

1.

a.

i. 15 (dec)

$$-128 + 64 = -64 + 32 = -32 + 16 = -16 + 1 = -15$$

**11110001**

ii. A (hex) which is 10 in decimal

$$-128 + 64 = -64 + 32 = -32 + 16 = -16 + 4 = -12 + 2 = -10$$

**11110110**

iii. 0020 (octal) which is 16 in decimal

$$-128 + 64 = -64 + 32 = -32 + 16 = -16$$

**11110000**

iv. 0b011101 which is 29 in decimal

$$-128 + 64 = -64 + 32 = -32 + 2 = -30 + 1 = -29$$

**11100011**

v. 0x23 which is 35 in decimal

$$-128 + 64 = -64 + 16 = -48 + 8 = -40 + 4 = -36 + 1 = -35$$

**11011101**

b.

i. 0000 0001 0111 0010

0172 (hex)

$$1*16^2 + 7*16 + 2 = \mathbf{370}$$

ii. 1111111111100000

100000

$$-32 + 0 = \mathbf{-32}$$

iii. 1111 1110 0000 1100

1000001100

$$-512 + 8 + 4 = \mathbf{-500}$$

iv. 0000 0010 0111 0011

0273 (hex)

$$2*16^2 + 7*16 + 3 = \mathbf{627}$$

v. 1111 1000 0011 1001

100000111001

$$-2048 + 32 + 16 + 8 + 1 = \mathbf{-1991}$$

2. r1 = a, r2 = b, r3 = c, r4 = d, r5 = e, r6 = f

a.

add r1, r2, r1

**a += b;**

mov r2, r3

**b = c;**

sub r4, r3, r4

**d = c - d;**

mul r5, r4, r1

**e = d \* a;**

b.

f = d - a;

**sub r6, r4, r1**

b = 15;

**mov r2, #15**

a = a + 6;

**add r1, r1, #6**

d = a ^ c;

**xor r4, r1, r3**

c.

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i. f = a + b + 2 * d;
    mul r6, r4, #2
    add r6, r6, r1
    add r6, r6, r2
ii. f = (1 + a - f) * b;
    sub r6, r1, r6
    add r6, r6, #1
    mul r6, r6, r2

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3.

a.

```

add 1 2 3          00000000 000 001 010 00000000000000 011
                   0000 0000 0000 1010 0000 0000 0000 0011
                   0x000A0003
nand 3 4 5         00000000 001 011 100 00000000000000 101
                   0000 0000 0101 1100 0000 0000 0000 0101
                   0x005C0005
beq 0 1 2          00000000 100 000 001 00000000000000 010
                   0000 0001 0000 0001 0000 0000 0000 0010
                   0x01010002
halt               00000000 110 000000000000000000000000
                   0000 0001 1000 0000 0000 0000 0000 0000
                   0x01800000

```

b.

```

0x017E0000
0000 0001 0111 1110 0000 0000 0000 0000
00000000 101 111 110 000000000000000000
jalr 7 6
0x00E504D2
0000 0000 1110 0101 0000 0100 1101 0010
00000000 011 100 101 0000010011010010
sw 4 5 1234
0x008A10E1
0000 0000 1000 1010 0001 0000 1110 0001
00000000 010 001 010 0001000011100001
lw 1 2 4321
0x01C00000
0000 0001 1100 0000 0000 0000 0000 0000
00000000 111 000000000000000000000000
noop

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4. r1 = a, r2 = b, r3 = c, r4 = d, r7 = G, r8 = E

a. d = a + b + G[2];

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lw 7, 4, 2
add 1, 4, 4
add 2, 4, 4

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b.  $c = a + G[E[0]];$   
    **lw 8, 3, 0**  
    **adr add 7, 3, 3**  
    **lw 3, 3, 0**  
    **add 1, 3, 3**