

CprE 281 QUIZ 04
ELECTRICAL AND COMPUTER
ENGINEERING
IOWA STATE UNIVERSITY

Initial Stuff and Basics
Assigned Date: Week 6

Instructions

Complete the question below to the best of your ability. Once complete, upload a PDF of your work to canvas.

Questions

P1. Binary Addition and Subtraction (5 x 10p each = 50p)

Convert the following integers into binary numbers and perform the addition or subtraction using 2's complement if necessary. Write your answers and all intermediary steps to the right of each problem. Use 5-bit numbers for all problems and indicate if any bits need to be ignored. In each case, please write the carries generated clearly and please indicate whether or not overflow occurs.

a)

$$\begin{array}{r} (+5) \\ - \\ (+2) \\ \hline +3 \end{array}$$

$+5 = 00101_2$ Mag. 5 bits
1st $-2 = 11101_2 \rightarrow$ 1st Comp.
 $+1$
 $\hline 11110_2 \rightarrow$ 2nd Comp.

$$\begin{array}{r} 00101_2 \\ + 11110_2 \\ \hline \text{X} 00011_2 \checkmark +3 \end{array}$$

b)

$$\begin{array}{r} (+8) = \\ + \\ (-1) = \\ \hline +7 \end{array}$$

$01000 \rightarrow$ magnitude
 $11110 \rightarrow$ 1st Comp.
 $+1$
 $\hline 11111 \rightarrow$ 2nd Comp.

$$\begin{array}{r} 01000 \\ + 11111 \\ \hline \text{X} 00111 \checkmark +7 \end{array}$$

c)

$$\begin{array}{r} -7 (-7) = \\ - \\ +2 (-2) = \\ \hline -5 \end{array}$$

$00111_2 \rightarrow$ magnitude
 $11000_2 \rightarrow$ 1st Comp.
 $+1$
 $\hline 11111_2 \rightarrow$ 2nd Comp.

$$\begin{array}{r} 11001_2 \\ + 00110_2 \\ \hline 11011 \checkmark -5 \end{array}$$

$(-2) + 2 = 00010$

d)

$$\begin{array}{r} (-15) = \\ + \\ (+14) = \\ \hline -1 \end{array}$$

$01111_2 \rightarrow$ magnitude
 $10000_2 \rightarrow$ 1st Comp.
 $+1$
 $\hline 10001_2 \rightarrow$ 2nd Comp.

$$\begin{array}{r} 10001_2 \\ + 01110_2 \\ \hline 11111 \checkmark -1 \end{array}$$

e)

$$\begin{array}{r} (-3) = \\ + \\ (-12) = \\ \hline -15 \end{array}$$

$01100_2 \rightarrow$ magnitude
 $10011_2 \rightarrow$ 1st Comp.
 $+1$
 $\hline 11100 \rightarrow$ 2nd comp

$$\begin{array}{r} 11100_2 \\ + 11101_2 \\ \hline \text{X} 00001 \checkmark \end{array}$$

$$\begin{array}{r} 00011_2 \\ 11100_2 \\ \hline 11101_2 \end{array}$$

$0 \rightarrow +$
 $1 \rightarrow -$

2^{n-1} 5 bits
 $2^5 = 16$
16 8 4 2 1