**Week 2 – Homework Problems**

Eric Vara

The University of Arizona Global Campus

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Professor Austine Ohwobete

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**Chapter 3  
Exercise 3.4**

To calculate 4365 - 3412 where these values are unsigned 12-bit octal numbers:

1. Convert Octal to Decimal:

**4365 in Octal:**

4 \* 8^3 + 3 \* 8^2 + 6 \* 8^1 + 5 \* 8^0 = 2048 + 192 + 48 + 5 = 2293

**3412 in Octal:**

3 \* 8^3 + 4 \* 8^2 + 1 \* 8^1 + 2 \* 8^0 = 1536 + 256 + 8 + 2 = 1802

2. Perform Subtraction in Decimal:

2293 - 1802 = 491

3. Convert the Result Back to Octal:

Decimal 491 to octal: 491 = 7 \* 8^2 + 5 \* 8^1 + 3 \* 8^0

Octal representation: 753\_8

Conclusion: 4365\_8 - 3412\_8 = 753\_8

**Exercise 3.5**

To calculate 4365 - 3412 where these values are signed 12-bit octal numbers stored in sign-magnitude format:

1. Convert Octal to Decimal (Sign-Magnitude Format):

**For 4365**:

Convert to binary: 4365\_8 is 100 011 110 101 in binary.

Extract sign and magnitude:

Sign bit: 1 (indicating negative).

Magnitude: 011 110 101 is 245 in decimal.

Therefore, in decimal, 4365\_8 is -245

**For 3412**:

Convert to binary: 3412\_8 is 011 100 001 010 in binary.

Extract sign and magnitude:

Sign bit: 0 (indicating positive).

Magnitude: 100 001 010 is 1802 in decimal.

Therefore, in decimal, 3412\_8 is 1802

2. Perform Subtraction in Decimal:

Calculate -245 - 1802 to get -2047

3. Convert the Result Back to Octal (Sign-Magnitude Format):

Convert to binary: -2047 is 1 111 1111 1111 in binary (sign bit 1 for negative, magnitude 2047

Convert to octal: The binary number 1 111 1111 1111 is 7777\_8 in octal.

Conclusion: 4365\_8 - 3412\_8 = 7777\_8 in sign-magnitude format.

**Exercise 3.8**

To calculate 185 - 122 where these values are signed 8-bit decimal integers stored in sign-magnitude format:

1. Convert Each Number to Decimal:

**For 185:**

The first bit is 1, indicating a negative number.

Subtract 128 (the value of the sign bit in 8-bit format) from 185 to find the magnitude, which is 57.

Therefore, 185 in decimal is -57.

**For 122:**

The first bit is 0, indicating a positive number.

Therefore, 122 in decimal is 122.

2. Perform the Subtraction in Decimal:

Calculate -57 - 122 to get -179

3. Check for Overflow or Underflow:

The range of signed 8-bit integers in sign-magnitude format is from -127 to + 127.

Since the result of -179 falls outside this range, there is an overflow.

Conclusion: The subtraction 185 - 122 results in an overflow when the numbers are considered as signed 8-bit integers in sign-magnitude format.