1.

a. addi x15, x22, -45

addi => I-type format

imm[11:0]	rs1	funct3	rd	opcode

$(-45)_{10} = (1111\ 1101\ 0011)_2$

$(22)_{10} = (10110)_2$

$(15)_{10} = (01111)_2$

1111 1101 0011	10110	000	01111	0010011

In hex, the above binary number is **0xFD3B0793**

b. and x23, x8, x9

and => R-type format

funct7	rs2	rs1	funct3	rd	opcode

$(23)_{10} = (10111)_2$

$(8)_{10} = (01000)_2$

$(9)_{10} = (01001)_2$

0000000	01001	01000	111	10111	0110011

In hex, the above binary number is **0x00947BB3**

c. blt x2, x11, 240

blt => B-type format

imm[12]	imm[10:5]	rs2	rs1	funct3	imm[4:1]	imm[11]	opcode

$(2)_{10} = (00010)_2$

$(11)_{10} = (01011)_2$

$(240)_{10} = (0\ 0000\ 1111\ 0000)$

0	000111	01011	00010	100	1000	0	1100011

In hex, the above binary is **0x0EB14863**

d. sd x19, -54(x1)
sd => S-type

imm[11:5]	rs2	rs1	funct3	imm[4:0]	opcode

$(19)_{10} = (10011)_2$
$(1)_{10} = (00001)_2$
$(-54)_{10} = (1111\ 1100\ 1010)_2$

1111 110	10011	00001	011	01010	0100011

In hex, the above binary is **0xFD30B523**

e. jal x3, -10116
jal => J-type

imm[20]	imm[10:1]	imm[11]	imm[19:12]	rd	opcode

$(3)_{10} = (00011)_2$
$(-10116)_{10} = (1\ 1111\ 1101\ 1000\ 0111\ 1100)_2$

1	000 0111 110	1	11111101	00011	1101111

In hex, the above binary is **0x87DFD1EF**

2.

a. li x5, 0xFFFFFFFFFFFFFFFF
$(\text{FFFFFFFFFFFFFFFF})_{16} = (-1)_{10}$

lui x5, 0
addi x5, x5, -1

b. li x5, 132

lui x5, 0
addi x5, x5, 132

c. li x5, 2134
2134 = 4096 - 1962

lui x5, 0x1 *# 4096 is loaded in x5*
addi x5, x5, -1962

d. li x5, 0x000000002345ABCD

$(2345ABCD)_{16} = (0010\ 0011\ 0100\ 0101\ 1010\ 1011\ 1100\ 1101)_2$

lui x5, 0x2345A *# Load the first 20 bits*
addi x5, x5, 0xBCD *# Add the last 12 bits*

3.

a. 0x0019F233

$(0019F233)_{16} = (000\ 000\ 0001\ 1001\ 1111\ 0010\ 0011\ 0011)_2$

opcode (last 7 bits) = 0110011 => R-type format

0000000	00001	10011	111	00100	0110011
funct7	rs2	rs1	funct3	rd	opcode

rs1: $(10011)_2 = (19)_{10}$
rs2: $(00001)_2 = (1)_{10}$
rd: $(00100)_2 = (4)_{10}$
funct3 = 111 => and

and x4, x19, x1

b. 0x06B4D763

$(06B4D763)_{16} = (0000\ 0110\ 1011\ 0100\ 1101\ 0111\ 0110\ 0011)_2$

opcode (last 7 bits) = 1100011 => B-type format

0	000011	01011	01001	101	0111	0	1100011
imm[12]	imm[10:5]	rs2	rs1	funct3	imm[4:1]	imm[11]	opcode

rs1: $(01001)_2 = (9)_{10}$
rs2: $(01011)_2 = (11)_{10}$
imm: $(0\ 0000\ 0110\ 1110)_2 = (110)_{10}$
funct3 = 101 => bge

bge x9, x11, 110

c. 0x0169CF93

$(0169CF93)_{16} = (0000\ 0001\ 0110\ 1001\ 1100\ 1111\ 1001\ 0011)_2$

opcode (last 7 bits) = 0010011 => I-type format

0000 0001 0110	10011	100	11111	0010011
imm[11:0]	rs1	funct3	rd	opcode

rs1: $(10011)_2 = (19)_{10}$
rd: $(11111)_2 = (32)_{10}$
imm: $(0000\ 0001\ 0110)_2 = (22)_{10}$
funct3 = 100 => xori

xori x31, x19, 22