1100111
+110(1)111

	opcode	I	Immsel	A	B	ALU	WBsel
R	0x33	b0110011 ~~0x 0110011~~	* cba	0	0	vary Funct3&7	0b01
I	0x67	b1100111		0	1	+	0b10
	0x03	b0000011	000	0	1	+ ~~vary~~	~~0b01~~ 0b00
	0x13	b0010011		0	1	vary Funct3&7	0b01
S	0x23	b0100011	001	* 0	1	+	*
SB	0x63	b1100011	0010	1 ~~*0~~	~~*~~ 1	~~*~~ +	*
U	~~0x17~~ 0x37	b0110111	011	*	1	Bselect	0b01
UJ	0x6F	b1101111	100 ✓	1	1	+	0b10

$c = x_4$

$a = \overline{x_6} x_5 \overline{x_4} \overline{x_3} \overline{x_2} x_1 x_0 + \overline{x_6} x_5 x_4 \overline{x_3} x_2 x_1 x_0$

$b = x_6 x_5 \overline{x_4}\, \overline{x_3}\, \overline{x_2} x_1 x_0 + \overline{x_6} x_5 x_4 \overline{x_3} x_2 x_1 x_0$

$= x_5 x_1 x_0 \cdot \overline{x_3} (x_6 \overline{x_4}\, \overline{x_2} + \overline{x_6} x_4 x_2)$

~~$b = x_6 x_5 x_1 x_0 + x_5 x_4 x_2 x_1 x_0$~~

~~$= x_5 x_1 x_0 (x_6 + x_4 x_2)$~~

~~$= x_5 x_1 x_0 (x_6 + x_4 x_2)$~~

~~$a = x_5 x_1 x_0 + x_5 x_4 x_2 x_1 x_0$~~

~~$= x_5 x_2 x_0 (1 +$~~

$b =$

011 0011
+001 0011
011 0111

654 32
011 00
001 00
011 01

~~$\overline{x_6} \cdot \overline{x_3} \cdot ($~~
~~$x_5 x_4 x_2 + x$~~

Task: 9 Imm A B WBSel 5

MemW PCSel BrUn RegEn. ALU

0x33 R	0	0	*	1	*
0x03 I	0	0	*	1	
0x13 I	0	0	*	1	
0x23 S	1	0	*	0	
0x63 SB	0	Funct3/Cmp output. 0/1	Funct3 */0/1	0	
0x37 U	0	0	*	1	
0x6f UJ	0	1	*	1	
0x67 I	0	1	*	1	

010

$\overline{x6}\,x5\,\overline{x4}$ { $\overline{x6}x5\overline{x4}\,\overline{x3}\,\overline{x2}$; $x6x5\overline{x4}$ ~

x6 = 110 ⇓ = 0

PCSel

x6 = 0 ⇒ 0.

x6 = 1 ⇒ { f: 1111 → 1; 7:0111 → 1; 3:0011 → $x_2=1$ ⇒ 1; $x_2=0$ ⇒

BrUn

Fctn3

000	*
100	0
110	1
001	*

007 001|

PCSel Design:

X6 = 0 Y=0

X6 = 1 Y= { X2=1 1
X2=0 ⇒

Func3 Outcome Y

000	BrEq	BrEq &
100	BrLt	BrLt. & $\bar{i}_2$
110	BrLt	
001	!BrEq	

X6	X2	Y
0	*	0
1	1	1
1	0	?
1	1	1

I:

func3	fun7	ALU
0	*	0 ✓
1	*	6 ✓
2	*	7 ✓
4	*	3 ✓
5	0x00	4
5	0x20	5
6	*	2 ✓
7	*	1 ✓

ALU Design:

Opcode	Func3	Func7	ALU (4bit)
0x67	*	*	0x0
0x03			
0x23			"+"
0x63			
0x6F			
0x37	*	*	0b1101 "BSel"
01| 0111			0x13(D)
✓ 0x33			~~A B C D~~
011 0011			Input 4
0x13			
001 0011			Input 8.

R:

010 0000
f5 f0

Input 4:

Func3		Funct 7 [31:25]	
0	0	00	0
0		01	10
0		20	12
✓1		00	6
1		01	14
✓2		00	7
00000✓3		01	11
8421 ✓4		00	3
✓5		00	4
5		01	8
✓6		00	2
✓7		00	2 D1
7		01	9