

# KIT103/KMA155 Practical 09: Converting between number systems

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This week you'll write and test functions for converting between number systems.

## Preparation

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Open Spyder and save the empty .py file it starts with under a new name to keep a copy of your work from today.

### 1 Warm up: Base 2–36 to decimal

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**Task:** Using the `int(s, b)` function convert the following values to decimal:

- a.  $1010_2$
- b.  $12_8$
- c.  $A_{16}$
- d.  $F00DCAFE_{16}$
- e.  $ARGH_{36}$

### 2 Decimal to base 2–9

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**Task:** Implement the `dec2smaller` function from the lecture. You may choose either the iterative or recursive version. Test that it works by converting these decimal values to the nominated base (you will have to work out on paper or in your head if the answer is correct):

- a. 10 to base 2
- b. 8 to base 8
- c. 255 to base 2
- d. 27 to base 3
- e. 100 to base 9

### 3 Decimal to (almost) anything

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**Task:** Modify your solution from the last task to use a predefined set of digits instead of `str(r)` (code to generate these digits appears in the lecture slides). Call the new function `dec2other`. Test it on the following conversions:

- a. 10 to base 2
- b. 121 to base 11
- c. 10 to base 16
- d. 4096 to base 16

- e. 100 to base 20
- f. 22569 to base 36

### 3.1 Passing messages in class

Given that every base-36 number has a unique decimal representation you could write a brief message (containing only letters and numbers), then treat this as a base-36 number and convert it to decimal. This decimal number could then be given to someone else who could 'decipher' the message by converting the decimal value back to base-36. (For added security, if you could avoid using Z, or Y, or X, you could use a slightly smaller base, the exact number being a secret.)

**Task:** Write a very brief message as a base-36 string and convert it to decimal as you did [above](#). Tell the person next to you the decimal value and the base originally used, if you used a base smaller than 36. Can they 'decrypt' the message?

Is this a good (as in secure) method of encrypting messages?