

31	25	24	20	19	15	14	12	11	7	6	0
imm[31:12]								rd	opcode		
imm[20 10:1 11 19:12]								rd	opcode		
imm[11:0]				rs1	funct3			rd	opcode		
imm[12 10:5]		rs2		rs1	funct3		imm[4:1 11]		opcode		
imm[11:5]		rs2		rs1	funct3		imm[4:0]		opcode		
funct5		funct2		rs2	rs1	funct3		rd	opcode		

**Type-U**  
**Type-UJ**  
**Type-I**  
**Type-SB**  
**Type-S**  
**Type-R**

### RV32I Base Integer Instruction Set

imm[31:12]					rd	0110111	
imm[31:12]					rd	0010111	
imm[20 10:1 11 19:12]					rd	1101111	
imm[11:0]			rs1	000	rd	1100111	
imm[12 10:5]		rs2	rs1	000	imm[4:1 11]	1100011	
imm[12 10:5]		rs2	rs1	001	imm[4:1 11]	1100011	
imm[12 10:5]		rs2	rs1	100	imm[4:1 11]	1100011	
imm[12 10:5]		rs2	rs1	101	imm[4:1 11]	1100011	
imm[12 10:5]		rs2	rs1	110	imm[4:1 11]	1100011	
imm[12 10:5]		rs2	rs1	111	imm[4:1 11]	1100011	
imm[11:0]			rs1	000	rd	0000011	
imm[11:0]			rs1	001	rd	0000011	
imm[11:0]			rs1	010	rd	0000011	
imm[11:0]			rs1	100	rd	0000011	
imm[11:0]			rs1	101	rd	0000011	
imm[11:5]		rs2	rs1	000	imm[4:0]	0100011	
imm[11:5]		rs2	rs1	001	imm[4:0]	0100011	
imm[11:5]		rs2	rs1	010	imm[4:0]	0100011	
imm[11:0]			rs1	000	rd	0010011	
imm[11:0]			rs1	010	rd	0010011	
imm[11:0]			rs1	011	rd	0010011	
imm[11:0]			rs1	100	rd	0010011	
imm[11:0]			rs1	110	rd	0010011	
imm[11:0]			rs1	111	rd	0010011	
000000		0	shamt5	rs1	001	rd	0010011
000000		0	shamt5	rs1	101	rd	0010011
010000		0	shamt5	rs1	101	rd	0010011
00000		00	rs2	rs1	000	rd	0110011
01000		00	rs2	rs1	000	rd	0110011
00000		00	rs2	rs1	001	rd	0110011
00000		00	rs2	rs1	010	rd	0110011
00000		00	rs2	rs1	011	rd	0110011
00000		00	rs2	rs1	100	rd	0110011
00000		00	rs2	rs1	101	rd	0110011
01000		00	rs2	rs1	101	rd	0110011
00000		00	rs2	rs1	110	rd	0110011
00000		00	rs2	rs1	111	rd	0110011
0000	pred	pred	succ	00000	000	00000	0001111
0000000			00000	00000	001	00000	0001111

LUI rd, imm  
AUIPC rd, imm  
JAL rd, disp  
JALR rd, rs1, imm  
BEQ rs1, rs2, disp  
BNE rs1, rs2, disp  
BLT rs1, rs2, disp  
BGE rs1, rs2, disp  
BLTU rs1, rs2, disp  
BGEU rs1, rs2, disp  
LB rd, imm(rs1)  
LH rd, imm(rs1)  
LW rd, imm(rs1)  
LBU rd, imm(rs1)  
LHU rd, imm(rs1)  
SB rs2, imm(rs1)  
SH rs2, imm(rs1)  
SW rs2, imm(rs1)  
ADDI rd, rs1, imm  
SLTI rd, rs1, imm  
SLTIU rd, rs1, imm  
XORI rd, rs1, imm  
ORI rd, rs1, imm  
ANDI rd, rs1, imm  
SLLI rd, rs1, imm  
SRLI rd, rs1, imm  
SRAI rd, rs1, imm  
ADD rd, rs1, rs2  
SUB rd, rs1, rs2  
SLL rd, rs1, rs2  
SLT rd, rs1, rs2  
SLTU rd, rs1, rs2  
XOR rd, rs1, rs2  
SRL rd, rs1, rs2  
SRA rd, rs1, rs2  
OR rd, rs1, rs2  
AND rd, rs1, rs2  
FENCE  
FENCE.I

### RV64I Base Integer Instruction Set (in addition to RV32I)

imm[11:0]		rs1	110	rd	0000011
imm[11:0]		rs1	011	rd	0000011
imm[11:5]		rs2	011	imm[4:0]	0100011
000000	shamt6	rs1	001	rd	0010011
000000	shamt6	rs1	101	rd	0010011
010000	shamt6	rs1	101	rd	0010011
imm[11:0]		rs1	000	rd	0011011
0000000	shamt5	rs1	001	rd	0011011

LWU rd, imm(rs1)  
LD rd, imm(rs1)  
SD rs2, imm(rs1)  
SLLI rd, rs1, imm  
SRLI rd, rs1, imm  
SRAI rd, rs1, imm  
ADDIW rd, rs1, imm  
SLLIW rd, rs1, imm

31	25	24	20	19	15	14	12	11	7	6	0	
imm[11:0]				rs1	funct3		rd		opcode			<b>Type-I</b>
funct5	funct2	rs2		rs1	funct3		rd		opcode			<b>Type-R</b>

#### RV64I Base Integer Instruction Set (in addition to RV32I) contd

0000000		shamt5	rs1	101	rd	0011011	SRLIW rd, rs1, imm
0100000		shamt5	rs1	101	rd	0011011	SRAIW rd, rs1, imm
00000	00	rs2	rs1	000	rd	0111011	ADDW rd, rs1, rs2
01000	00	rs2	rs1	000	rd	0111011	SUBW rd, rs1, rs2
00000	00	rs2	rs1	001	rd	0111011	SLLW rd, rs1, rs2
00000	00	rs2	rs1	101	rd	0111011	SRLW rd, rs1, rs2
01000	00	rs2	rs1	101	rd	0111011	SRAW rd, rs1, rs2

#### RV32M Standard Extension for Integer Multiply and Divide

00000	01	rs2	rs1	000	rd	0110011	MUL rd, rs1, rs2
00000	01	rs2	rs1	001	rd	0110011	MULH rd, rs1, rs2
00000	01	rs2	rs1	010	rd	0110011	MULHSU rd, rs1, rs2
00000	01	rs2	rs1	011	rd	0110011	MULHU rd, rs1, rs2
00000	01	rs2	rs1	100	rd	0110011	DIV rd, rs1, rs2
00000	01	rs2	rs1	101	rd	0110011	DIVU rd, rs1, rs2
00000	01	rs2	rs1	110	rd	0110011	REM rd, rs1, rs2
00000	01	rs2	rs1	111	rd	0110011	REMU rd, rs1, rs2

#### RV64M Standard Extension for Integer Multiply and Divide (in addition to RV32M)

00000	01	rs2	rs1	000	rd	0111011	MULW rd, rs1, rs2
00000	01	rs2	rs1	100	rd	0111011	DIVW rd, rs1, rs2
00000	01	rs2	rs1	101	rd	0111011	DIVUW rd, rs1, rs2
00000	01	rs2	rs1	110	rd	0111011	REMW rd, rs1, rs2
00000	01	rs2	rs1	111	rd	0111011	REMUW rd, rs1, rs2

#### RV32A Standard Extension for Atomic Instructions

00010	aqrl	00000	rs1	010	rd	0101111	LR.W aqrl, rd, (rs1)
00011	aqrl	rs2	rs1	010	rd	0101111	SC.W aqrl, rd, rs2, (rs1)
00001	aqrl	rs2	rs1	010	rd	0101111	AMOSWAP.W aqrl, rd, rs2, (rs1)
00000	aqrl	rs2	rs1	010	rd	0101111	AMOADD.W aqrl, rd, rs2, (rs1)
00100	aqrl	rs2	rs1	010	rd	0101111	AMOXOR.W aqrl, rd, rs2, (rs1)
01000	aqrl	rs2	rs1	010	rd	0101111	AMOOR.W aqrl, rd, rs2, (rs1)
01100	aqrl	rs2	rs1	010	rd	0101111	AMOAND.W aqrl, rd, rs2, (rs1)
10000	aqrl	rs2	rs1	010	rd	0101111	AMOMIN.W aqrl, rd, rs2, (rs1)
10100	aqrl	rs2	rs1	010	rd	0101111	AMOMAX.W aqrl, rd, rs2, (rs1)
11000	aqrl	rs2	rs1	010	rd	0101111	AMOMINU.W aqrl, rd, rs2, (rs1)
11100	aqrl	rs2	rs1	010	rd	0101111	AMOMAXU.W aqrl, rd, rs2, (rs1)

#### RV64A Standard Extension for Atomic Instructions (in addition to RV32A)

00010	aqrl	00000	rs1	011	rd	0101111	LR.D aqrl, rd, (rs1)
00011	aqrl	rs2	rs1	011	rd	0101111	SC.D aqrl, rd, rs2, (rs1)
00001	aqrl	rs2	rs1	011	rd	0101111	AMOSWAP.D aqrl, rd, rs2, (rs1)
00000	aqrl	rs2	rs1	011	rd	0101111	AMOADD.D aqrl, rd, rs2, (rs1)
00100	aqrl	rs2	rs1	011	rd	0101111	AMOXOR.D aqrl, rd, rs2, (rs1)
01000	aqrl	rs2	rs1	011	rd	0101111	AMOOR.D aqrl, rd, rs2, (rs1)
01100	aqrl	rs2	rs1	011	rd	0101111	AMOAND.D aqrl, rd, rs2, (rs1)
10000	aqrl	rs2	rs1	011	rd	0101111	AMOMIN.D aqrl, rd, rs2, (rs1)
10100	aqrl	rs2	rs1	011	rd	0101111	AMOMAX.D aqrl, rd, rs2, (rs1)
11000	aqrl	rs2	rs1	011	rd	0101111	AMOMINU.D aqrl, rd, rs2, (rs1)
11100	aqrl	rs2	rs1	011	rd	0101111	AMOMAXU.D aqrl, rd, rs2, (rs1)

31	25	24	20	19	15	14	12	11	7	6	0	
imm[11:0]				rs1	funct3	rd	opcode					<b>Type-I</b>
imm[11:5]		rs2		rs1	funct3	imm[4:0]	opcode					<b>Type-S</b>
funct5	funct2	rs2		rs1	funct3	rd	opcode					<b>Type-R</b>

#### RV32S Standard Extension for Supervisor-level Instructions

0000000	00000	00000	000	00000	1110011	ECALL
0000000	00001	00000	000	00000	1110011	EBREAK
0000000	00010	00000	000	00000	1110011	URET
0001000	00000	00000	000	00000	1110011	SRET
0010000	00010	00000	000	00000	1110011	HRET
0011000	00010	00000	000	00000	1110011	MRET
0111101	10010	00000	000	00000	1110011	DRET
0001000	00001	rs1	000	00000	1110011	SFENCE.VM
0001000	00010	00000	000	00000	1110011	WFI
imm[11:0]		rs1	001	rd	1110011	CSRRW rd, csr, rs1
imm[11:0]		rs1	010	rd	1110011	CSRRS rd, csr, rs1
imm[11:0]		rs1	011	rd	1110011	CSRRC rd, csr, rs1
imm[11:0]		imm5	101	rd	1110011	CSRRWI rd, csr, imm5
imm[11:0]		imm5	110	rd	1110011	CSRRSI rd, csr, imm5
imm[11:0]		imm5	111	rd	1110011	CSRRCI rd, csr, imm5

#### RV32F Standard Extension for Single-Precision Floating-Point

imm[11:0]			rs1	010	rd	0000111	FLW frd, imm(rs1)
imm[11:5]		rs2	rs1	010	imm[4:0]	0100111	FSW frs2, imm(rs1)
rs3	00	rs2	rs1	rm	rd	1000011	FMADD.S rm, frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1000111	FMSUB.S rm, frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1001011	FNMSUB.S rm, frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1001111	FNMADD.S rm, frd, frs1, frs2, frs3
00000	00	rs2	rs1	rm	rd	1010011	FADD.S rm, frd, frs1, frs2
00001	00	rs2	rs1	rm	rd	1010011	FSUB.S rm, frd, frs1, frs2
00010	00	rs2	rs1	rm	rd	1010011	FMUL.S rm, frd, frs1, frs2
00011	00	rs2	rs1	rm	rd	1010011	FDIV.S rm, frd, frs1, frs2
00100	00	rs2	rs1	000	rd	1010011	FSGNJ.S rm, frd, frs1, frs2
00100	00	rs2	rs1	001	rd	1010011	FSGNJN.S rm, frd, frs1, frs2
00100	00	rs2	rs1	010	rd	1010011	FSGNJX.S rm, frd, frs1, frs2
00101	00	rs2	rs1	000	rd	1010011	FMIN.S rm, frd, frs1, frs2
00101	00	rs2	rs1	001	rd	1010011	FMAX.S rm, frd, frs1, frs2
01011	00	00000	rs1	rm	rd	1010011	FSQRT.S rm, frd, frs1, frs2
10100	00	rs2	rs1	000	rd	1010011	FLE.S rd, frs1, frs2
10100	00	rs2	rs1	001	rd	1010011	FLT.S rd, frs1, frs2
10100	00	rs2	rs1	010	rd	1010011	FEQ.S rd, frs1, frs2
11000	00	00000	rs1	rm	rd	1010011	FCVT.W.S rm, rd, frs1
11000	00	00001	rs1	rm	rd	1010011	FCVT.WU.S rm, rd, frs1
11010	00	00000	rs1	rm	rd	1010011	FCVT.S.W rm, frd, rs1
11010	00	00001	rs1	rm	rd	1010011	FCVT.S.WU rm, frd, rs1
11100	00	00000	rs1	000	rd	1010011	FMV.X.S rd, frs1
11100	00	00000	rs1	001	rd	1010011	FCLASS.S rd, frs1
11110	00	00000	rs1	000	rd	1010011	FMV.X.S rd, frs1
000000000011			00000	010	rd	1110011	FRCSR rd, csr, rs1
000000000010			00000	010	rd	1110011	FRRM rd, csr, rs1
000000000001			00000	010	rd	1110011	FRFLAGS rd, csr, rs1
000000000011			rs1	001	rd	1110011	FSCSR rd, csr, rs1
000000000010			rs1	001	rd	1110011	FSRM rd, csr, rs1

31	25	24	20	19	15	14	12	11	7	6	0			
imm[11:0]				rs1		funct3		rd	opcode			Type-I		
funct5	funct2			rs2		rs1		funct3		rd	opcode		Type-R	
imm[11:5]				rs2		rs1		funct3		imm[4:0]	opcode			Type-S

RV32F Standard Extension for Single-Precision Floating-Point contd

000000000001				rs1	001	rd	1110011	FSFLAGS rd, csr, rs1
000000000010				imm5	101	rd	1110011	FSRMI rd, csr, imm5
000000000001				imm5	101	rd	1110011	FSFLAGSI rd, csr, imm5

RV64F Standard Extension for Single-Precision Floating-Point (in addition to RV32F)

11000	00	00010	rs1	rm	rd	1010011	FCVT.L.S rm, rd, frs1
11000	00	00011	rs1	rm	rd	1010011	FCVT.LU.S rm, rd, frs1
11010	00	00010	rs1	rm	rd	1010011	FCVT.S.L rm, frd, rs1
11010	00	00011	rs1	rm	rd	1010011	FCVT.S.LU rm, frd, rs1

RV32D Standard Extension for Double-Precision Floating-Point

imm[11:0]			rs1	011	rd	0000111	FLD frd, imm(rs1)
imm[11:5]			rs2	rs1	imm[4:0]	0100111	FSD frs2, imm(rs1)
rs3	01	rs2	rs1	rm	rd	1000011	FMADD.D rm, frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1000111	FMSUB.D rm, frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1001011	FNMSUB.D rm, frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1001111	FNMADD.D rm, frd, frs1, frs2, frs3
00000	01	rs2	rs1	rm	rd	1010011	FADD.D rm, frd, frs1, frs2
00001	01	rs2	rs1	rm	rd	1010011	FSUB.D rm, frd, frs1, frs2
00010	01	rs2	rs1	rm	rd	1010011	FMUL.D rm, frd, frs1, frs2
00011	01	rs2	rs1	rm	rd	1010011	FDIV.D rm, frd, frs1, frs2
00100	01	rs2	rs1	000	rd	1010011	FSGNJ.D rm, frd, frs1, frs2
00100	01	rs2	rs1	001	rd	1010011	FSGNJD rm, frd, frs1, frs2
00100	01	rs2	rs1	010	rd	1010011	FSGNJX.D rm, frd, frs1, frs2
00101	01	rs2	rs1	000	rd	1010011	FMIN.D rm, frd, frs1, frs2
00101	01	rs2	rs1	001	rd	1010011	FMAX.D rm, frd, frs1, frs2
01000	00	00001	rs1	rm	rd	1010011	FCVT.S.D rm, frd, frs1
01000	01	00000	rs1	rm	rd	1010011	FCVT.D.S rm, frd, frs1
01011	01	00000	rs1	rm	rd	1010011	FSQRT.D rm, frd, frs1
10100	01	rs2	rs1	000	rd	1010011	FLE.D rd, frs1, frs2
10100	01	rs2	rs1	001	rd	1010011	FLT.D rd, frs1, frs2
10100	01	rs2	rs1	010	rd	1010011	FEQ.D rd, frs1, frs2
11000	01	00000	rs1	rm	rd	1010011	FCVT.W.D rm, rd, frs1
11000	01	00001	rs1	rm	rd	1010011	FCVT.WU.D rm, rd, frs1
11010	01	00000	rs1	rm	rd	1010011	FCVT.D.W rm, frd, rs1
11010	01	00001	rs1	rm	rd	1010011	FCVT.D.WU rm, frd, rs1
11100	01	00000	rs1	001	rd	1010011	FCLASS.D rd, frs1

RV64D Standard Extension for Double-Precision Floating-Point (in addition to RV32D)

11000	01	00010	rs1	rm	rd	1010011	FCVT.L.D rm, rd, frs1
11000	01	00011	rs1	rm	rd	1010011	FCVT.LU.D rm, rd, frs1
11100	01	00000	rs1	000	rd	1010011	FMV.X.D rd, frs1
11010	01	00010	rs1	rm	rd	1010011	FCVT.D.L rm, frd, rs1
11010	01	00011	rs1	rm	rd	1010011	FCVT.D.LU rm, frd, rs1
11110	01	00000	rs1	000	rd	1010011	FMV.D.X frd, rs1

15	13	12	10	9	7	6	5	4	2	1	0	
funct3		imm8						rd'		op		Type-CIW
funct3		imm3		rs1'		imm2		rd'		op		Type-CL
funct3		imm3		rs1'		imm2		rs2'		op		Type-CS
funct3		imm1	rd/rs1			imm5			op		Type-CI	
funct3		imm11						op		Type-CJ		
funct3		imm3		rs1'		imm5			op		Type-CB	
funct4			rd/rs1			rs2			op		Type-CR	
funct3		imm6				rs2			op		Type-CSS	

#### RV32C Standard Extension for Compressed Instructions

000	imm[5:4 9:6 2 3]				rd'	00	C.ADDI4SPN rd, rs1, imm	
001	imm[5:3]		rs1'		imm[7:6]	rd'	00	C.FLD frd, imm(rs1)
010	imm[5:3]		rs1'		imm[2:6]	rd'	00	C.LW rd, imm(rs1)
011	imm[5:3]		rs1'		imm[2:6]	rd'	00	C.FLW frd, imm(rs1)
101	imm[5:3]		rs1'		imm[7:6]	rs2'	00	C.FSD frs2, imm(rs1)
110	imm[5:3]		rs1'		imm[2:6]	rs2'	00	C.SW rs2, imm(rs1)
111	imm[5:3]		rs1'		imm[2:6]	rs2'	00	C.FSW frs2, imm(rs1)
000	0	00000			00000		01	C.NOP
000	imm[5]	rs1/rd			imm[4:0]		01	C.ADDI rd, rs1, imm
001	imm[11 4 9:8 10 6 7 3:1 5]						01	C.JAL rd, disp
010	imm[5]	rs1/rd			imm[4:0]		01	C.LI rd, rs1, imm
011	imm[17]	rd			imm[16:12]		01	C.LUI rd, imm
011	imm[9]	rs1/rd			imm[4 6 8:7 5]		01	C.ADDI16SP rd, rs1, imm
100	imm[5]	00	rs1'/rd'		imm[4:0]		01	C.SRLI rd, rs1, imm
100	imm[5]	01	rs1'/rd'		imm[4:0]		01	C.SRAI rd, rs1, imm
100	imm[5]	10	rs1'/rd'		imm[4:0]		01	C.ANDI rd, rs1, imm
100	011		rs1'/rd'		00	rs2'	01	C.SUB rd, rs1, rs2
100	011		rs1'/rd'		01	rs2'	01	C.XOR rd, rs1, rs2
100	011		rs1'/rd'		10	rs2'	01	C.OR rd, rs1, rs2
100	011		rs1'/rd'		11	rs2'	01	C.AND rd, rs1, rs2
100	111		rs1'/rd'		00	rs2'	01	C.SUBW rd, rs1, rs2
100	111		rs1'/rd'		01	rs2'	01	C.ADDW rd, rs1, rs2
101	imm[11 4 9:8 10 6 7 3:1 5]						01	C.J rd, disp
110	imm[8 4:3]		rs1'		imm[7:6 2:1 5]		01	C.BEQZ rs1, rs2, disp
111	imm[8 4:3]		rs1'		imm[7:6 2:1 5]		01	C.BNEZ rs1, rs2, disp
000	imm[5]	rd			imm[4:0]		10	C.SLLI rd, rs1, imm
001	imm[5]	rd			imm[4:3 8:6]		10	C.FLDSP frd, imm(rs1)
010	imm[5]	rd			imm[4:2 7:6]		10	C.LWSP rd, imm(rs1)
011	imm[5]	rd			imm[4:2 7:6]		10	C.FLWSP frd, imm(rs1)
1000		rs1			00000		10	C.JR rd, rs1, imm
1000		rd			rs2		10	C.MV rd, rs1, rs2
100	100	000		00	000		10	C.EBREAK
1001		rs1			00000		10	C.JALR rd, rs1, imm
1001		rd			rs2		10	C.ADD rd, rs1, rs2
101	imm[5:3 8:6]			rs2		10		C.FSDSP frs2, imm(rs1)
110	imm[5:2 7:6]			rs2		10		C.SWSP rs2, imm(rs1)
111	imm[5:2 7:6]			rs2		10		C.FSWSP frs2, imm(rs1)

#### RV64C Standard Extension for Compressed Instructions (in addition to RV32C)

011	imm[5:3]		rs1'	imm[7:6]	rd'	00	C.LD rd, imm(rs1)	
111	imm[5:3]		rs1'	imm[7:6]	rs2'	00	C.SD rs2, imm(rs1)	
001	imm[5]	rs1/rd		imm[4:0]			01	C.ADDIW rd, rs1, imm
011	imm[5]	rs1/rd		imm[4:3 8:6]			10	C.LDSP rd, imm(rs1)
111	imm[5:3 8:6]			rs2			10	C.SDSP rs2, imm(rs1)