Lab 5: MIPS Datapath for R and I-type Instructions

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Introduction: The purpose of this lab is to construct a Datapath that can accept R, I and J-type instructions. The idea is to build onto the Datapath that was made in lab 4.

Problem Logic & Solution: I used Vivado's block design tool to add the extra components needed to support the J-type instructions. Also, I modified some components to allow for J-type instructions.

Logio Utilization		Used	
Logic Utilization	R-type	R and I-type	R, I, and J-type
# of LUTs	519	599	599
# of Flip-Flops	43	43	43
# of Slices	836	836	836
Max Frequency (MHz)	100	100	100

Simulation Results

- Datapath

Name	Value	0.000 ns	100.000 ns	200.000 ns	300.000 ns	400.000 ns 500.000 ns	600.000 ns	700.000 ns		900.000 ns
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¹å Rst	0									
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> 😽 [2][31:0]	00000000					00000000				
> 🐶 [3][31:0]	00000000					00000000				
> 😽 [4][31:0]	00000000					00000000				
> 😽 [5][31:0]	00000000					00000000				
> 😽 [6][31:0]	00000000					00000000				
> 😽 [7][31:0]	00000000					00000000				
> 😽 [8][31:0]	00000014	00000009	00000000	00000003	χ 0000	000ь / 00000014	000000	15	0000001ь	
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> 😽 [11][31:0]	0000000c					0000000c	1			
> 😽 [12][31:0]	00000010	00000000	00000004	0000	0008	0000000e X 000000	10 X 0	0000014	00000	018
> 😽 [13][31:0]	00000020	0000000e	X			00000020				
> 😽 [14][31:0]	0000000f					0000000f	1			
> 😽 [15][31:0]	00000010					00000010				
> 😽 [16][31:0]	00000004	00000	00000001	х	00000002	00000003	00000004 X		00000005	
> 😽 [17][31:0]	00000005	00000012				00000005				
> 😽 [18][31:0]	00000013					00000013				
> 😽 [19][31:0]	00000014					00000014				
> 😽 [20][31:0]	00000015					00000015				
> 😽 [21][31:0]	00000016					00000016				
> 😽 [22][31:0]	00000017					00000017				
> 😽 [23][31:0]	00000018					00000018				
> 😽 [24][31:0]	00000019					00000019				
> 😽 [25][31:0]	0000001a					0000001a				
> 😽 [26][31:0]	00000000					00000000				
> 💆 [27][31:0]	00000000					0000000				
> 😽 [28][31:0]	00000000					00000000				
> 😽 [29][31:0]	00000000					00000000				

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> 😽 [18][31:0]	00000013							00000									
> W [19][31:0]	00000014							00000									
> W [20][31:0]	00000015							00000									
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> 💆 [24][31:0]	00000019							00000									
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> 💆 [28][31:0]	00000000							00000	0000								
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> 💆 [2][31:0]	80000000							00000									
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- MIPs

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> 🕨 [5][31:0]	00000000	(00000000												
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> • [20][31:0]	00000015	——										00000015												
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> ₩ [22][31:0]	00000017	<u> </u>										00000017												
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> ₩ [24][31:0]	00000019											00000019												
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> V [28][31:0]	00000000											00000000												
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> 🛡 [31][31:0]	80000000	00000										0000000	8											

- SignExt



- ALUCNTL

		0.000 ns								
Name		0.000 ns								80.000 ns
> W Din1[5:0]	20	20	21	3f	23	27	3f	20	21	3f
> W O1[5:0]	00		00		01	02	31		00	·
> W Dout1[3:0]	2		2	f	2	0	f		2	f

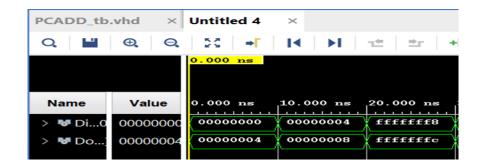
- ADD

Name	Value	0.000 ns		20.000 ns	30.000 ns	40.000 ns	50.000 ns	60.000 ns
> W A1[31:0]	ffffffe	fffffffe	00000000	d1111111	fffffffe	00000000	d1111111	fffffffe
> W B1[31:0]	00000001	0000	0001	00000000	0000	0001	00000000	00000
> W D1[31:0]	ffffffff	ffffffff	00000001	d1111111	ffffffff	00000001	d1111111	ffffffff

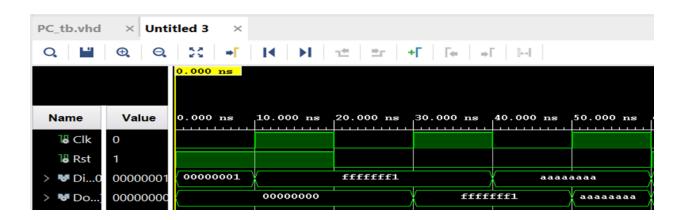
- Shift2

Shift2.vhd × Untitled 17	×					? ♂ [
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		0.000 ns				
Name	Value	0.000 ns 5.000 ns	10.000 ns 15.000 ns	20.000 ns 25.000 ns	30.000 ns 35.000 ns	40.000 ns 45.000 n
> W Di[31:0]	00001234	00001234	00000001	c0001000	00000000	00001234
> W Do[31:0]	000048d0	00004840	0000003c	0003e000	00000000	00004840

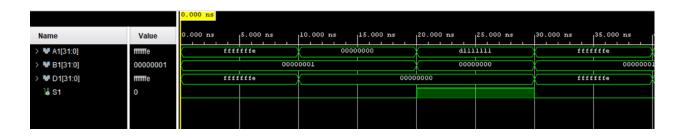
- PCADD



- PC



- Mux32b



- Control

ame	Value		^{10.000 ns}	^{20.000 ns}	30.000 ns	40.000 ns	50.000 ns	^{60.000} ns
₩ D1[5:0]	0a	00	02	08	0a	23		02
₩ O1[5:0]	08		<u>1</u>	01	08	04	∮ ———	<u>1</u>
₩ Jr1[5:0]	09)8	00	¥	09)	08
₩ Rd1[1:0]	0	0	2	¥		Ó		2
₩ J1[1:0]	0	2	1	¥	0		2	1
₩ Mtr1[1:0]	0			0		1	<u> </u>	1
ไ∎ B1	0							
™ Mr1	0							
ไ ≜ Mw1	0							
¼ S1	1							
¼ Rw1	1							

- GAND

		0.000 ns		
Name	Value	0.000 ns	20.000 ns	30.000 ns
1⊌ A1	0			
™ B1	0			
™ D1	0			

- Shift28

			9.500 ns		
Name	Value	0.000 ns	10.000 ns	20.000 ns	30.000 ns
> W Di[25:0]	103c78f	103c78f	100478f	123c78f	383c78f
> W Do[27:0]	40f1e3c	40fle3c	4011e3c	48fle3c	eOfle3c

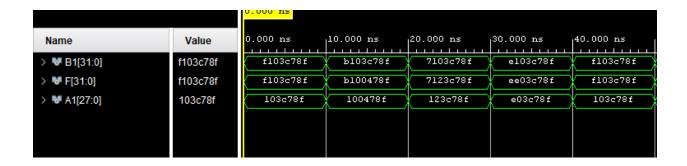
- Mux5b

		0.000 ns			
Name	Value	0.000 ns	10.000 ns	20.000 ns	30.000 ns
> W A1[4:0]	04	04	00	1ь	04
> W B1[4:0]	10	10	01	04	10
> W D1[4:0]	04	04	01	lf.	04
> 😽 S1[1:0]	0	0	1	2	0

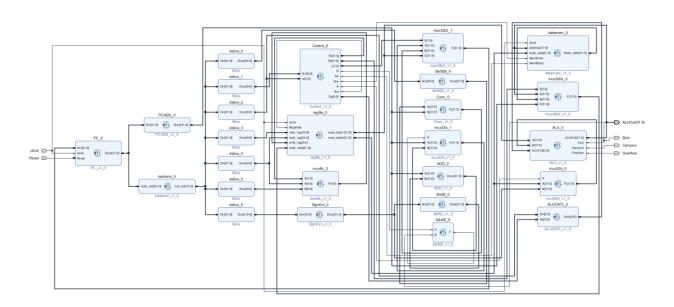
- Mux32b3

		0.000 ns			
Name	Value	0.000 ns	10.000 ns	20.000 ns	30.000 ns
> W A1[31:0]	ffffffe	fffffffe	00000000	d1111111	fffffffe
> W B1[31:0]	00000001	0000	0001	00000000	00000001
> W C1[31:0]	f0000001	f0000001	f0010001	f00f0001	f0000001
> W D1[31:0]	ffffffe	fffffffe	00000001	f00f0001	fffffffe
> W S1[1:0]	0	0	1	z	0

- Conn



Block Diagram



Conclusion: This lab was fairly simple I struggled to get jal working but quickly discovered the
bug.