

CMSC 311 Computer Organization

Jolly Numbers Worksheet

–NO CALCULATORS–

Summer, 2000

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1. Write the decimal number,  $(108_{10})$ , as an unsigned binary number. Express your answer in hexadecimal and octal as well.
2. Write the hexadecimal number,  $(108_{16})$ , as a decimal number.
3. What is the largest integer (in decimal) that can be expressed as a 32-bit unsigned binary number? Note: as always, you may express your answer in terms of powers of two or 16 if you like.
4. Write the decimal number  $(-2100_{10})$  as a 16-bit sign magnitude number. Express your answer in hexadecimal as well.
5. Express the hexadecimal number  $(7A0F_{16})$  as a base 10 number, assuming that the original hexadecimal number is in **sign magnitude** form. Repeat assuming unsigned binary form.
6. Express the hexadecimal number  $(F401_{16})$  as a base 10 number, assuming that the original hexadecimal number is in **sign magnitude** form. Repeat assuming unsigned binary form.
7. Convert the following “decimal fractions” to 32-bit fixed point equivalents, where the “binary fraction” is the lower 16 bits, and the “binary integer” part is the upper 16 bits. The “binary integer” part is stored as a sign magnitude number. You may give your answer in hexadecimal for convenience. Also indicate which representations are exact, and which are approximations because of truncations. Is underflow present anywhere?
  - (a) 125.25
  - (b) -456.089
  - (c) 512.0000000025
  - (d) 104.11111
  - (e) -116.8888
8. Express the fixed point numbers above using 32-bit IEEE floating-point notation.
9. Express both operands in signed 2’s complement, and perform the indicated operations. (Note: don’t forget to sign-extend the numbers so that all arithmetic is performed between numbers of the same size.)
  - (a)  $46 - 120$
  - (b)  $-(-1654 + 2098)$
  - (c)  $25246 + 21670$
  - (d)  $(-256 - 1248)$
  - (e)  $116 - (-76)$
10. Which of the operations in the previous problem, if any, can be performed correctly using 16-bit signed 2’s complement arithmetic.