**DEPARTMENT OF APPLIED MATHEMATICS AND COMPUTATIONAL SCIENCES  
MSc CYBER SCEURITY  
20XC14 DIGITAL SYSTEM DESIGN**

**WORKSHEET 2**

**CONTEXT: BINARY ARITHMETIC DUE DATE: 11/10/2021**

1. Convert the following decimal numbers to 8-bit two’s complement numbers and indicate whether the decimal number would overflow the range.

a) 4210

b) - 6310

c) 12410

d) -12810

e) 13310

1. Convert the following 4-bit two’s complement numbers to 8-bit two’s complement numbers.

a) 01012

b) 10102

1. How many 5-bit two’s complement numbers are greater than 0? How many are less than 0? How would your answers differ for sign/magnitude numbers?
2. A memory on the Pentium II microprocessor is organized as a rectangular array of bits with 28 rows and 29 columns. Estimate how many bits it has without using a calculator.
3. Perform the following additions of unsigned binary numbers. Indicate whether or not the sum overflows an 8-bit result.

a) 100110012 + 010001002

b) 110100102 +101101102

c) 10110112 − 1011102

d) 10010012 − 101012

1. Perform the following calculations:

a)10012 x 11002

b) 11011 2 X 10012

c) 1011012 / 112

d) 1111112 / 1102

1. Convert the following decimal numbers to 6-bit two’s complement binary numbers and perform the arithmetic operation. If there is any overflow, indicate.

a) 1610 + 910

b) 2710 +3110

c) -- 410 + 1910

d) 310 + 3210

1. Convert the following decimal numbers to 5-bit two’s complement binary numbers and subtract them. Indicate whether or not the difference overflows a 5-bit result.

a) 910  -- 710

b) 1210 -- 1510

c) \_610  -- 1110

d) 410  -- 810

1. Do these calculations in two’s complement using the minimum number of bits to

avoid overflow.

1. 3 + *(*−7*)*
2. −3 + 7
3. 11 + *(*−11*)*
4. 18 − *(*−3*)*
5. And Ben Bitdiddle and Alyssa P. Hacker are having an argument. Ben says, “All integers greater than zero and exactly divisible by six have exactly two 1’s in their binary representation.” Alyssa disagrees. She says, “No, but all such numbers have an even number of 1’s in their representation.” Do you agree with Ben or Alyssa or both or neither? Explain.