COMPUTERGESTÜTZTES EXPERIMENTIEREN I
(Computer-Assisted Experimentation I)

Introduction to Computer Engineering

Numerals in Various Bases

You should be able to solve the following exercises regarding conversion of numbers into systems of the commonly used bases and the representation of negative dual numbers in two's complement.

1. Convert the following numbers from decimal to dual
   (a) 24_{10} (b) 37_{10} (c) 15_{10} (d) 157_{10}
2. Convert the following numbers from dual to decimal:
   (a) 10011_2 (b) 11101011_2 (c) 01100111_2 (d) 1001100_2
3. Convert the following decimal numbers into dual and then into octal and hexadecimal
   (a) 27_{10} (= Escape in ASCII code) (b) 48_{10} (c) 172_{10}
4. Do the following additions in dual and confirm your results by converting and performning the calculation in decimal
   (a) 0011 1011 + 0111 0011
   (b) 0101 0110 + 1101 0111
5. If you represent dual numbers in 8 bit two's complement, what is the biggest positive number and what is the smallest negative number? Interpret the numbers of exercise 4 as 8 bit two's complement. What do they represent now? Are the results stil valid? How would you recognize an overflow?
6. Convert the following negative numbers into 8 bit two's complement dual numbers
   (a) -2_{10} (b) -128_{10} (c) -32_{10} (d) -86_{10}
7. Do the following subtractions in the decimal system and in the dual system using 8 bit two's complement
   (a) $29_{10} - 23_{10} =$
   (b) $101_{10} - 121_{10} =$
   (c) $-15_{10} + 36_{10} =$