

Problem 1 [24 pts: (6 each)]: Base conversions

Compute each of the operations in the given base. (You're welcome to convert back to base 10 to check your work, but do give yourself the experience of computing in other bases. I admit that the experience feels kind of awkward at first, but these exercises build fluency and motivate essential questions).

i $(0110)_2 + (11100)_2$

ii $(0110)_2 * (101)_2$

iii $(123)_7 * (42)_7$

Suggestion: It might sound silly, but try doing a quick base-10 3-digit by 2-digit multiplication to prime your brain a bit before working in base-7

Problem 2 [24 pts: (6 each)]: Base conversions

An IP address expresses the location of a computer within a network. IP addresses are 32-bit binary numbers, commonly expressed in the dotted-decimal format in which the 32 bits are sliced into four sections with 8 bits each. The table below shows a single IP address in different representations (i.e. they're all equivalent):

Notation	Value
Dotted decimal	192.0.2.235
Hexadecimal	0xC00002EB
Decimal	3221226219
Octal	(030000001353) ₈
Binary	(1100000000000000000000001011101011) ₂

Table modified from [Wikipedia on IPv4](#).

- Convert the IP address 179.55.223.12 from dotted decimal format to hexadecimal and decimal formats.
- Convert the IP address $(BAC2A78F)_{16}$ to the dotted decimal and decimal formats.

Problem 3 [24 pts: (6 each)]: Base conversions

Find all values of x which meet all of the following criteria:

- $x > 3$
- $x < 30$
- $x \bmod 5 = 2$

Problem 4 [24 pts: (6 each)]: Base conversions

Write a succinct, sufficient explanation (proof) which shows why Euclid's Division method correctly converts a number from base10 to binary.

Hint: while not a proof, it may help to look at a particular example (e.g. $14 = (1110)_2$). Do Euclid's Division Algorithm to convert and then see if you can be clever about substituting the equalities into each other to produce only powers of two.

Problem 5 [24 pts: (6 each)]: Base conversions

Solve for x in each of the equalities below

i $(10)_{10} = (x)_2$

ii $(1100)_2 = (x)_{10}$

iii $(A9)_{16} = (x)_{10}$