

Programming C++

Project Kaprekar Constant

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Supervisor: Prof.Dr. G. Haase,

`gundolf.haase@uni-graz.at`

The Indian mathematician D.R. Kaprekar¹ found a constant named after him which can be achieved using the rule described in Wikipedia². There are unique constants for 3- and for 4-digit numbers with base 10, but we get non-unique constants and/or non-unique cycles for all other numbers of digits with base 10.

The final goal of this project consists in determining the constants and cycles for 2-20 digit numbers in base 10 and afterwards in an arbitrary base.

1. Implement the rule for 3 or 4 digit numbers of base 10. One possible course of action:
 - Write function(s) that generate the smallest and the largest number from a given number n with digits $abcd$ contained in the given base.
 - Compare your constants with those from literature.
 - Take care that the result of, e.g. $221 - 122$ is again interpreted as 3-digit number. Similar with more digits.

Storing the numbers:

- You might store your numbers as `int` or `unsigned long long int` and extract the digits from this representation.
 - On the other hand you might store the numbers in its digits representation and provide the necessary functionality (min, max, subtract, ...). A (template?) class would encapsulate that.
2. Extend you algorithm such that cycles as well as constants are determined for others than 3 or 4 digits. (6 Pkt.)
 - Use 2-10 digits³ in base 10.
 - Use 11-20 digits⁴ in base 10.
Data type `long long int` fully includes up to 17 digits.
 - More than 20 digits?
 3. Extend your algorithms to an arbitrary base. Check the results for special bases with available results⁵. (+2 Pkt.)

¹https://en.wikipedia.org/wiki/D._R._Kaprekar

²https://de.wikipedia.org/wiki/Kaprekar-Konstante#Verfahren_zur_Berechnung_der_Kaprekar-Konstante

³<http://kaprekar.sourceforge.net/output/sample.php>

⁴<http://kaprekar.sourceforge.net/output/sample2.php>

⁵https://en.wikipedia.org/wiki/Kaprekar's_routine#Kaprekar's_constants_and_cycles_of_the_Kaprekar_mapping_for_specific_base_b