

# IN1011 Tutorial (practice questions) :

## Changing between Number Bases

### 1 Introduction

This tutorial gives you some practice with thinking about representing a number in different numerical bases. You should try solving these questions using the “series” method you were shown in today’s lecture.

#### 1.1 “Warm up” Questions

An  $n$  digit number in base  $k$  is a number with  $n$  digits where each digit is a “counting”<sup>1</sup> number that lies in the range 0 to  $k - 1$ . How many numbers can be represented by:

- (a) a 1 digit number in base 2?
- (b) a 3 digit number in base 5?
- (c) a 5 digit number in base 3?
- (d) a 2 digit number in base 14?
- (e) a 9 digit number in base 1?

Write down the largest number for:

- (a) a 2 digit number in base 6;
- (b) a 2 digit number in base 8;
- (c) a 3 digit number in base 4;
- (d) a 4 digit number in base 3;
- (e) a 6 digit number in base 20.

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<sup>1</sup>A reminder: in all of the questions only “counting” numbers (i.e. 0, 1, 2, 3, ...) and English alphabet letters are used as digits.

## 1.2 “Change of Base” Questions

Convert the following numbers between bases:

1. 758 in base 10 to base 6;
2. a831 in base 11 to base 13;
3. 11011 in base 2 to base 8;
4. 29 in hexadecimal to base 2.

## 1.3 “Bonus” Questions

The following questions are more difficult than the previous ones, for those of you that would like more of a challenge. If you attempt these questions, I will give you feedback on your solution during my office hours.

1. Convert 458 from base 10 to a base where the series representation of the number looks like  $x_0 + x_1 2 + x_2 2 \cdot 3 + x_3 2 \cdot 3 \cdot 4 + x_4 2 \cdot 3 \cdot 4 \cdot 5 + \dots$ ;
2. Convert 16.5 from base 10 to base 2;
3. Consider the numbers 23 and 32 in base 4. Add these numbers together in base 4, without first performing the addition in base 10;
4. Consider the numbers 1011 and 1110 in base 3. Multiply these numbers together in base 3, without first performing the multiplication in base 10;
5. Consider the numbers 101 and 12 in base 3. Divide 101 by 12 in base 3, without first dividing these numbers in base 10.

Hint: modify the “series” in the questions to make them more like the “series” we used in the lecture.