

Modulo in everyday life



1. Name of the project:

Modulo in everyday life

2. Subjects covered from STEAM areas:

Mathematics,
CS

3. Target group (age range and size of the group):

- Age group: 13+ years
- Group size: class/course size

4. Duration of the activity:

6 lessons

5. Key words:

- modulo calculation
- modulo congruence
- corner calculation
- check digits
- division with remainder

6. Key sentence describing context of the activity, followed by short description (200 words):

In this lesson, students learn how to use the modulo congruence relation and apply it using check digits as an example. For this the basics of division with remainder from elementary school are repeated, Calculation rules for addition and multiplication are established and practiced in an illustrative/practical way. When the students are confident in using the modulo operator, this knowledge is to be applied to the context of check digit systems. As a conclusion, the students will develop a tool to check digits.

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7. Description of the activity environment, including the list of materials and tools needed:

The lesson can be done without additional material, if necessary the teacher can prepare information material about different check digit systems (ISBN10, ISBN13, ASIN, EAN, ...)

8. Step by step, detailed description of the activity, including teaching and learning strategies:

- i. Repeat division with remainder (short exercises), solo + plenary presentation.
- ii. Modification to modulo operator (correct spelling based on an introductory example, "only calculate with remainders", further common examples to get used to, practical examples like time/calendar), plenum
- iii. Corner arithmetic with modulo tasks (introduction to the new (double) lesson or for familiarization, towards the end include tasks with calculations -> preparation for working out the arithmetic rules), activity
- iv. Remainder classes, calculation rules (basics of remainder class concept, calculating with remainder classes, trying out addition rules for remainder classes + formalization, trying out multiplication rules + formalization, exercises), group/station work
- v. Check-digit-systems (lesson introduction: review modulo computation/residue classes/calculus rules for modulo; motivation: check-digit-systems as a means of integrity checking in everyday life; research assignment for check-digit-systems), with partner/research.
- vi. Implementation (partner work on self-selected check digit system: A develops check digit generator, B develops check digit validator; alternative: development of own check digit system; conclusion short presentation in plenary), with a partner/presentation

9. Learning objectives/competencies:

Use of the modulo operator as an example for calculating with congruence classes, Knowledge of check digit systems, implementation of algorithms.

10. Evaluation/Assessment guidelines:

Successful implementation of a check digit system based on modulo operators, If applicable, evaluated worksheet from the work phase on residue classes/calculus rules.

11. Lessons learned:

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The concept of residual classes occurs more often in everyday life than one realizes, therefore correct handling is important - however, this is actually not formally considered in the curriculum. Check digit systems offer a simpler, more descriptive introduction than the "classical" introduction of modulo computation and its calculation rules (in computer science) via RSA encryption, which makes it easier to understand later on, because one the elementary mathematical operators in addition to the actual algorithm. algorithm must be understood.

12. Additional information/Links:

Calculating with congruences: <http://didaktik.mathematik.hu-berlin.de/files/2016-07-07-kongruenzen-skript.pdf> (german)

13. Contact person:

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