	00	Pack...	Inter...
[1048575]	00	Pack...	Inter...
[1048576]	xx	Pack...	Inter...

In the **SimpleIf** benchmark, the integers x, y, and c hold values 5, 2, and 7, respectively. The value 7 is stored in register 2 (v0) in the register at the end of program execution. The integers 5,2,7 are stored in the data memory starting at address 0x8011FFE8. The final value (the sum) of 7 is stored in the memory at address 0x8011FFF0.

Swap

Register File: Before (left), After (right) **Data Memory** (next page)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	8011fff4	Pack...	Inter...
[4]	8011fff0	Pack...	Inter...
[3]	00000009	Pack...	Inter...
[2]	0000000e	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

+ [1048520]	00	Pack... Inter...
+ [1048521]	00	Pack... Inter...
+ [1048522]	00	Pack... Inter...
+ [1048523]	05	Pack... Inter...
+ [1048524]	xx	Pack... Inter...
+ [1048525]	xx	Pack... Inter...
+ [1048526]	xx	Pack... Inter...
+ [1048527]	xx	Pack... Inter...
+ [1048528]	xx	Pack... Inter...
+ [1048529]	xx	Pack... Inter...
+ [1048530]	xx	Pack... Inter...
+ [1048531]	xx	Pack... Inter...
+ [1048532]	80	Pack... Inter...
+ [1048533]	11	Pack... Inter...
+ [1048534]	ff	Pack... Inter...
+ [1048535]	d8	Pack... Inter...
+ [1048536]	80	Pack... Inter...
+ [1048537]	11	Pack... Inter...
+ [1048538]	ff	Pack... Inter...
+ [1048539]	f0	Pack... Inter...
+ [1048540]	80	Pack... Inter...
+ [1048541]	11	Pack... Inter...
+ [1048542]	ff	Pack... Inter...
+ [1048543]	f4	Pack... Inter...
+ [1048544]	xx	Pack... Inter...

In the **Swap** benchmark, the final values of registers v0 and v1 are 0xE and 0x9, respectively.

During the swap operations, the values of 9 and 5 swap memory locations, referenced by memory locations 0x8011FFF0 and 0x8011FFF4

+ [1048545]	xx	Pack... Inter...
+ [1048546]	xx	Pack... Inter...
+ [1048547]	xx	Pack... Inter...
+ [1048548]	xx	Pack... Inter...
+ [1048549]	xx	Pack... Inter...
+ [1048550]	xx	Pack... Inter...
+ [1048551]	xx	Pack... Inter...
+ [1048552]	80	Pack... Inter...
+ [1048553]	11	Pack... Inter...
+ [1048554]	ff	Pack... Inter...
+ [1048555]	f0	Pack... Inter...
+ [1048556]	80	Pack... Inter...
+ [1048557]	11	Pack... Inter...
+ [1048558]	ff	Pack... Inter...
+ [1048559]	f4	Pack... Inter...
+ [1048560]	00	Pack... Inter...
+ [1048561]	00	Pack... Inter...
+ [1048562]	00	Pack... Inter...
+ [1048563]	09	Pack... Inter...
+ [1048564]	00	Pack... Inter...
+ [1048565]	00	Pack... Inter...
+ [1048566]	00	Pack... Inter...
+ [1048567]	05	Pack... Inter...
+ [1048568]	00	Pack... Inter...
+ [1048569]	00	Pack... Inter...
+ [1048570]	00	Pack... Inter...
+ [1048571]	00	Pack... Inter...
+ [1048572]	de	Pack... Inter...
+ [1048573]	ad	Pack... Inter...
+ [1048574]	be	Pack... Inter...
+ [1048575]	ef	Pack... Inter...
+ [1048576]	xx	Pack... Inter...

fact

Register File: Before (left), After (right) Data Memory (bottom)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00009d80	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

























Data Memory (Part 1)

[1048320]	80	Pack...	Inter...
[1048321]	11	Pack...	Inter...
[1048322]	ff	Pack...	Inter...
[1048323]	08	Pack...	Inter...
[1048324]	80	Pack...	Inter...
[1048325]	02	Pack...	Inter...
[1048326]	00	Pack...	Inter...
[1048327]	a4	Pack...	Inter...
[1048328]	00	Pack...	Inter...
[1048329]	00	Pack...	Inter...
[1048330]	00	Pack...	Inter...
[1048331]	00	Pack...	Inter...
[1048332]	xx	Pack...	Inter...
[1048333]	xx	Pack...	Inter...
[1048334]	xx	Pack...	Inter...
[1048335]	xx	Pack...	Inter...
[1048336]	xx	Pack...	Inter...
[1048337]	xx	Pack...	Inter...
[1048338]	xx	Pack...	Inter...
[1048339]	xx	Pack...	Inter...
[1048340]	xx	Pack...	Inter...
[1048341]	xx	Pack...	Inter...
[1048342]	xx	Pack...	Inter...
[1048343]	xx	Pack...	Inter...

























Data Memory (Part 2)

[1048344]	80	Pack...	Inter...
[1048345]	11	Pack...	Inter...
[1048346]	ff	Pack...	Inter...
[1048347]	20	Pack...	Inter...
[1048348]	80	Pack...	Inter...
[1048349]	02	Pack...	Inter...
[1048350]	00	Pack...	Inter...
[1048351]	a4	Pack...	Inter...
[1048352]	00	Pack...	Inter...
[1048353]	00	Pack...	Inter...
[1048354]	00	Pack...	Inter...
[1048355]	01	Pack...	Inter...

























Data Memory (Part 3)

		[1048368]	80	Pack... Inter...
		[1048369]	11	Pack... Inter...
		[1048370]	ff	Pack... Inter...
		[1048371]	38	Pack... Inter...
		[1048372]	80	Pack... Inter...
		[1048373]	02	Pack... Inter...
		[1048374]	00	Pack... Inter...
		[1048375]	a4	Pack... Inter...
		[1048376]	00	Pack... Inter...
		[1048377]	00	Pack... Inter...
		[1048378]	00	Pack... Inter...
		[1048379]	02	Pack... Inter...

























Data Memory (Part 4)

		[1048392]	80	Pack... Inter...
		[1048393]	11	Pack... Inter...
		[1048394]	ff	Pack... Inter...
		[1048395]	50	Pack... Inter...
		[1048396]	80	Pack... Inter...
		[1048397]	02	Pack... Inter...
		[1048398]	00	Pack... Inter...
		[1048399]	a4	Pack... Inter...
		[1048400]	00	Pack... Inter...
		[1048401]	00	Pack... Inter...
		[1048402]	00	Pack... Inter...
		[1048403]	03	Pack... Inter...

























Data Memory (Part 5)

		[1048416]	80	Pack... Inter...
		[1048417]	11	Pack... Inter...
		[1048418]	ff	Pack... Inter...
		[1048419]	68	Pack... Inter...
		[1048420]	80	Pack... Inter...
		[1048421]	02	Pack... Inter...
		[1048422]	00	Pack... Inter...
		[1048423]	a4	Pack... Inter...
		[1048424]	00	Pack... Inter...
		[1048425]	00	Pack... Inter...
		[1048426]	00	Pack... Inter...
		[1048427]	04	Pack... Inter...

























Data Memory (Part 6)

		[1048440]	80	Pack... Inter...
		[1048441]	11	Pack... Inter...
		[1048442]	ff	Pack... Inter...
		[1048443]	80	Pack... Inter...
		[1048444]	80	Pack... Inter...
		[1048445]	02	Pack... Inter...
		[1048446]	00	Pack... Inter...
		[1048447]	a4	Pack... Inter...
		[1048448]	00	Pack... Inter...
		[1048449]	00	Pack... Inter...
		[1048450]	00	Pack... Inter...
		[1048451]	05	Pack... Inter...

Data Memory (Part 7)

		[1048464]	80	Pack... Inter...
		[1048465]	11	Pack... Inter...
		[1048466]	ff	Pack... Inter...
		[1048467]	98	Pack... Inter...
		[1048468]	80	Pack... Inter...
		[1048469]	02	Pack... Inter...
		[1048470]	00	Pack... Inter...
		[1048471]	a4	Pack... Inter...
		[1048472]	00	Pack... Inter...
		[1048473]	00	Pack... Inter...
		[1048474]	00	Pack... Inter...
		[1048475]	06	Pack... Inter...

Data Memory (Part 8)

		[1048488]	80	Pack... Inter...
		[1048489]	11	Pack... Inter...
		[1048490]	ff	Pack... Inter...
		[1048491]	b0	Pack... Inter...
		[1048492]	80	Pack... Inter...
		[1048493]	02	Pack... Inter...
		[1048494]	00	Pack... Inter...
		[1048495]	a4	Pack... Inter...
		[1048496]	00	Pack... Inter...
		[1048497]	00	Pack... Inter...
		[1048498]	00	Pack... Inter...
		[1048499]	07	Pack... Inter...

Data Memory (Part 9)

+	◆	[1048512]	80	Pack... Inter...
+	◆	[1048513]	11	Pack... Inter...
+	◆	[1048514]	ff	Pack... Inter...
+	◆	[1048515]	c8	Pack... Inter...
+	◆	[1048516]	80	Pack... Inter...
+	◆	[1048517]	02	Pack... Inter...
+	◆	[1048518]	00	Pack... Inter...
+	◆	[1048519]	a4	Pack... Inter...
+	◆	[1048520]	00	Pack... Inter...
+	◆	[1048521]	00	Pack... Inter...
+	◆	[1048522]	00	Pack... Inter...
+	◆	[1048523]	08	Pack... Inter...

Data Memory (Part 10)

+	◆	[1048536]	80	Pack... Inter...
+	◆	[1048537]	11	Pack... Inter...
+	◆	[1048538]	ff	Pack... Inter...
+	◆	[1048539]	e0	Pack... Inter...
+	◆	[1048540]	80	Pack... Inter...
+	◆	[1048541]	02	Pack... Inter...
+	◆	[1048542]	00	Pack... Inter...
+	◆	[1048543]	28	Pack... Inter...
+	◆	[1048544]	00	Pack... Inter...
+	◆	[1048545]	00	Pack... Inter...
+	◆	[1048546]	00	Pack... Inter...
+	◆	[1048547]	09	Pack... Inter...

Data Memory (Part 11)

+	◆	[1048560]	00	Pack... Inter...
+	◆	[1048561]	00	Pack... Inter...
+	◆	[1048562]	00	Pack... Inter...
+	◆	[1048563]	0a	Pack... Inter...
+	◆	[1048564]	00	Pack... Inter...
+	◆	[1048565]	05	Pack... Inter...
+	◆	[1048566]	89	Pack... Inter...
+	◆	[1048567]	80	Pack... Inter...
+	◆	[1048568]	00	Pack... Inter...
+	◆	[1048569]	00	Pack... Inter...
+	◆	[1048570]	00	Pack... Inter...
+	◆	[1048571]	00	Pack... Inter...
+	◆	[1048572]	de	Pack... Inter...
+	◆	[1048573]	ad	Pack... Inter...
+	◆	[1048574]	be	Pack... Inter...
+	◆	[1048575]	ef	Pack... Inter...
+	◆	[1048576]	xx	Pack... Inter...

For the **fact** benchmark, the final memory contents hold the 9! factorial at the address 0x8011FFF4. The value at that memory address is 0x58980, which is the $9! = 362880_{10}$. In the register file, the value of 8! which is $0x9D80 = 40320$ is stored in register v0.

SumArray

Register File: Before (left), After (right) **Data Memory** (next page)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

REGFILE	00000000	Net	Out
REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000024	Pack...	Inter...
[2]	0000002d	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

Data Memory (Part 1)

+ [1048520]	00	Pack... Inter...
+ [1048521]	00	Pack... Inter...
+ [1048522]	00	Pack... Inter...
+ [1048523]	0a	Pack... Inter...
+ [1048524]	00	Pack... Inter...
+ [1048525]	00	Pack... Inter...
+ [1048526]	00	Pack... Inter...
+ [1048527]	2d	Pack... Inter...
+ [1048528]	00	Pack... Inter...
+ [1048529]	00	Pack... Inter...
+ [1048530]	00	Pack... Inter...
+ [1048531]	00	Pack... Inter...
+ [1048532]	00	Pack... Inter...
+ [1048533]	00	Pack... Inter...
+ [1048534]	00	Pack... Inter...
+ [1048535]	01	Pack... Inter...
+ [1048536]	00	Pack... Inter...
+ [1048537]	00	Pack... Inter...
+ [1048538]	00	Pack... Inter...
+ [1048539]	02	Pack... Inter...
+ [1048540]	00	Pack... Inter...
+ [1048541]	00	Pack... Inter...
+ [1048542]	00	Pack... Inter...
+ [1048543]	03	Pack... Inter...
+ [1048544]	00	Pack... Inter...
+ [1048545]	00	Pack... Inter...
+ [1048546]	00	Pack... Inter...
+ [1048547]	04	Pack... Inter...
+ [1048548]	00	Pack... Inter...
+ [1048549]	00	Pack... Inter...
+ [1048550]	00	Pack... Inter...
+ [1048551]	05	Pack... Inter...
+ [1048552]	00	Pack... Inter...

Data Memory (Part 2)

+ [1048553]	00	Pack... Inter...
+ [1048554]	00	Pack... Inter...
+ [1048555]	06	Pack... Inter...
+ [1048556]	00	Pack... Inter...
+ [1048557]	00	Pack... Inter...
+ [1048558]	00	Pack... Inter...
+ [1048559]	07	Pack... Inter...
+ [1048560]	00	Pack... Inter...
+ [1048561]	00	Pack... Inter...
+ [1048562]	00	Pack... Inter...
+ [1048563]	08	Pack... Inter...
+ [1048564]	00	Pack... Inter...
+ [1048565]	00	Pack... Inter...
+ [1048566]	00	Pack... Inter...
+ [1048567]	09	Pack... Inter...
+ [1048568]	xx	Pack... Inter...
+ [1048569]	xx	Pack... Inter...
+ [1048570]	xx	Pack... Inter...
+ [1048571]	xx	Pack... Inter...
+ [1048572]	00	Pack... Inter...
+ [1048573]	00	Pack... Inter...
+ [1048574]	00	Pack... Inter...
+ [1048575]	00	Pack... Inter...
+ [1048576]	xx	Pack... Inter...

In the **SumArray** benchmark, the contents of the array (0,1,2,...9) are added, which is 0x2D and stored in the data memory at address 0x8011FFCC. The contents of the array are stored at memory locations starting at 0x8011FFD0. In the register file, the sum of 0x2D is stored in v0 and the sum of (0,1,2,...8), which his 0x24 is stored.

BubbleSort

Register File: Before (left), After (right) **Data Memory** (next page)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

IS	00000000	Net	Out
rt	00000000	Net	Out
REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000008	Pack...	Inter...
[4]	8011ffd8	Pack...	Inter...
[3]	00000008	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

Data Memory (Part 1)

+	[1048490]	xxxxxxx	Pack... Inter...
+	[1048491]	xxxxxxx	Pack... Inter...
+	[1048492]	xxxxxxx	Pack... Inter...
+	[1048493]	xxxxxxx	Pack... Inter...
+	[1048494]	xxxxxxx	Pack... Inter...
+	[1048495]	xxxxxxx	Pack... Inter...
+	[1048496]	00	Pack... Inter...
+	[1048497]	00	Pack... Inter...
+	[1048498]	00	Pack... Inter...
+	[1048499]	08	Pack... Inter...
+	[1048500]	00	Pack... Inter...
+	[1048501]	00	Pack... Inter...
+	[1048502]	00	Pack... Inter...
+	[1048503]	01	Pack... Inter...
+	[1048504]	00	Pack... Inter...
+	[1048505]	00	Pack... Inter...
+	[1048506]	00	Pack... Inter...
+	[1048507]	04	Pack... Inter...
+	[1048508]	xx	Pack... Inter...
+	[1048509]	xx	Pack... Inter...
+	[1048510]	xx	Pack... Inter...
+	[1048511]	xx	Pack... Inter...
+	[1048512]	xx	Pack... Inter...
+	[1048513]	xx	Pack... Inter...
+	[1048514]	xx	Pack... Inter...
+	[1048515]	xx	Pack... Inter...
+	[1048516]	80	Pack... Inter...
+	[1048517]	11	Pack... Inter...
+	[1048518]	ff	Pack... Inter...
+	[1048519]	c8	Pack... Inter...
+	[1048520]	80	Pack... Inter...

Data Memory (Part 2)

+	[1048520]	80	Pack... Inter...
+	[1048521]	11	Pack... Inter...
+	[1048522]	ff	Pack... Inter...
+	[1048523]	d8	Pack... Inter...
+	[1048524]	00	Pack... Inter...
+	[1048525]	00	Pack... Inter...
+	[1048526]	00	Pack... Inter...
+	[1048527]	08	Pack... Inter...
+	[1048528]	xx	Pack... Inter...
+	[1048529]	xx	Pack... Inter...
+	[1048530]	xx	Pack... Inter...
+	[1048531]	xx	Pack... Inter...
+	[1048532]	xx	Pack... Inter...
+	[1048533]	xx	Pack... Inter...
+	[1048534]	xx	Pack... Inter...
+	[1048535]	xx	Pack... Inter...
+	[1048536]	00	Pack... Inter...
+	[1048537]	00	Pack... Inter...
+	[1048538]	00	Pack... Inter...
+	[1048539]	01	Pack... Inter...
+	[1048540]	00	Pack... Inter...
+	[1048541]	00	Pack... Inter...
+	[1048542]	00	Pack... Inter...
+	[1048543]	03	Pack... Inter...

Data Memory (Part 3)

+	[1048545]	00	Pack... Inter...
+	[1048546]	00	Pack... Inter...
+	[1048547]	04	Pack... Inter...
+	[1048548]	00	Pack... Inter...
+	[1048549]	00	Pack... Inter...
+	[1048550]	00	Pack... Inter...
+	[1048551]	09	Pack... Inter...
+	[1048552]	00	Pack... Inter...
+	[1048553]	00	Pack... Inter...
+	[1048554]	00	Pack... Inter...
+	[1048555]	0a	Pack... Inter...
+	[1048556]	00	Pack... Inter...
+	[1048557]	00	Pack... Inter...
+	[1048558]	00	Pack... Inter...
+	[1048559]	0c	Pack... Inter...
+	[1048560]	00	Pack... Inter...
+	[1048561]	00	Pack... Inter...
+	[1048562]	00	Pack... Inter...
+	[1048563]	63	Pack... Inter...
+	[1048564]	00	Pack... Inter...
+	[1048565]	00	Pack... Inter...
+	[1048566]	00	Pack... Inter...
+	[1048567]	78	Pack... Inter...
+	[1048568]	00	Pack... Inter...
+	[1048569]	00	Pack... Inter...
+	[1048570]	00	Pack... Inter...
+	[1048571]	00	Pack... Inter...
+	[1048572]	de	Pack... Inter...
+	[1048573]	ad	Pack... Inter...
+	[1048574]	be	Pack... Inter...
+	[1048575]	ef	Pack... Inter...
+	[1048576]	xx	Pack... Inter...

In the **BubbleSort** benchmark, the data memory stores the final sorted order of values in the program, starting at address 0x8011FFD8. The values are stored in increasing memory locations in increasing order. Thus, the values are sorted in ascending order as follows: 0x1, 0x3, 0x4, 0x9, 0x10, 0x12, 0x63, 0x78

CheckVowel

Register File: Before (left), After (right) **Data Memory** (bottom)

REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	00000000	Pack...	Inter...
[4]	00000000	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

rt	00000000	Net	Out
REGFILE	deadbeef 000...	Fixe...	Inter...
[31]	deadbeef	Pack...	Inter...
[30]	00000000	Pack...	Inter...
[29]	80120000	Pack...	Inter...
[28]	00000000	Pack...	Inter...
[27]	00000000	Pack...	Inter...
[26]	00000000	Pack...	Inter...
[25]	00000000	Pack...	Inter...
[24]	00000000	Pack...	Inter...
[23]	00000000	Pack...	Inter...
[22]	00000000	Pack...	Inter...
[21]	00000000	Pack...	Inter...
[20]	00000000	Pack...	Inter...
[19]	00000000	Pack...	Inter...
[18]	00000000	Pack...	Inter...
[17]	00000000	Pack...	Inter...
[16]	00000000	Pack...	Inter...
[15]	00000000	Pack...	Inter...
[14]	00000000	Pack...	Inter...
[13]	00000000	Pack...	Inter...
[12]	00000000	Pack...	Inter...
[11]	00000000	Pack...	Inter...
[10]	00000000	Pack...	Inter...
[9]	00000000	Pack...	Inter...
[8]	00000000	Pack...	Inter...
[7]	00000000	Pack...	Inter...
[6]	00000000	Pack...	Inter...
[5]	43686563	Pack...	Inter...
[4]	6b566f77	Pack...	Inter...
[3]	00000000	Pack...	Inter...
[2]	00000000	Pack...	Inter...
[1]	00000000	Pack...	Inter...
[0]	00000000	Pack...	Inter...

[1048535]	xxxxxxxx	Pack...	Inter...
[1048536]	00	Pack...	Inter...
[1048537]	00	Pack...	Inter...
[1048538]	00	Pack...	Inter...
[1048539]	14	Pack...	Inter...
[1048540]	00	Pack...	Inter...
[1048541]	00	Pack...	Inter...
[1048542]	00	Pack...	Inter...
[1048543]	03	Pack...	Inter...
[1048544]	43	Pack...	Inter...
[1048545]	68	Pack...	Inter...
[1048546]	65	Pack...	Inter...
[1048547]	63	Pack...	Inter...
[1048548]	6b	Pack...	Inter...
[1048549]	56	Pack...	Inter...
[1048550]	6f	Pack...	Inter...
[1048551]	77	Pack...	Inter...
[1048552]	65	Pack...	Inter...
[1048553]	6c	Pack...	Inter...
[1048554]	21	Pack...	Inter...
[1048555]	0a	Pack...	Inter...
[1048556]	00	Pack...	Inter...
[1048557]	00	Pack...	Inter...
[1048558]	00	Pack...	Inter...
[1048559]	00	Pack...	Inter...
[1048560]	00	Pack...	Inter...
[1048561]	00	Pack...	Inter...
[1048562]	00	Pack...	Inter...
[1048563]	00	Pack...	Inter...
[1048564]	xx	Pack...	Inter...
[1048565]	xx	Pack...	Inter...
[1048566]	xx	Pack...	Inter...
[1048567]	xx	Pack...	Inter...
[1048568]	xx	Pack...	Inter...
[1048569]	xx	Pack...	Inter...

In the **CheckVowel** benchmark, the final number of vowels found in the program is 0x3, which is stored in memory location 0x8011FFDC. The number of iterations to check the char string in the program for vowels is 0x14, which is stored in 8011FFD8. The char bytes of the string “CheckVowel” are stored in byte addressed memory locations starting 0x8011FFE0 till 0x8011FFEA

DivDivDiv

Register File: Before (left), After (right) **Data Memory** (bottom)

REGFILE				rs			
	deadbeef	00000000	Fixe...		00000000	Net	Out
+				rt			
+				REGFILE			
+	[31]	deadbeef	Pack... Inter...	+	[31]	deadbeef	Pack... Inter...
+	[30]	00000000	Pack... Inter...	+	[30]	00000000	Pack... Inter...
+	[29]	80120000	Pack... Inter...	+	[29]	80120000	Pack... Inter...
+	[28]	00000000	Pack... Inter...	+	[28]	00000000	Pack... Inter...
+	[27]	00000000	Pack... Inter...	+	[27]	00000000	Pack... Inter...
+	[26]	00000000	Pack... Inter...	+	[26]	00000000	Pack... Inter...
+	[25]	00000000	Pack... Inter...	+	[25]	00000000	Pack... Inter...
+	[24]	00000000	Pack... Inter...	+	[24]	00000000	Pack... Inter...
+	[23]	00000000	Pack... Inter...	+	[23]	00000000	Pack... Inter...
+	[22]	00000000	Pack... Inter...	+	[22]	00000000	Pack... Inter...
+	[21]	00000000	Pack... Inter...	+	[21]	00000000	Pack... Inter...
+	[20]	00000000	Pack... Inter...	+	[20]	00000000	Pack... Inter...
+	[19]	00000000	Pack... Inter...	+	[19]	00000000	Pack... Inter...
+	[18]	00000000	Pack... Inter...	+	[18]	00000000	Pack... Inter...
+	[17]	00000000	Pack... Inter...	+	[17]	00000000	Pack... Inter...
+	[16]	00000000	Pack... Inter...	+	[16]	00000000	Pack... Inter...
+	[15]	00000000	Pack... Inter...	+	[15]	00000000	Pack... Inter...
+	[14]	00000000	Pack... Inter...	+	[14]	00000000	Pack... Inter...
+	[13]	00000000	Pack... Inter...	+	[13]	00000000	Pack... Inter...
+	[12]	00000000	Pack... Inter...	+	[12]	00000000	Pack... Inter...
+	[11]	00000000	Pack... Inter...	+	[11]	00000000	Pack... Inter...
+	[10]	00000000	Pack... Inter...	+	[10]	00000000	Pack... Inter...
+	[9]	00000000	Pack... Inter...	+	[9]	00000000	Pack... Inter...
+	[8]	00000000	Pack... Inter...	+	[8]	00000000	Pack... Inter...
+	[7]	00000000	Pack... Inter...	+	[7]	00000000	Pack... Inter...
+	[6]	00000000	Pack... Inter...	+	[6]	00000000	Pack... Inter...
+	[5]	00000000	Pack... Inter...	+	[5]	00000000	Pack... Inter...
+	[4]	00000000	Pack... Inter...	+	[4]	00000000	Pack... Inter...
+	[3]	00000000	Pack... Inter...	+	[4]	00000000	Pack... Inter...
+	[2]	00000000	Pack... Inter...	+	[3]	00000009	Pack... Inter...
+	[1]	00000000	Pack... Inter...	+	[2]	0000000a	Pack... Inter...
+	[0]	00000000	Pack... Inter...	+	[1]	00000000	Pack... Inter...
				+	[0]	00000000	Pack... Inter...

Data Memory (Part 1)

+ [1048480]	00	Pack... Inter...
+ [1048481]	00	Pack... Inter...
+ [1048482]	00	Pack... Inter...
+ [1048483]	0a	Pack... Inter...
+ [1048484]	00	Pack... Inter...
+ [1048485]	00	Pack... Inter...
+ [1048486]	00	Pack... Inter...
+ [1048487]	0a	Pack... Inter...
+ [1048488]	00	Pack... Inter...
+ [1048489]	00	Pack... Inter...
+ [1048490]	00	Pack... Inter...
+ [1048491]	01	Pack... Inter...
+ [1048492]	00	Pack... Inter...
+ [1048493]	00	Pack... Inter...
+ [1048494]	00	Pack... Inter...
+ [1048495]	02	Pack... Inter...
+ [1048496]	00	Pack... Inter...
+ [1048497]	00	Pack... Inter...
+ [1048498]	00	Pack... Inter...
+ [1048499]	03	Pack... Inter...
+ [1048500]	00	Pack... Inter...
+ [1048501]	00	Pack... Inter...
+ [1048502]	00	Pack... Inter...
+ [1048503]	04	Pack... Inter...
+ [1048504]	00	Pack... Inter...
+ [1048505]	00	Pack... Inter...
+ [1048506]	00	Pack... Inter...
+ [1048507]	05	Pack... Inter...

Data Memory (Part 2)

+ [1048508]	00	Pack... Inter...
+ [1048509]	00	Pack... Inter...
+ [1048510]	00	Pack... Inter...
+ [1048511]	06	Pack... Inter...
+ [1048512]	00	Pack... Inter...
+ [1048513]	00	Pack... Inter...
+ [1048514]	00	Pack... Inter...
+ [1048515]	07	Pack... Inter...
+ [1048516]	00	Pack... Inter...
+ [1048517]	00	Pack... Inter...
+ [1048518]	00	Pack... Inter...
+ [1048519]	08	Pack... Inter...
+ [1048520]	00	Pack... Inter...
+ [1048521]	00	Pack... Inter...
+ [1048522]	00	Pack... Inter...
+ [1048523]	09	Pack... Inter...
+ [1048524]	00	Pack... Inter...
+ [1048525]	00	Pack... Inter...
+ [1048526]	00	Pack... Inter...
+ [1048527]	0a	Pack... Inter...
+ [1048528]	00	Pack... Inter...
+ [1048529]	00	Pack... Inter...
+ [1048530]	00	Pack... Inter...
+ [1048531]	01	Pack... Inter...
+ [1048532]	00	Pack... Inter...
+ [1048533]	00	Pack... Inter...
+ [1048534]	00	Pack... Inter...
+ [1048535]	01	Pack... Inter...
+ [1048536]	00	Pack... Inter...
+ [1048537]	00	Pack... Inter...
+ [1048538]	00	Pack... Inter...
+ [1048539]	01	Pack... Inter...

Data Memory (Part 3)

+ [1048540]	00	Pack... Inter...
+ [1048541]	00	Pack... Inter...
+ [1048542]	00	Pack... Inter...
+ [1048543]	01	Pack... Inter...
+ [1048544]	00	Pack... Inter...
+ [1048545]	00	Pack... Inter...
+ [1048546]	00	Pack... Inter...
+ [1048547]	01	Pack... Inter...
+ [1048548]	00	Pack... Inter...
+ [1048549]	00	Pack... Inter...
+ [1048550]	00	Pack... Inter...
+ [1048551]	01	Pack... Inter...
+ [1048552]	00	Pack... Inter...
+ [1048553]	00	Pack... Inter...
+ [1048554]	00	Pack... Inter...
+ [1048555]	01	Pack... Inter...
+ [1048556]	00	Pack... Inter...
+ [1048557]	00	Pack... Inter...
+ [1048558]	00	Pack... Inter...
+ [1048559]	01	Pack... Inter...
+ [1048560]	00	Pack... Inter...
+ [1048561]	00	Pack... Inter...
+ [1048562]	00	Pack... Inter...
+ [1048563]	01	Pack... Inter...
+ [1048564]	00	Pack... Inter...
+ [1048565]	00	Pack... Inter...
+ [1048566]	00	Pack... Inter...
+ [1048567]	01	Pack... Inter...

Data Memory (Part 4)

+ [1048570]	xx	Pack... Inter...
+ [1048571]	xx	Pack... Inter...
+ [1048572]	00	Pack... Inter...
+ [1048573]	00	Pack... Inter...
+ [1048574]	00	Pack... Inter...
+ [1048575]	00	Pack... Inter...
+ [1048576]	xx	Pack... Inter...

In the **DivDivDiv** benchmark, the register value holds the value 0x9 and 0xA in v1 and v0, respectively. The sum, which is 0xA is stored in datamemory at location 0x8011FFA0. The values (10,9,...1) are stored in descending order in increasing memory addresses starting at 0x8011FFA4

Stalls and Forwarding in Simplelf

The following sequence of instructions show forwarding (bypassing) occurring:

```
80020000: 27bdffe8    addiu sp,sp,-24
80020004: afbe0014    sw     s8,20(sp)
80020008: 03a0f021    move  s8,sp
```

Instruction afbe0014, which does a store-word of s8 (frame pointer) to MEM[20+SP] **must** read the value of sp which was updated by the previous instruction 27bdffe8. In this case, an MX-Bypass on input A (rs) is done, where the new value of sp, which is sp - 24, is available in memory stage of the pipeline, is forwarded to the store word instruction which is in the execute stage of the pipeline. This value is then used to compute the offset to be used to store the value in register s8 in the memory. The third instruction, 03a0f021, which does a pseudo-instruction move (which translates to addiu rs, rt, 0) demonstrates the WX-Bypass path. This is because the move instruction **must** read the value of sp that was updated by the first instruction. Therefore, when the first instruction is in the write back stage, the value that is to be written to the regfile is forwarded to the third instruction, which is currently in the execute stage of the pipeline. This allows the updated value of sp (which is sp - 24) to be used to add the constant 0 and store it in register s8 (which is the frame pointer).

The following sequence of instructions show the load-use stall occurring in the Simplelf benchmark

```
80020020: 8fc20000    lw     v0,0(s8)
80020024: 28420005    slti  v0,v0,5
```

This sequence is an example of a load instruction to register v0 (r2), followed by an instruction that must use the value stored in v0 and check if that value is less than 5 and set the value of v0 accordingly. In this situation, a stall occurs when the slti instruction is fetched, if a load instruction was just decoded (i.e., the instruction is in the DX pipeline register). This induces a nop instruction to allow the load instruction to propagate to the write back stage, ensuring that the instruction that must use the updated value of v0 is in execute stage, and thus a bypass path can be used. Otherwise, if a nop was not inserted in the pipeline, the slti instruction would be in the memory stage when the load instruction is in the write back stage, thus making it impossible for v0 in the slti instruction to see the updated value for v0 done by the load instruction.