

EncodingHW

Due: Saturday, February 20, 2021, 11:59 p.m.

Submission: Canvas

Each question is worth 3.7037 for a total of 100 points.

Signed and unsigned encoding.

This is a 3-part homework. For each part, you will convert either the binary number to decimal or decimal to binary using the encoding specified. Each example is only 1 byte in size. **You MUST show your work. I want to know that you did not just get the answer from some online calculator. If you do not show your work, you will not get credit.** If you prefer to write your answers, make sure the grader can read your handwriting. If you type your answer, your answer must be in **RED**.

In our notes for chapter 2 there are examples for each of the three parts.

Part 1 – SIGNED MAGNITUDE

A. Find slide on signed magnitude write the slide number and a description of the rules/how to determine the values of signed magnitude.

Slide 48.

If the value is negative, the most significant bit will be 1.

B. Convert the following binary numbers to decimal.

$$1 + 2 + 4 + 8 \quad + \quad 16 + 32 + 64 * \\ -1$$

1. 0110 0011

$$1 + 2 + 0 + 0 + 0 + 32 + 64 + 0 = \\ 99$$

2. 1011 0010

$$0 + 2 + 0 + 0 + 16 + 32 + 0 * -1 = \\ -50$$

3. 1111 0011

$$1 + 2 + 0 + 0 + 16 + 32 + 64 * -1 = \\ -115$$

4. 0101 0011

$$1 + 2 + 0 + 0 + 16 + 0 + 64 + 0 = \\ 83$$

Convert the following decimal to binary.

1. 63

$$63/2 = 31 \quad \text{r. } 1$$

$$31/2 = 15 \quad \text{r. } 1$$

$$15/2 = 7 \quad \text{r. } 1$$

$$7/2 = 3 \quad \text{r. } 1$$

$$3/2 = 1 \quad \text{r. } 1$$

$$1/2 = 0 \quad \text{r. } 1$$

0011 1111

2. -92

$$92/2 = 46 \quad \text{r. } 0$$

$$46/2 = 23 \quad \text{r. } 0$$

$$23/2 = 11 \quad \text{r. } 1$$

$$11/2 = 5 \quad \text{r. } 1$$

$$5/2 = 2 \quad \text{r. } 1$$

$$2/2 = 1 \quad \text{r. } 0$$

$$1/2 = 0 \quad \text{r. } 1$$

$$\text{First val.} \quad \text{r. } -1$$

1101 1100

3. 100

$$100/2 = 50 \quad \text{r. } 0$$

$$50/2 = 25 \quad \text{r. } 0$$

$$25/2 = 12 \quad \text{r. } 1$$

$$12/2 = 6 \quad \text{r. } 0$$

$$6/2 = 3 \quad \text{r. } 0$$

$$3/2 = 1 \quad \text{r. } 1$$

$$1/2 = 0 \quad \text{r. } 1$$

0110 0100

4. -112

$$112/2 = 56 \quad \text{r. } 0$$

$$56/2 = 28 \quad \text{r. } 0$$

$$28/2 = 14 \quad \text{r. } 0$$

$$14/2 = 7 \quad \text{r. } 0$$

$$7/2 = 3 \quad \text{r. } 1$$

$$3/2 = 1 \quad \text{r. } 1$$

$$1/2 = 0 \quad \text{r. } 1$$

1111 0000

Part 2 – 1's Complement

- A. Find slide on 1's Complement write the slide number and a description of the rules/how to determine the values of 1's Complement.

Slide 49. If the MSB is 1, then the number is negative.

If MSB is 1, excluding the MSB, complement the bits & then add them + a negative.

- B. Convert the following binary numbers to decimal.

$$1 + 2 + 4 + 8 + 16 + 32 + 64 * -1$$

1. 1010 1010

$$\sim(010\ 1010) = 101\ 0101$$

$$1 + 0 + 4 + 0 + 16 + 0 + 64 * -1 = -85$$

2. 0111 0010

$$0 + 2 + 0 + 0 + 16 + 32 + 64 + 0 = 114$$

3. 1001 0101

$$\sim(001\ 0101) = 110\ 1010$$

$$0 + 2 + 0 + 8 + 0 + 32 + 64 * -1 = -106$$

4. 0011 1111

$$1 + 2 + 4 + 8 + 16 + 32 + 0 + 0 = 63$$

Convert the following decimal to binary.

1. 58

$58/2 = 29$ r.0
 $29/2 = 14$ r. 1
 $14/2 = 7$ r. 0
 $7/2 = 3$ r. 1
 $3/2 = 1$ r. 1
 $1/2 = 0$ r. 1
0011 1010

2. -39

$39/2 = 19$ r. 1
 $19/2 = 9$ r. 1
 $9/2 = 4$ r. 1
 $4/2 = 2$ r. 0
 $2/2 = 1$ r. 0
 $1/2 = 0$ r. 1
 $\sim(010\ 0111) = 101\ 1000 + 1 =$
1101 1000

3. 117

$117/2 = 58$ r. 1
 $58/2 = 29$ r. 0
 $29/2 = 14$ r. 1
 $14/2 = 7$ r. 0
 $7/2 = 3$ r. 1
 $3/2 = 1$ r. 1
 $1/2 = 0$ r. 1
0111 0101

4. -75

$75/2 = 37$ r. 1
 $37/2 = 18$ r. 1
 $18/2 = 9$ r. 0
 $9/2 = 4$ r. 1
 $4/2 = 2$ r. 0
 $2/2 = 1$ r. 0
 $1/2 = 0$ r. 1
 $\sim(100\ 1011) = 011\ 0100 + 1 =$
1011 0100

Part 3 – 2's Complement

- A. Find slide on 2's Complement write the slide number and a description of the rules/how to determine the values of 2's Complement.

Slide 51. The rule for 2's complement is complement the bits, and then add 1.

- B. Convert the following binary numbers to decimal.

$$1 + 2 + 4 + 8 + 16 + 32 + 64 * -1$$

1. 1111 1101

$$1111\ 1100$$

$$\sim(111\ 1100) = 000\ 0011$$

$$1 + 2 + 0 + 0 + 0 + 0 + 0 * -1 =$$

$$-3$$

2. 0011 0100

$$0 + 0 + 4 + 0 + 16 + 32 + 0 + 0 =$$

$$52$$

3. 1101 0011

$$1101\ 0010$$

$$\sim(101\ 0010) = 010\ 1101$$

$$1 + 0 + 4 + 8 + 0 + 32 + 0 * -1 =$$

$$-45$$

4. 0010 1111

$$1 + 2 + 4 + 8 + 0 + 32 + 0 + 0 =$$

$$47$$

Convert the following decimal numbers to binary.

1. -99

$$\begin{array}{ll} 99/2 = 49 & \text{r. 1} \\ 49/2 = 24 & \text{r. 1} \\ 24/2 = 12 & \text{r. 0} \\ 12/2 = 6 & \text{r. 0} \\ 6/2 = 3 & \text{r. 0} \\ 3/2 = 1 & \text{r. 1} \\ 1/2 = 0 & \text{r. 1} \\ \sim(110\ 0011) = 0011100 = \\ 1001\ 1101 \end{array}$$

2. 79

$$\begin{array}{ll} 79/2 = 39 & \text{r. 1} \\ 39/2 = 19 & \text{r. 1} \\ 19/2 = 9 & \text{r. 1} \\ 9/2 = 4 & \text{r. 1} \\ 4/2 = 2 & \text{r. 0} \\ 2/2 = 1 & \text{r. 0} \\ 1/2 = 0 & \text{r. 1} \\ 0100\ 1111 \end{array}$$

3. 101

$$\begin{array}{ll} 101/2 = 50 & \text{r. 1} \\ 50/2 = 25 & \text{r. 0} \\ 25/2 = 12 & \text{r. 1} \\ 12/2 = 6 & \text{r. 0} \\ 6/2 = 3 & \text{r. 1} \\ 3/2 = 1 & \text{r. 1} \\ 1/2 = 0 & \text{r. 1} \\ 0110\ 0101 \end{array}$$

4. -123

$$\begin{array}{ll} 123/2 = 61 & \text{r. 1} \\ 61/2 = 30 & \text{r. 1} \\ 30/2 = 15 & \text{r. 0} \\ 15/2 = 7 & \text{r. 1} \\ 7/2 = 3 & \text{r. 1} \\ 3/2 = 1 & \text{r. 1} \\ 1/2 = 0 & \text{r. 1} \\ \sim(111\ 1011) = 000\ 0100 = \\ 1000\ 0101 \end{array}$$