CSC 205: Homework 1
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Instructions: Solve all problems below, showing ALL work (calculations). Simply writing an answer will result in ZERO credit for the problem. You are encouraged to practice on your own to be certain you can properly calculate the number base conversions and math correctly before attempting these problems.

1. Convert 1282_{10} to binary.

Work Start by picking an arbitrarily large power of two (not to exceed 1/2 the number we are to convert). I'll pick 2^7, which is 128.

Divide 1282 by 128. This yields 10R2 (a quotient of ten with a remainder of two). Since for the choice of divisor I picked 2^7, the binary representation that I'll be appending later won't just be two in base two (because two was our remainder): it'll be two in base two with seven place values (the number of place values must match the power of the base we choose to make our divisor).

Divide 10 by 128. This yields 0R10. Again, since for the choice of divisor I picked 2^7, the binary representation that I'll be appending will be ten in base two with seven place values.

Just like the standard algorithm for change of base, we take the last remainder in the new base and it becomes the leftmost part of the new representation. As such, we'll concatenate 10_10 and 2_10 after converting to get our binary representation of 1282_{10}.

10_{10} to seven place values in base two is 0001010_2. Likewise, 2_{10} to seven place values in base two is 0000010_2. The concatenation is 00010100000010_2. Leading zeros hold no value, so this is equivalent to 10100000010_2.

Check The number 10100000010_2 can be written as $1 \times 2^{10} + 1 \times 2^8 + 1 \times 2^1$, which is 1282_{10}.

2. Convert 359_{10} to octal.

Work Start by picking an arbitrarily large power of eight (not to exceed 1/2 the number we are to convert). I'll pick 8^2, which is 64.

Divide 359 by 64. This yields 5R39. Since for the choice of divisor I picked 8^2, the octal representation that I'll be appending later won't just be 39 in base eight: it'll be 39 in base eight with two place values (the number of place values must match the power of the base we choose to make our divisor).

It should be noted that one pitfall of this method is that although it cuts the number of computations needed for larger numbers by using higher powers of the base, it also draws on one's ability to recognize smaller numbers in that base. For example, by choosing 8^2 as the divisor instead of 8^1, we do roughly half as many calculations. However, we now how to find 39_{10} in octal with two place values, where as if we had chosen 8^1, the remainder would certainly have been under eight (and which makes sense, not least of all because we would be forced to write the remainder with one place value, since the number of place values must match the power of the base).

Divide 5 by 64. This yields 0R5. Again, since for the choice of divisor I picked 8^2, the octal representation that I'll be appending will be five in base eight with two place values.

5_{10} to two place values in octal is 05_8. Likewise, 39_{10} to two place values in octal is 47_8. The concatenation is 0547_8. Again, leading zeros hold no value, so this is equivalent to 547_8.

Check The number 547_8 can be written as $5 \times 8^2 + 4 \times 8^1 + 7 \times 8^0$, which is 359_{10}.

3. Convert 8191_{10} to hexadecimal.

Work Start by picking an arbitrarily large power of eight (not to exceed 1/2 the number we are to convert). I'll pick 16^2, which is 256.

Divide 8191 by 256

4. Convert $2E0C_{16}$ to decimal.

Work

5. Convert 561_8 to decimal.

Work

6. Convert 1110110_2 to decimal.

Work

7. Convert $67EA_{16}$ to binary DIRECTLY (no intermediate base).

Work

8. Convert 6204_8 from octal to binary DIRECTLY (no intermediate base).

Work

9. Convert 1110110011001111110101_2 to hexadecimal DIRECTLY (no intermediate base).

Work

10. Convert 100110111101_2 to octal DIRECTLY (no intermediate base).

Work

11. Represent -160 in three notations: sign magnitude, 1's complement, and 2's complement.

Work

Perform the following arithmetic using signed BINARY numbers and the 2's complement representation.

12. $27 + 19$

Work

13. $72 - 85$

Work

14. $31 - 11$

Work

Answer the following questions regarding BINARY numbers.

15. What is the LARGEST positive unsigned value that can be represented using 12 bits?

Work

16. Using 16-bit 2's complement signed numbers, what is the largest POSITIVE magnitude that can be represented? What is the smallest NEGATIVE magnitude (e.g. -10 is smaller than -5)?

Work