31	25	24	20	19	15	14	12	11	7	6	0	
imm[31:12]								rd		opcode		Type-U
imm[20|10:1|11|19:12]								rd		opcode		Type-UJ
imm[11:0]				rs1		funct3		rd		opcode		Type-I
imm[12|10:5]		rs2		rs1		funct3		imm[4:1|11]		opcode		Type-SB
imm[11:5]		rs2		rs1		funct3		imm[4:0]		opcode		Type-S
funct7		rs2		rs1		funct3		rd		opcode		Type-R

RV32I Base Integer Instruction Set

31	25	24	20	19	15	14	12	11	7	6	0	
imm[31:12]								rd		0110111		LUI rd, imm
imm[31:12]								rd		0010111		AUIPC rd, imm
imm[20|10:1|11|19:12]								rd		1101111		JAL rd, disp
imm[11:0]				rs1		000		rd		1100111		JALR rd, rs1, imm
imm[12|10:5]		rs2		rs1		000		imm[4:1|11]		1100011		BEQ rs1, rs2, disp
imm[12|10:5]		rs2		rs1		001		imm[4:1|11]		1100011		BNE rs1, rs2, disp
imm[12|10:5]		rs2		rs1		100		imm[4:1|11]		1100011		BLT rs1, rs2, disp
imm[12|10:5]		rs2		rs1		101		imm[4:1|11]		1100011		BGE rs1, rs2, disp
imm[12|10:5]		rs2		rs1		110		imm[4:1|11]		1100011		BLTU rs1, rs2, disp
imm[12|10:5]		rs2		rs1		111		imm[4:1|11]		1100011		BGEU rs1, rs2, disp
imm[11:0]				rs1		000		rd		0000011		LB rd, imm(rs1)
imm[11:0]				rs1		001		rd		0000011		LH rd, imm(rs1)
imm[11:0]				rs1		010		rd		0000011		LW rd, imm(rs1)
imm[11:0]				rs1		100		rd		0000011		LBU rd, imm(rs1)
imm[11:0]				rs1		101		rd		0000011		LHU rd, imm(rs1)
imm[11:5]		rs2		rs1		000		imm[4:0]		0100011		SB rs2, imm(rs1)
imm[11:5]		rs2		rs1		001		imm[4:0]		0100011		SH rs2, imm(rs1)
imm[11:5]		rs2		rs1		010		imm[4:0]		0100011		SW rs2, imm(rs1)
imm[11:0]				rs1		000		rd		0010011		ADDI rd, rs1, imm
imm[11:0]				rs1		010		rd		0010011		SLTI rd, rs1, imm
imm[11:0]				rs1		011		rd		0010011		SLTIU rd, rs1, imm
imm[11:0]				rs1		100		rd		0010011		XORI rd, rs1, imm
imm[11:0]				rs1		110		rd		0010011		ORI rd, rs1, imm
imm[11:0]				rs1		111		rd		0010011		ANDI rd, rs1, imm
000000	0	shamt5		rs1		001		rd		0010011		SLLI rd, rs1, imm
000000	0	shamt5		rs1		101		rd		0010011		SRLI rd, rs1, imm
010000	0	shamt5		rs1		101		rd		0010011		SRAI rd, rs1, imm
0000000		rs2		rs1		000		rd		0110011		ADD rd, rs1, rs2
0100000		rs2		rs1		000		rd		0110011		SUB rd, rs1, rs2
0000000		rs2		rs1		001		rd		0110011		SLL rd, rs1, rs2
0000000		rs2		rs1		010		rd		0110011		SLT rd, rs1, rs2
0000000		rs2		rs1		011		rd		0110011		SLTU rd, rs1, rs2
0000000		rs2		rs1		100		rd		0110011		XOR rd, rs1, rs2
0000000		rs2		rs1		101		rd		0110011		SRL rd, rs1, rs2
0100000		rs2		rs1		101		rd		0110011		SRA rd, rs1, rs2
0000000		rs2		rs1		110		rd		0110011		OR rd, rs1, rs2
0000000		rs2		rs1		111		rd		0110011		AND rd, rs1, rs2
0000	pred	pred	succ	00000		000		00000		0001111		FENCE
0000000		00000		00000		001		00000		0001111		FENCE.I

RV64I Base Integer Instruction Set (in addition to RV32I)

31	25	24	20	19	15	14	12	11	7	6	0	
imm[11:0]				rs1		110		rd		0000011		LWU rd, imm(rs1)
imm[11:0]				rs1		011		rd		0000011		LD rd, imm(rs1)
imm[11:5]		rs2		rs1		011		imm[4:0]		0100011		SD rs2, imm(rs1)
000000		shamt6		rs1		001		rd		0010011		SLLI rd, rs1, imm
000000		shamt6		rs1		101		rd		0010011		SRLI rd, rs1, imm
010000		shamt6		rs1		101		rd		0010011		SRAI rd, rs1, imm
imm[11:0]				rs1		000		rd		0011011		ADDIW rd, rs1, imm
0000000		shamt5		rs1		001		rd		0011011		SLLIW rd, rs1, imm

31		25	24	20	19	15	14	12	11	7	6	0	

imm[11:0]			rs1	funct3	rd	opcode	Type-I
funct7	rs2		rs1	funct3	rd	opcode	Type-R

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

funct7	rs2/shamt	rs1	funct3	rd	opcode	
0000000	shamt5	rs1	101	rd	0011011	SRLIW rd, rs1, imm
0100000	shamt5	rs1	101	rd	0011011	SRAIW rd, rs1, imm
0000000	rs2	rs1	000	rd	0111011	ADDW rd, rs1, rs2
0100000	rs2	rs1	000	rd	0111011	SUBW rd, rs1, rs2
0000000	rs2	rs1	001	rd	0111011	SLLW rd, rs1, rs2
0000000	rs2	rs1	101	rd	0111011	SRLW rd, rs1, rs2
0100000	rs2	rs1	101	rd	0111011	SRAW rd, rs1, rs2

RV32M Standard Extension for Integer Multiply and Divide

funct7	rs2	rs1	funct3	rd	opcode	
0000001	rs2	rs1	000	rd	0110011	MUL rd, rs1, rs2
0000001	rs2	rs1	001	rd	0110011	MULH rd, rs1, rs2
0000001	rs2	rs1	010	rd	0110011	MULHSU rd, rs1, rs2
0000001	rs2	rs1	011	rd	0110011	MULHU rd, rs1, rs2
0000001	rs2	rs1	100	rd	0110011	DIV rd, rs1, rs2
0000001	rs2	rs1	101	rd	0110011	DIVU rd, rs1, rs2
0000001	rs2	rs1	110	rd	0110011	REM rd, rs1, rs2
0000001	rs2	rs1	111	rd	0110011	REMU rd, rs1, rs2

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

funct7	rs2	rs1	funct3	rd	opcode	
0000001	rs2	rs1	000	rd	0111011	MULW rd, rs1, rs2
0000001	rs2	rs1	100	rd	0111011	DIVW rd, rs1, rs2
0000001	rs2	rs1	101	rd	0111011	DIVUW rd, rs1, rs2
0000001	rs2	rs1	110	rd	0111011	REMW rd, rs1, rs2
0000001	rs2	rs1	111	rd	0111011	REMUW rd, rs1, rs2

RV32A Standard Extension for Atomic Instructions

funct5	aqrl	rs2	rs1	funct3	rd	opcode	
00010	aqrl	00000	rs1	010	rd	0101111	LR.W rd, (rs1)
00011	aqrl	rs2	rs1	010	rd	0101111	SC.W rd, rs2, (rs1)
00001	aqrl	rs2	rs1	010	rd	0101111	AMOSWAP.W rd, rs2, (rs1)
00000	aqrl	rs2	rs1	010	rd	0101111	AMOADD.W rd, rs2, (rs1)
00100	aqrl	rs2	rs1	010	rd	0101111	AMOXOR.W rd, rs2, (rs1)
01000	aqrl	rs2	rs1	010	rd	0101111	AMOOR.W rd, rs2, (rs1)
01100	aqrl	rs2	rs1	010	rd	0101111	AMOAND.W rd, rs2, (rs1)
10000	aqrl	rs2	rs1	010	rd	0101111	AMOMIN.W rd, rs2, (rs1)
10100	aqrl	rs2	rs1	010	rd	0101111	AMOMAX.W rd, rs2, (rs1)
11000	aqrl	rs2	rs1	010	rd	0101111	AMOMINU.W rd, rs2, (rs1)
11100	aqrl	rs2	rs1	010	rd	0101111	AMOMAXU.W rd, rs2, (rs1)

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

funct5	aqrl	rs2	rs1	funct3	rd	opcode	
00010	aqrl	00000	rs1	011	rd	0101111	LR.D rd, (rs1)
00011	aqrl	rs2	rs1	011	rd	0101111	SC.D rd, rs2, (rs1)
00001	aqrl	rs2	rs1	011	rd	0101111	AMOSWAP.D rd, rs2, (rs1)
00000	aqrl	rs2	rs1	011	rd	0101111	AMOADD.D rd, rs2, (rs1)
00100	aqrl	rs2	rs1	011	rd	0101111	AMOXOR.D rd, rs2, (rs1)
01000	aqrl	rs2	rs1	011	rd	0101111	AMOOR.D rd, rs2, (rs1)
01100	aqrl	rs2	rs1	011	rd	0101111	AMOAND.D rd, rs2, (rs1)
10000	aqrl	rs2	rs1	011	rd	0101111	AMOMIN.D rd, rs2, (rs1)
10100	aqrl	rs2	rs1	011	rd	0101111	AMOMAX.D rd, rs2, (rs1)
11000	aqrl	rs2	rs1	011	rd	0101111	AMOMINU.D rd, rs2, (rs1)
11100	aqrl	rs2	rs1	011	rd	0101111	AMOMAXU.D rd, rs2, (rs1)

31	25	24	20	19	15	14	12	11	7	6	0	
imm[11:0]				rs1		funct3		rd		opcode		Type-I
imm[11:5]		rs2		rs1		funct3		imm[4:0]		opcode		Type-S
rs3	funct2	rs2		rs1		funct3		rd		opcode		Type-R4
funct7		rs2		rs1		funct3		rd		opcode		Type-R

RV32S Standard Extension for Supervisor-level Instructions

0000000	00000	00000	000	00000	1110011	SCALL
0000000	00001	00000	000	00000	1110011	SBREAK
0001000	00000	00000	000	00000	1110011	SRET
0001000	00001	rs1	000	00000	1110011	SFENCE.VM
0001000	00010	00000	000	00000	1110011	WFI
0011000	00110	00000	000	00000	1110011	MRTH
0011000	00101	00000	000	00000	1110011	MRTS
0010000	00101	00000	000	00000	1110011	HRTS
110000000000		00000	010	rd	1110011	RDCYCLE rd, csr, rs1
110000000001		00000	010	rd	1110011	RDTIME rd, csr, rs1
110000000010		00000	010	rd	1110011	RDINSTRET rd, csr, rs1
110010000000		00000	010	rd	1110011	RDCYCLEH rd, csr, rs1
110010000001		00000	010	rd	1110011	RDTIMEH rd, csr, rs1
110010000010		00000	010	rd	1110011	RDINSTRETH rd, csr, rs1
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 frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1000111	FMSUB.S frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1001011	FNMSUB.S frd, frs1, frs2, frs3
rs3	00	rs2	rs1	rm	rd	1001111	FNMADD.S frd, frs1, frs2, frs3
0000000		rs2	rs1	rm	rd	1010011	FADD.S frd, frs1, frs2
0000100		rs2	rs1	rm	rd	1010011	FSUB.S frd, frs1, frs2
0001000		rs2	rs1	rm	rd	1010011	FMUL.S frd, frs1, frs2
0001100		rs2	rs1	rm	rd	1010011	FDIV.S frd, frs1, frs2
0010000		rs2	rs1	000	rd	1010011	FSGNJ.S frd, frs1, frs2
0010000		rs2	rs1	001	rd	1010011	FSGNJN.S frd, frs1, frs2
0010000		rs2	rs1	010	rd	1010011	FSGNJX.S frd, frs1, frs2
0010100		rs2	rs1	000	rd	1010011	FMIN.S frd, frs1, frs2
0010100		rs2	rs1	001	rd	1010011	FMAX.S frd, frs1, frs2
0101100		00000	rs1	rm	rd	1010011	FSQRT.S frd, frs1, frs2
1010000		rs2	rs1	000	rd	1010011	FLE.S frd, rs1, frs2
1010000		rs2	rs1	001	rd	1010011	FLT.S frd, rs1, frs2
1010000		rs2	rs1	010	rd	1010011	FEQ.S frd, rs1, frs2
1100000		00000	rs1	rm	rd	1010011	FCVT.W.S rd, frs1
1100000		00001	rs1	rm	rd	1010011	FCVT.WU.S rd, frs1
1101000		00000	rs1	rm	rd	1010011	FCVT.S.W frd, rs1
1101000		00001	rs1	rm	rd	1010011	FCVT.S.WU frd, rs1
1110000		00000	rs1	000	rd	1010011	FMV.X.S rd, frs1
1110000		00000	rs1	001	rd	1010011	FCLASS.S rd, frs1
1111000		00000	rs1	000	rd	1010011	FMV.S.X frd, rs1

31	25	24	20	19	15	14	12	11	7	6	0	
imm[11:0]				rs1		funct3		rd		opcode		Type-I
funct7		rs2		rs1		funct3		rd		opcode		Type-R
imm[11:5]		rs2		rs1		funct3		imm[4:0]		opcode		Type-S
rs3	funct2	rs2		rs1		funct3		rd		opcode		Type-R4

RV32F Standard Extension for Single-Precision Floating-Point contd

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
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)

1100000	00010	rs1	rm	rd	1010011	FCVT.L.S rd, frs1
1100000	00011	rs1	rm	rd	1010011	FCVT.LU.S rd, frs1
1101000	00010	rs1	rm	rd	1010011	FCVT.S.L frd, rs1
1101000	00011	rs1	rm	rd	1010011	FCVT.S.LU 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	011	imm[4:0]	0100111	FSD frs2, imm(rs1)	
rs3	01	rs2	rs1	rm	rd	1000011	FMADD.D frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1000111	FMSUB.D frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1001011	FNMSUB.D frd, frs1, frs2, frs3
rs3	01	rs2	rs1	rm	rd	1001111	FNMADD.D frd, frs1, frs2, frs3
0000001		rs2	rs1	rm	rd	1010011	FADD.D frd, frs1, frs2
0000101		rs2	rs1	rm	rd	1010011	FSUB.D frd, frs1, frs2
0001001		rs2	rs1	rm	rd	1010011	FMUL.D frd, frs1, frs2
0001101		rs2	rs1	rm	rd	1010011	FDIV.D frd, frs1, frs2
0010001		rs2	rs1	000	rd	1010011	FSGNJ.D frd, frs1, frs2
0010001		rs2	rs1	001	rd	1010011	FSGNJN.D frd, frs1, frs2
0010001		rs2	rs1	010	rd	1010011	FSGNJX.D frd, frs1, frs2
0010101		rs2	rs1	000	rd	1010011	FMIN.D frd, frs1, frs2
0010101		rs2	rs1	001	rd	1010011	FMAX.D frd, frs1, frs2
0100000		00001	rs1	rm	rd	1010011	FCVT.S.D frd, frs1
0100001		00000	rs1	rm	rd	1010011	FCVT.D.S frd, frs1
0101101		00000	rs1	rm	rd	1010011	FSQRT.D frd, frs1
1010001		rs2	rs1	000	rd	1010011	FLE.D frd, rs1, frs2
1010001		rs2	rs1	001	rd	1010011	FLT.D frd, rs1, frs2
1010001		rs2	rs1	010	rd	1010011	FEQ.D frd, rs1, frs2
1100001		00000	rs1	rm	rd	1010011	FCVT.W.D rd, frs1
1100001		00001	rs1	rm	rd	1010011	FCVT.WU.D rd, frs1
1101001		00000	rs1	rm	rd	1010011	FCVT.D.W frd, rs1
1101001		00001	rs1	rm	rd	1010011	FCVT.D.WU frd, rs1
1110001		00000	rs1	001	rd	1010011	FCLASS.D rd, frs1

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

1100001	00010	rs1	rm	rd	1010011	FCVT.L.D rd, frs1
1100001	00011	rs1	rm	rd	1010011	FCVT.LU.D rd, frs1
1110001	00000	rs1	000	rd	1010011	FMV.X.D rd, frs1
1101001	00010	rs1	rm	rd	1010011	FCVT.D.L frd, rs1
1101001	00011	rs1	rm	rd	1010011	FCVT.D.LU frd, rs1
1111001	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

15:13	12	11:10	9:7	6:5	4:2	1:0	
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)

15:13	12	11:10	9:7	6:5	4:2	1:0	
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)