



vsduser@vsduser-VirtualBox: ~

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vsduser@vsduser-VirtualBox:~\$ gedit sum.c

vsduser@vsduser-VirtualBox:~\$ gcc sum.c

vsduser@vsduser-VirtualBox:~\$./a.out

R-Type Instruction:0x402081B3

I-Type Instruction:0x0FF08193

S-Type Instruction:0x1E208FA3

B-Type Instruction:0x1E208F63

U-Type Instruction:0x123451B7

J-Type Instruction:0x1FF1F1EF

vsduser@vsduser-VirtualBox:~\$ cat sum.c

#include<stdio.h>

#include<stdint.h>

//Function to create an R-Type instruction

uint32_t createInstructionR(uint8_t opcode,uint8_t funct3,uint8_t funct7,uint8_t rs1,uint8_t rs2,uint8_t rd)

{

return(funct7<<25)|(rs2<<20)|(rs1<<15)|((funct3<<12)|(rd<<7)|opcode;

}

//Function to create an I-Type instruction

uint32_t createInstructionI(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rd,uint16_t imm)

{

return(imm<<20)|(rs1<<15)|((funct3<<12)|(rd<<7)|opcode;

}

//Function to create an S-Type instruction

uint32_t createInstructionS(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)

{

uint8_t imm11_5=(imm>>5)&0x7F;

uint8_t imm4_0=imm&0x1F;

return(imm11_5<<25)|(rs2<<20)|(rs1<<15)|((funct3<<12)|(imm4_0<<7)|opcode;

}

//Function to create an B-Type instruction

uint32_t createInstructionB(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)

{

uint8_t imm12=(imm>>12)&0x1;

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```
#include<stdio.h>
#include<stdint.h>
//Function to create an R-Type instruction
uint32_t createInstructionR(uint8_t opcode,uint8_t funct3,uint8_t funct7,uint8_t rs1,uint8_t rs2,uint8_t rd)
{
    return(funct7<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(rd<<7)|opcode;
}
//Function to create an I-Type instruction
uint32_t createInstructionI(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rd,uint16_t imm)
{
    return(imm<<20)|(rs1<<15)|(funct3<<12)|(rd<<7)|opcode;
}
//Function to create an S-Type instruction
uint32_t createInstructionS(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)
{
    uint8_t imm11_5=(imm>>5)&0x7F;
    uint8_t imm4_0= imm&0x1F;
    return(imm11_5<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(imm4_0<<7)|opcode;
}
//Function to create an B-Type instruction
uint32_t createInstructionB(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)
{
    uint8_t imm12=(imm>>12)&0x1;
    uint8_t imm10_5=(imm>>5)&0x3F;
    uint8_t imm4_1=(imm>>1)&0xF;
    uint8_t imm11=(imm>>11)&0x1;
    return(imm12<<31)|(imm11<<7)|(imm10_5<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(imm4_1<<8)|opcode;
}
//Function to create an U-Type instruction
uint32_t createInstructionU(uint8_t opcode,uint8_t rd,uint32_t imm)
{
    return(imm<<12)|(rd<<7)|opcode;
}
```



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```
return(imm<<12)|(rd<<7)|opcode;
}
//Function to create an J-Type instruction
uint32_t createInstructionJ(uint8_t opcode,uint8_t rd,uint32_t imm)
{
    uint8_t imm20=(imm>>20)&0x1;|
    uint8_t imm10_1=(imm>>1)&0x3FF;
    uint8_t imm11=(imm>>11)&0x1;
    uint8_t imm19_12=(imm>>12)&0xFF;
    return(imm20<<31)|(imm19_12<<12)|(imm11<<20)|(imm10_1<<21)|(rd<<7)|opcode;
}

int main()
{
    //Example:creating an R-Type instruction
    uint32_t rType = createInstructionR(0x33,0x0,0x20,1,2,3);
    //opcode=0x33,funct3=0,funct7=0x20,rs1=1,rs2=2,rd=3
    printf("R-Type Instruction:0x%08X\n",rType);
    //Example:creating an I-Type instruction
    uint32_t iType = createInstructionI(0x13,0x0,1,3,0xFF);
    //opcode=0x13,funct3=0,rs1=1,rd=3,imm=0xFF
    printf("I-Type Instruction:0x%08X\n",iType);
    //Example:creating an S-Type instruction
    uint32_t sType = createInstructionS(0x23,0x0,1,2,0x1FF);
    //opcode=0x23,funct3=0,rs1=1,rs2=2,imm=0x1FF
    printf("S-Type Instruction:0x%08X\n",sType);
    //Example:creating a B-Type instruction
    uint32_t bType = createInstructionB(0x63,0x0,1,2,0x1FF);
    //opcode=0x63,funct3=0,rs1=1,rs2=2,imm=0x1FF
    printf("B-Type Instruction:0x%08X\n",bType);
    //Example:creating a J-Type instruction
```



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```
int main()
{
//Example:creating an R-Type instruction
uint32_t rType = createInstructionR(0x33,0x0,0x20,1,2,3);
//opcode=0x33,funct3=0,funct7=0x20,rs1=1,rs2=2,rd=3
printf("R-Type Instruction:0x%08X\n",rType);
//Example:creating an I-Type instruction
uint32_t iType = createInstructionI(0x13,0x0,1,3,0xFF);
//opcode=0x13,funct3=0,rs1=1,rd=3,imm=0xFF
printf("I-Type Instruction:0x%08X\n",iType);
//Example:creating an S-Type instruction
uint32_t sType = createInstructionS(0x23,0x0,1,2,0x1FF);
//opcode=0x23,funct3=0,rs1=1,rs2=2,imm=0x1FF
printf("S-Type Instruction:0x%08X\n",sType);
//Example:creating a B-Type instruction
uint32_t bType = createInstructionB(0x63,0x0,1,2,0x1FF);
//opcode=0x63,funct3=0,rs1=1,rs2=2,imm=0x1FF
printf("B-Type Instruction:0x%08X\n",bType);
//Example:creating a U-Type instruction
uint32_t uType = createInstructionU(0x37,3,0x12345);
//opcode=0x37,rd=3,imm=0x12345
printf("U-Type Instruction:0x%08X\n",uType);
//Example:creating a J-Type instruction
uint32_t jType = createInstructionJ(0x6F,3,0x1FFFF);
//opcode=0x6F,rd=3,imm=0x1FFFF
printf("J-Type Instruction:0x%08X\n",jType);

return 0;
}
```

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```
#include<stdio.h>
#include<stdint.h>
//Function to create an R-Type instruction
uint32_t createInstructionR(uint8_t opcode,uint8_t funct3,uint8_t funct7,uint8_t rs1,uint8_t rs2,uint8_t rd)
{
    return(funct7<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(rd<<7)|opcode;
}
//Function to create an I-Type instruction
uint32_t createInstructionI(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rd,uint16_t imm)
{
    return(imm<<20)|(rs1<<15)|(funct3<<12)|(rd<<7)|opcode;
}
//Function to create an S-Type instruction
uint32_t createInstructionS(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)
{
    uint8_t imm11_5=(imm>>5)&0x7F;
    uint8_t imm4_0= imm&0x1F;
    return(imm11_5<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(imm4_0<<7)|opcode;
}
//Function to create an B-Type instruction
uint32_t createInstructionB(uint8_t opcode,uint8_t funct3,uint8_t rs1,uint8_t rs2,uint16_t imm)
{
    uint8_t imm12=(imm>>12)&0x1;
    uint8_t imm10_5=(imm>>5)&0x3F;
    uint8_t imm4_1=(imm>>1)&0xF;
    uint8_t imm11=(imm>>11)&0x1;
    return(imm12<<31)|(imm11<<7)|(imm10_5<<25)|(rs2<<20)|(rs1<<15)|(funct3<<12)|(imm4_1<<8)|opcode;
}
//Function to create an U-Type instruction
uint32_t createInstructionU(uint8_t opcode,uint8_t rd,uint32_t imm)
{
    return(imm<<12)|(rd<<7)|opcode;
}
```



```
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{
    return(imm<<12)|(rd<<7)|opcode;
}
//Function to create an J-Type instruction
uint32_t createInstructionJ(uint8_t opcode,uint8_t rd,uint32_t imm)
{
    uint8_t imm20=(imm>>20)&0x1;
    uint8_t imm10_1=(imm>>1)&0x3FF;
    uint8_t imm11=(imm>>11)&0x1;
    uint8_t imm19_12=(imm>>12)&0xFF;
    return(imm20<<31)|(imm19_12<<12)|(imm11<<20)|(imm10_1<<21)|(rd<<7)|opcode;
}

int main()
{
    //Example:creating an R-Type instruction
    uint32_t rType = createInstructionR(0x33,0x0,0x20,1,2,3);
    //opcode=0x33,funct3=0,funct7=0x20,rs1=1,rs2=2,rd=3
    printf("R-Type Instruction:0x%08X\n",rType);
    //Example:creating an I-Type instruction
    uint32_t iType = createInstructionI(0x13,0x0,1,3,0xFF);
    //opcode=0x13,funct3=0,rs1=1,rd=3,imm=0xFF
    printf("I-Type Instruction:0x%08X\n",iType);
    //Example:creating an S-Type instruction
    uint32_t sType = createInstructionS(0x23,0x0,1,2,0x1FF);
    //opcode=0x23,funct3=0,rs1=1,rs2=2,imm=0x1FF
    printf("S-Type Instruction:0x%08X\n",sType);
    //Example:creating a B-Type instruction
    uint32_t bType = createInstructionB(0x63,0x0,1,2,0x1FF);
    //opcode=0x63,funct3=0,rs1=1,rs2=2,imm=0x1FF
    printf("B-Type Instruction:0x%08X\n",bType);
    //Example:creating a U-Type instruction
```

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```
//opcode=0x33, funct3=0, funct7=0x20, rs1=1, rs2=2, rd=3
printf("R-Type Instruction:0x%08X\n", rType);
//Example:creating an I-Type instruction
uint32_t iType = createInstructionI(0x13, 0x0, 1, 3, 0xFF);
//opcode=0x13, funct3=0, rs1=1, rd=3, imm=0xFF
printf("I-Type Instruction:0x%08X\n", iType);
//Example:creating an S-Type instruction
uint32_t sType = createInstructionS(0x23, 0x0, 1, 2, 0x1FF);
//opcode=0x23, funct3=0, rs1=1, rs2=2, imm=0x1FF
printf("S-Type Instruction:0x%08X\n", sType);
//Example:creating a B-Type instruction
uint32_t bType = createInstructionB(0x63, 0x0, 1, 2, 0x1FF);
//opcode=0x63, funct3=0, rs1=1, rs2=2, imm=0x1FF
printf("B-Type Instruction:0x%08X\n", bType);
//Example:creating a U-Type instruction
uint32_t uType = createInstructionU(0x37, 3, 0x12345);
//opcode=0x37, rd=3, imm=0x12345
printf("U-Type Instruction:0x%08X\n", uType);
//Example:creating a J-Type instruction
uint32_t jType = createInstructionJ(0x6F, 3, 0x1FFFF);
//opcode=0x6F, rd=3, imm=0x1FFFF
printf("J-Type Instruction:0x%08X\n", jType);

return 0;
}
```

```
vsduser@vsduser-VirtualBox:~$ riscv64-unknown-elf-gcc-01 -mabi=lp64 -march=rv64i -o sum.o sum.c
riscv64-unknown-elf-gcc-01: command not found
vsduser@vsduser-VirtualBox:~$ riscv64-unknown-elf-gcc -mabi=lp64 -march=rv64i -o sum.o sum.c
vsduser@vsduser-VirtualBox:~$ ls -ltr sum.o
-rwxrwxr-x 1 vsduser vsduser 169384 Jan 17 21:55 sum.o
```



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```
212dc: 40b005b3
212e0: fe0558e3
212e4: 40a00533
212e8: f61ff0ef
212ec: 40b00533
212f0: 00028067
212f4: 01f29293
212f8: f45514e3
212fc: 00008067
```

```
neg    a1,a1
bgez   a0,212d0 <__moddi3+0xc>
neg    a0,a0
jal     ra,21248 <__udivdi3>
neg    a0,a1
jr      t0
slli   t0,t0,0x1f
bne     a0,t0,21240 <__divdi3>
ret
```

0000000000021300 <__clzdi2>:

```
21300: 03800793
21304: 00f55733
21308: 0ff77713
2130c: 00071663
21310: ff878793
21314: fe0798e3
21318: 04000713
2131c: 40f70733
21320: 00f557b3
21324: 00001517
21328: d4c50513
2132c: 00f507b3
21330: 0007c503
21334: 40a7053b
21338: 00008067
```

```
li      a5,56
srl     a4,a0,a5
andi    a4,a4,255
bnez    a4,21318 <__clzdi2+0x18>
addi    a5,a5,-8
bnez    a5,21304 <__clzdi2+0x4>
li      a4,64
sub     a4,a4,a5
srl     a5,a0,a5
auipc   a0,0x1
addi    a0,a0,-692 # 22070 <__clz_tab>
add     a5,a0,a5
lbu     a0,0(a5)
subw    a0,a4,a0
ret
```


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212dc: 40b005b3
212e0: fe0558e3
212e4: 40a00533
212e8: f61ff0ef
212ec: 40b00533
212f0: 00028067
212f4: 01f29293
212f8: f45514e3
212fc: 00008067

neg a1,a1
bgez a0,212d0 <__moddi3+0xc>
neg a0,a0
jal ra,21248 <__udivdi3>
neg a0,a1
jr t0
slli t0,t0,0x1f
bne a0,t0,21240 <__divdi3>
ret

0000000000021300 <__clzdi2>:

21300: 03800793
21304: 00f55733
21308: 0ff77713
2130c: 00071663
21310: ff878793
21314: fe0798e3
21318: 04000713
2131c: 40f70733
21320: 00f557b3

li a5,56
srl a4,a0,a5
andi a4,a4,255
bnez a4,21318 <__clzdi2+0x18>
addi a5,a5,-8
bnez a5,21304 <__clzdi2+0x4>
li a4,64
sub a4,a4,a5
srl a5,a0,a5

vsduser@vsduser-VirtualBox: ~ x

```
neg    a1,a1
bgez   a0,212d0 <__moddi3+0xc>
neg    a0,a0
jal     ra,21248 <__udivdi3>
neg    a0,a1
jr      t0
slli   t0,t0,0x1f
bne     a0,t0,21240 <__divdi3>
ret
```

```
li      a5,56
srl     a4,a0,a5
andi    a4,a4,255
bnez    a4,21318 <__clzdi2+0x18>
addi    a5,a5,-8
bnez    a5,21304 <__clzdi2+0x4>
li      a4,64
sub     a4,a4,a5
srl     a5,a0,a5
auipc   a0,0x1
addi    a0,a0,-692 # 22070 <__clz_tab>
add     a5,a0,a5
lbu     a0,0(a5)
subw    a0,a4,a0
ret
```

```
ciscv64_unknown_elf_objdump: sum c: file format not recognized
```