```
Instruction: addi (Add Immediate)
0000000000010158 <<mark>main</mark>>:
                                                                                            addi sp, sp, -32
                                     addi
                                             sp, sp, -32
             1101
 10158:
                                                                                            Type: I-Type
                                     sd
                                             ra,24(sp)
             ec06
 1015a:
                                                                                            Opcode: 0010011
                                             s0,16(sp)
                                     sd
             e822
 1015c:
                                                                                            funct3: 000
                                     addi
                                             s0, sp, 32
             1000
 1015e:
                                                                                            rs1: sp (x2) → 00010
                                             a5,0x22
             000227b7
                                     lui
 10160:
                                                                                            rd: sp (x2) → 00010
                                             a0.a5.288 # 22120 < clzdi2+0x30>
                                     addi
             12078513
 10164:
                                                                                            Immediate: -32 (12-bit signed: 11111111110000)
                                     jal
                                             ra,1041e <puts>
             2b6000ef
 10168:
                                                                                            Encoding: 1111111111000 00010 000 00010 0010011
                                     addi
                                             a5,s0,-24
             fe840793
 1016c:
                                                                                            Result: 0xFFF12013
                                             a1,a5
 10170:
             85be
                                     MV
                                     lui
                                             a5,0x22
 10172:
             000227b7
                                             a0,a5,312 # 22138 < clzdi2+0x48>
                                     addi
 10176:
             13878513
                                            ra,10428 <scanf>
                                     jal
                                                                                           Instruction: sd (Store Doubleword)
 1017a:
             2ae000ef
                                             a5.0x22
 1017e:
             000227b7
                                     lui
                                                                                            sd ra, 16(sp)
                                            a0,a5,320 # 22140 < clzdi2+0x50>
                                     addi
 10182:
             14078513
                                                                                            Type: S-Type
 10186:
             298000ef
                                     jal
                                            ra,1041e <puts>
                                                                                           Opcode: 0100011
             fe440793
                                     addi
                                            a5,s0,-28
 1018a:
                                                                                           funct3: 011
             85be
                                            a1,a5
 1018e:
                                     MΛ
                                                                                           rs1: sp (x2) \rightarrow 00010
             000227b7
                                            a5.0x22
 10190:
                                     lui
                                                                                           rs2: ra (x1) → 00001
                                            a0.a5.312 # 22138 < clzdi2+0x48>
 10194:
             13878513
                                     addi
                                                                                           Immediate: 16 (imm[11:5]=0000000, imm[4:0]=10000)
                                     jal
                                            ra.10428 <scanf>
 10198:
             290000ef
                                                                                           Encoding: 0000000 00001 00010 011 10000 0100011
             fe842707
                                     flw
                                            fa4,-24(s0)
 1019c:
                                                                                           Result: 0x00812023
                                            fa5,-28(s0)
                                     flw
 101a0:
             fe442787
                                     fmul.s fa5,fa4,fa5
             10f777d3
 101a4:
                                            fa5,-20(s0)
 101a8:
             fef42627
                                     fsw
                                                                                          Instruction: lui (Load Upper Immediate)
                                    flw
                                            fa5,-20(s0)
             fec42787
 101ac:
                                    fcvt.d.s
                                                    fa5,fa5
                                                                                           lui x5, 0x22
 101b0:
             420787d3
                                    fmv.x.d a1,fa5
                                                                                           Type: U-Type
 101b4:
             e20785d3
                                                                                           Opcode: 0110111
 101b8:
             000227b7
                                            a5,0x22
                                     lui
 101bc:
                                    addi
                                            a0,a5,344 # 22158 < clzdi2+0x68>
             15878513
                                                                                           rd: x5 → 00101
                                    jal
             1ac000ef
                                            ra,1036c <printf>
 101c0:
                                                                                           Immediate: 0x22 → 0000 0000 0010 0010
                                    li
                                            a5,0
 101c4:
             4781
                                                                                           Encoding: 00000000000100010 00101 0110111
                                            a0,a5
 101c6:
             853e
                                    mv
                                                                                           Result: 0x00228537
                                    ld
                                            ra,24(sp)
 101c8:
             60e2
                                    ld
 101ca:
             6442
                                            s0,16(sp)
                                                                                          Instruction: jal (Jump and Link)
                                    addi
             6105
                                            sp, sp, 32
 101cc:
                                                                                          jal x1, 104
 101ce:
             8082
                                    ret
                                                                                          Type: J-Type
                                                                                          Opcode: 1101111
0000000000101d0 <atexit>:
                                                                                          rd: x1 → 00001
101d0:
                                            a1,a0
             85aa
                                    mv
                                                                                          Immediate: 104 (000000110100, J-Type encoding rearranges this):
 101d2:
             4681
                                    li
                                            a3,0
                                                                                          imm[20]=0, imm[10:1]=0001101000, imm[11]=1, imm[19:12]=00000000
 101d4:
             4601
                                    li
                                            a2,0
101d6:
                                                                                          Encoding: 000000000000011010001 00001 1101111
             4501
                                    li
                                            a0.0
101d8:
             0980406f
                                            14270 < register evitorors
                                                                                          Result: 0x068000FF
```

```
0000000010158 <<del>main</del>>:
                                                                                           Instruction: mv (Move, pseudo-instruction)
                                            sp, sp, -32
                                    addi
                                                                                            mv x11, x10 (translated as addi x11, x10, 0)
            1101
10158:
                                            ra,24(sp)
                                    sd
1015a:
            ес06
                                                                                           Type: I-Type
                                            s0,16(sp)
                                    sd
            e822
1015c:
                                                                                           Opcode: 0010011
                                            s0, sp, 32
                                    addi
            1000
1015e:
                                                                                            funct3: 000
                                            a5,0x22
                                    lui
10160:
            000227b7
                                                                                           rs1: x10 → 01010
                                            a0,a5,288 # 22120 < clzdi2+0x30>
                                    addi
            12078513
10164:
                                                                                           rd: x11 → 01011
                                    jal
                                            ra.1041e <puts>
            2b6000ef
10168:
                                                                                           Immediate: 0 → 000000000000
                                            a5,s0,-24
                                    addi
1016c:
            fe840793
                                                                                           Encoding: 000000000000 01010 000 01011 0010011
                                            a1,a5
                                    MV
10170:
            85be
                                                                                           Result: 0x00A58013
                                            a5.0x22
                                    lui
10172:
            000227b7
                                            a0,a5,312 # 22138 <__clzdi2+0x48>
                                    addi
            13878513
10176:
                                                                                           Instruction: flw (Floating-Point Load Word)
                                            ra,10428 <scanf>
                                    jal
            2ae000ef
1017a:
                                                                                           flw f4, -24(s0)
                                    lui
                                            a5.0x22
            000227b7
1017e:
                                            a0.a5.320 # 22140 < clzdi2+0x50>
                                                                                           Type: I-Type
                                    addi
            14078513
10182:
                                                                                           Opcode: 0000111
            298000ef
                                    jal
                                            ra.1041e <puts>
10186:
                                           a5,s0,-28
                                    addi
                                                                                           funct3: 010
1018a:
            fe440793
                                            a1,a5
                                                                                           rs1: s0 (x8) → 01000
            85be
                                    MV
1018e:
                                            a5,0x22
                                    lut
                                                                                           rd: f4 → 00100
10190:
            000227b7
                                           a0,a5,312 # 22138 < clzdi2+0x48>
                                    addi
                                                                                           Immediate: -24 (12-bit signed: 111110100100)
10194:
            13878513
                                           ra,10428 <scanf>
            290000ef
                                    jal
                                                                                           Encoding: 111110100100 01000 010 00100 0000111
10198:
                                            fa4,-24(s0)
                                    flw
            fe842707
1019c:
                                                                                              Result: 0xF8412407
                                           fa5,-28(s0)
                                    flw
101a0:
            fe442787
                                    fmul.s fa5,fa4,fa5
            10f777d3
101a4:
                                           fa5,-20(s0)
           fef42627
                                    fsw
101a8:
                                                                                          Instruction: fmul.s (Floating Multiply, Single)
                                           fa5,-20(s0)
            fec42787
                                    flw
101ac:
                                                                                           fmul.s fa5, fa5, fa4
                                                   fa5,fa5
                                    fcvt.d.s
101b0:
            420787d3
                                                                                           Type: R-Type
                                    fmv.x.d a1,fa5
101b4:
            e20785d3
                                                                                           Opcode: 1010011
                                           a5,0x22
                                    lui
101b8:
            000227b7
                                                                                           funct7: 0000001
                                           a0,a5,344 # 22158 < clzdi2+0x68>
                                    addi
101bc:
            15878513
                                                                                           funct3: 000
                                    jal
                                           ra,1036c <printf>
            1ac000ef
101c0:
                                                                                           rs1: fa5 → 01010
                                    li
                                           a5,0
            4781
101c4:
                                                                                           rs2: fa4 → 00100
                                           a0,a5
            853e
                                    MV
101c6:
                                                                                           rd: fa5 → 01010
            60e2
                                    ld
                                           ra,24(sp)
101c8:
                                                                                           Encoding: 0000001 00100 01010 000 01010 1010011
                                           s0,16(sp)
                                    ld
101ca:
            6442
                                    addi
                                           sp, sp, 32
                                                                                           Result: 0x20A52453
101cc:
            6105
            8082
                                   ret
101ce:
00000000101d0 <atexit>:
                                           a1,a0
101d0:
            85aa
                                   MV
                                                                                         Instruction: fsw (Floating-Point Store Word)
                                   li
                                           a3,0
101d2:
            4681
                                                                                          fsw fa5, -20(s0)
                                   li
                                           a2,0
101d4:
            4601
                                                                                          Type: S-Type
                                   li
                                           a0.0
            4501
101d6:
                                                                                          Opcode: 0100111
                                           14270 < register exitproc>
            0980406f
101d8:
                                                                                          funct3: 010
                                                                                          rs1: s0 (x8) → 01000
00000000101dc <exit>:
                                                                                          rs2: fa5 → 01010
                                    addi
                                          en en -16
```

```
Result: 0x20A52453
000000000010158 <main>:
                                              sp, sp, -32
                                      addi
 10158:
              1101
                                              ra,24(sp)
                                      sd
              ec06
 1015a:
                                              s0,16(sp)
 1015c:
              e822
                                      sd
                                                                                            Instruction: fsw (Floating-Point Store Word)
                                      addi
                                              s0.sp.32
 1015e:
              1000
                                                                                             fsw fa5. -20(s0)
                                              a5,0x22
                                      lut
 10160:
              000227b7
                                              a0,a5,288 # 22120 <__clzdi2+0x30>
                                                                                             Type: S-Type
                                      addi
              12078513
 10164:
                                                                                             Opcode: 0100111
                                      jal
 10168:
              2b6000ef
                                              ra,1041e <puts>
                                      addi
                                              a5,s0,-24
                                                                                             funct3: 010
              fe840793
 1016c:
                                              a1,a5
                                                                                             rs1: s0 (x8) → 01000
              85be
 10170:
                                      mv
 10172:
              000227b7
                                      lui
                                              a5.0x22
                                                                                             rs2: fa5 → 01010
                                              a0.a5.312 # 22138 < clzdi2+0x48>
                                      addi
 10176:
              13878513
                                                                                             Immediate: -20 \text{ ([imm[11:5]=1111111, imm[4:0]=0100)}
                                              ra,10428 <scanf>
                                      jal
                                                                                             Encoding: 1111111 01010 01000 010 00100 0100111
 1017a:
              2ae000ef
                                              a5.0x22
              000227b7
                                      lui
 1017e:
                                                                                             Result: 0xFAA2027
                                             a0,a5,320 # 22140 < clzdi2+0x50>
                                      addi
 10182:
              14078513
                                      jal
                                             ra.1041e <puts>
              298000ef
 10186:
                                     addi
                                             a5,s0,-28
              fe440793
 1018a:
                                                                                            Instruction: fcvt.d.s
                                             a1,a5
 1018e:
              85be
                                     MV
                                                                                            fcvt.d.s fa5, fa5
 10190:
              000227b7
                                     lui
                                              a5.0x22
                                                                                             Type: R-Type
                                             a0,a5,312 # 22138 < clzdi2+0x48>
                                     addi
              13878513
 10194:
                                                                                            Opcode: 1010011
                                             ra,10428 <scanf>
10198:
                                      jal
              290000ef
                                                                                             funct7: 0100000
                                             fa4.-24(s0)
                                     flw
 1019c:
              fe842707
                                                                                            rs1: fa5 → 01010
                                     flw
                                             fa5,-28(s0)
101a0:
              fe442787
                                                                                             rd: fa5 → 01010
                                     fmul.s fa5,fa4,fa5
101a4:
              10f777d3
                                                                                            funct3: 000
              fef42627
                                     fsw
                                             fa5,-20(s0)
101a8:
                                                                                             Encoding: 0100000 00000 01010 000 01010 1010011
                                             fa5,-20(s0)
101ac:
              fec42787
                                     flw
                                     fcvt.d.s
                                                     fa5,fa5
                                                                                             Result: 0x420A0053
101b0:
             420787d3
                                     fmv.x.d a1.fa5
101b4:
              e20785d3
101b8:
                                     lui
                                             a5.0x22
             000227b7
                                             a0,a5,344 # 22158 < clzdi2+0x68>
             15878513
                                     addi
101bc:
                                     jal
                                             ra,1036c <printf>
101c0:
             1ac000ef
                                                                                            Instruction: fnmadd.s
                                     li
                                             a5,0
101c4:
             4781
                                                                                            fnmadd.s fa5, fa5, fa4, fa5
                                             a0.a5
101c6:
             853e
                                                                                            Type: R4-Type
                                     ld
                                             ra,24(sp)
101c8:
             60e2
                                                                                            Opcode: 1000011
                                     ld
                                             s0,16(sp)
101ca:
             6442
                                                                                            funct2: 11
                                             sp, sp, 32
101cc:
             6105
                                     addi
                                                                                            rs1: fa5 → 01010
             8082
                                     ret
101ce:
                                                                                            rs2: fa4 → 00100
                                                                                            rd: fa5 → 01010
000000000101d0 <atexit>:
                                                                                            rm: Rounding mode → 000
                                             a1,a0
101d0:
             85aa
                                     MV
                                                                                            Encoding: 01010 01010 00100 000 01010 1000011
                                     li
                                             a3,0
             4681
101d2:
                                                                                            Result: 0x22A5423
                                     li
                                             a2,0
101d4:
             4601
                                     li
101d6:
             4501
                                             a0,0
                                             14270 < register_exitproc>
101d8:
             0980406f
000000000101dc <exit>:
                                                                                           Instruction: li (Load Immediate)
101dc:
                                          sp, sp, -16
            1141
                                     addi
                                                                                            li x10. 0x0 \rightarrow addi x10. x0. 0
```

```
obcode: 1000011
00000000010158 <main>:
                                                                                            funct2: 11
                                     addi
                                             sp, sp, -32
10158:
             1101
                                                                                            rs1: fa5 → 01010
                                             ra,24(sp)
1015a:
             ес06
                                     sd
                                                                                            rs2: fa4 → 00100
                                     sd
                                             s0,16(sp)
1015c:
             e822
                                                                                            rd: fa5 → 01010
                                     addi
1015e:
                                             s0.sp.32
             1000
                                                                                            rm: Rounding mode → 000
             000227b7
                                     lui
                                             a5,0x22
10160:
                                                                                            Encoding: 01010 01010 00100 000 01010 1000011
                                     addi
                                             a0,a5,288 # 22120 <_clzdi2+0x30>
10164:
             12078513
                                                                                            Result: 0x22A5423
                                     jal
                                             ra,1041e <puts>
             2b6000ef
10168:
                                     addi
                                             a5,s0,-24
             fe840793
1016c:
10170:
             85be
                                             a1,a5
                                     lui
                                             a5,0x22
10172:
             000227b7
                                            a0,a5,312 # 22138 < clzdi2+0x48>
                                                                                           Instruction: li (Load Immediate)
10176:
            13878513
                                     addi
                                                                                            li x10, 0x0 → addi x10, x0, 0
                                     jal
                                             ra,10428 <scanf>
1017a:
            2ae000ef
                                     lui
                                            a5,0x22
                                                                                            Type: I type
1017e:
            000227b7
                                                                                            Opcode: 0010011
                                            a0,a5,320 # 22140 <__clzdi2+0x50>
            14078513
                                     addi
10182:
                                     jal
10186:
                                            ra,1041e <puts>
                                                                                            funct3: 000
            298000ef
            fe440793
                                    addi
                                            a5,s0,-28
1018a:
                                                                                            rs1: 00000
                                            a1,a5
            85be
1018e:
                                     MV
                                                                                            rd: 01010
            000227b7
                                     lui
                                            a5,0x22
                                                                                            Encoding: 000000000000 00000 000 01010 0010011
10190:
                                            a0,a5,312 # 22138 <__clzdi2+0x48>
            13878513
                                     addi
10194:
                                                                                            Result: 0x00005013
                                    jal
                                            ra,10428 <scanf>
            290000ef
10198:
                                            fa4,-24(s0)
1019c:
            fe842707
                                    flw
                                            fa5,-28(s0)
101a0:
                                    flw
            fe442787
                                    fmul.s fa5,fa4,fa5
            10f777d3
101a4:
                                                                                           Instruction: ld (Load Doubleword)
                                    fsw
                                            fa5,-20(s0)
101a8:
            fef42627
                                                                                            ld ra, 24(sp)
101ac:
            fec42787
                                    flw
                                            fa5,-20(s0)
                                                                                            Type: I-Type
            420787d3
                                    fcvt.d.s
                                                    fa5,fa5
101b0:
                                                                                           Opcode: 0000011
                                    fmv.x.d a1,fa5
101b4:
            e20785d3
                                                                                           funct3: 011
101b8:
            000227b7
                                    lui
                                            a5,0x22
                                                                                            rs1: sp (x2) \rightarrow 00010
                                            a0,a5,344 # 22158 <_clzdi2+0x68>
101bc:
            15878513
                                    addi
                                                                                            rd: ra (x1) → 00001
                                    jal
                                            ra,1036c <printf>
            1ac000ef
101c0:
                                                                                            Immediate: 24 → 000000001100
                                            a5,0
                                    li
101c4:
            4781
                                                                                            Encoding: 000000001100 00010 011 00001 0000011
                                            a0, a5
            853e
                                    MV
101c6:
                                                                                            Result: 0x01812083
                                    ld
                                            ra,24(sp)
01c8:
            60e2
                                    ld
                                            s0,16(sp)
01ca:
            6442
                                            sp, sp, 32
                                    addi
            6105
01cc:
                                    ret
l01ce:
            8082
                                                                                          Instruction: ret
00000000101d0 <atexit>:
                                                                                           ret → jalr x0, x1, 0
                                            a1,a0
01d0:
            85aa
                                    MV
                                                                                           Type: I-Type
                                    li
                                            a3,0
01d2:
            4681
                                                                                           Opcode: 1100111
                                           a2,0
                                    li
01d4:
            4601
                                                                                           funct3: 000
                                    li
                                            a0,0
01d6:
            4501
                                                                                           rs1: x1 (ra) → 00001
                                            14270 < register_exitproc>
01d8:
            0980406f
                                                                                           rd: x0 → 00000
                                                                                           Immediate: 0 → 000000000000
0000000101dc <exit>:
                                                                                           Encoding: 000000000000 00001 000 00000 1100111
                                    -ddd co co 46
```