1) bne $t0, $s0, 0x20.

bne is I-type. | opcode | rs | rt | immediate |

Op Code is $4_{16} = 000100_2$ $t0 = 8_{10} = 01000$, $s0 = 16_{10} = 10000_2$

0x20 = 0000000000100000_2

Hence binary equivalent is: 000100 01000 10000 0000000000100000_2

  hex   equivalent is: | 11100020 |

2) addi $a0, $t4, 16

addi is I-type. opcode is $8_{16} = 001000_2$

$a0 = 4_{10} = 00100_2$, $t4 = 12_{10} = 01100_2$, $16_{10} = 0000000000010000_2$

Hence binary equivalent is: 001000 01100 00100 0000000000010000_2

  hex   equivalent is: | 21840010 |

3) $70BB50CC_{16}$ = 0111 0000 1011 1011 0101 0000 1100 1100_2

Big endia: store most significant byte in lower address.

0x00400000   store 70.
.....   BB
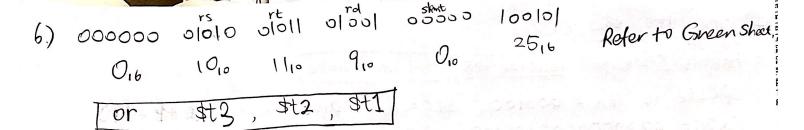- - - -   50
0x00400003   - - - -   CC

4) jr $ra

jr is R-type. opcode = 000000_2 $ra = 31_{10} = 11111_2   funct = 001000_2

Hence, binary equivalent is: 000000 11111 00000 00000 00000 001000

  hex   equivalent is: | 03E00008 |

5)

	rs	rt	immediate	
101011	01000	10000	0000000000100000	Refer to Green sheet,
= 2B_{16}	8_{10}	16_{10}	32_{10}.	
SW	$t0	$s0		

| SW $s0, 32($t0) |

6.)
$$\underset{rs}{000000} \quad \underset{rt}{01010} \quad \underset{rd}{01011} \quad \underset{}{01001} \quad \underset{shmt}{00000} \quad 100101$$

$$0_{16} \qquad 10_{10} \qquad 11_{10} \qquad 9_{10} \qquad 0_{10}$$

$$25_{16} \qquad \text{Refer to Green sheet.}$$

$$\boxed{\text{or } \quad \$t3 \,, \quad \$t2 \,, \quad \$t1}$$

7.) $000\,010\,\underbrace{0000}_{\substack{2_{16}. \\ \text{add 4bits}}}\,00000\quad 10010\quad 00010\quad 01000\quad 010010.\underbrace{00}_{\text{add 2bits}}$

$$\boxed{J \quad 0x00484848}$$

8.) sign bit is 1 because the number is negative.

$$40_{10} = 101000_2\,.$$

$$\begin{cases} 0.5625 \times 2 = 1.125\cdots 1 \\ 0.125 \times 2 = 0.25\cdots 0 \\ 0.25 \times 2 = 0.5\cdots 0 \\ 0.5 \times 2 = 1.0\cdots 1 \end{cases}$$

Combining together, $40.5625 = 101000.1001 = 1.01000\,1001 \times 2^5$

exponent $e = 5 + 127 = 132_{10} = 10000100_2$.

fraction $f = 9$ bits $+ 14$ zeros

$= 0100\ 0100\ 1000\quad 0000\ 0000000$.

Combine together, -40.5625 in binary is

$1\ 10000100\ 0100\ 0100\ 1000\quad 0000\quad 0000000$.

In hex format $= C\,2224000$.

9.)

$$\underset{s}{\underbrace{0}} \quad \underset{e}{\underbrace{10000101}} \quad \overset{1\ 2\ 34\ 567\ 8910\ \cdots\quad\quad\quad 23}{\underbrace{0000\ 111011\ 0000000000000}_{f}}$$

Sign bit is zero   so number is positive

exponent e $10000101_2 = 133_{10}$ $133-127 = 6 \implies 2^6$

fraction f $2^{-5} + 2^{-6} + 2^{-7} + 2^{-9} + 2^{-10} = 0.0576171875$

decimal = $(-1)^0 \times (1 + 0.0576171875) \times 2^6 = 67.6875$

22.) $119_{10} = 0111\ 0111_2$

$\Rightarrow$ One's complement $\quad -119_{10} = 0001\ 000_2$

23). $74 = 0\ 1001010$

$\Rightarrow$ One's comp. $\quad 1011\ 0101$

$\Rightarrow$ two's comp. $\quad \dfrac{+\qquad\qquad 1}{0110110}$

29).
• X NAND Y = NOT (X AND Y) = NOT (true) = $\boxed{\text{false}}$

• X XOR Z = NOT (X or Z) = NOT (false) = $\boxed{\text{true}}$

• NOT (X AND Y) NOR (W OR (X XOR Z))
= NOT (true) NOR (W OR (true))
= false NOR true = NOT (false or true) = $\boxed{\text{true}}$

• (X NAND Z) OR Z = NOT (X AND Z) OR Z = true or false = $\boxed{\text{false}}$

• NOT ((W AND Y) NOR (W or Y))
= NOT (false NOR true) = NOT (NOT (false or true)) = $\boxed{\text{true}}$

• Z AND Y OR X NAND W = false OR true NAND W
= true NAND false
= NOT(true and false) = $\boxed{\text{true}}$