

## STACK and the MINTFIT Hamburg Math Test

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**Abstract:** The MINTFIT Math Test is an online test for high school students or generally persons who are interested in a university STEM degree programme. It is provided by the MINTFIT project which is based at the universities HafenCity Universität Hamburg (HCU), Universität Hamburg (UHH), University of Applied Sciences Hamburg (HAW Hamburg), University Medical Center Hamburg-Eppendorf (UKE) and the University of Technology Hamburg (TUHH) in Hamburg, Germany and is funded by the Hamburg Ministry of Science, Research and Equalities Hamburg (Behörde für Wissenschaft, Forschung und Gleichstellung Hamburg, BWFG). The MINTFIT Math Test (as well as the MINTFIT online tests in physics, chemistry and informatics) runs on a Moodle system. The STACK plugin is used to provide a large variety of questions (and therefore test variants) and to give a participant an optimal feedback to the entered solution. Thus, the MINTFIT Math Test is a flexible tool not only used at home by future students who want to check if their math skills are already sufficient for a STEM degree programme, but also at universities in many different settings.

**Keywords:** Mathematics, E-Learning, E-Assessment, Online Test, Moodle, STACK, MINTFIT

### 1 Introduction

The MINTFIT Math Test is a free diagnostic online test which gives its participants the opportunity to check if their math skills are sufficient for a successful start into the first terms of a STEM degree programme.

After finishing the test, participants instantly get a feedback in which subjects of high school mathematics they should still put some efforts before beginning their university studies. Furthermore, two online mathematics bridging courses – the OMB+ and viaMINT – are presented, the recommended chapters in both courses are highlighted. Users can transfer their recommendations automatically to their preferred platform or to both platforms. The MINTFIT platform also offers online tests in physics, chemistry and informatics as well as a physics online course. The chemistry and informatics courses will be published by the end of 2020. In 2019, about 30,000 tests were completed at the MINTFIT Hamburg web page ([www.mintfit.hamburg](http://www.mintfit.hamburg)). An English version of the MINTFIT Math Test is available in addition to the original German version. For more information see [BS18].

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## 2 STACK in the MINTFIT Math Test

The MINTFIT Math Test consists of 2 subtests with 11 resp. 7 subfields of high school mathematics and with 2 questions in each subfield. The questions of a subfield are drawn from a question pool with at least 3 questions in it. About 50 questions in the question pool currently used are implemented with STACK. The potential response tree of a STACK question helps to diagnose the errors in a student's calculation because it is possible to compare the student's solution with false solutions which one gets by committing common mistakes. It also gives the opportunity to provide partial points for errors with subsequently correct answers or partially correct answers of the participant.

With STACK it is also possible to generate a broad variety of one and the same question. For example, if the question is to derive a polynomial, by letting the system randomly draw its coefficients (or more generally numbers for defined variables in the question design) from a specified set, one gets easily many variants of one question. After deploying the variants, one can remove by hand variants that seem too difficult or too easy. Thus, many test variants with a comparable level can be put together from the question pool and in exam-like situations, a test variant presented to a participant is with a high probability different from the one presented to fellow students, seatmates etc.

## 3 Additional Use of the MINTFIT Math Test

The use of STACK and thus the possibility to provide a broad variety of questions makes the MINTFIT Math Test fit many purposes apart from the initial one. From 2016 on, the MINTFIT Math Test is used at the University of Technology Hamburg (TUHH) with freshmen. They get the opportunity to collect bonus points for the first term mathematics exam depending on their results in the Math Test. As a benefit, students see where their knowledge gaps in high school mathematics are. The MINTFIT Math Test is also used as part of an entrance test for persons without university-entrance diploma (Abitur) for several study degree programmes and beyond that as a module requirement for freshmen of the Geodesy and Geoinformatics degree programme at the HafenCity Universität Hamburg (HCU). The range of use of the MINTFIT Math Test will be maintained and taken care of in the future course of the MINTFIT project.

## Bibliography

- [BS18] Barbas, H.; Schramm, T.: [The Hamburg Online Math Test MINTFIT for prospective Students of STEM Degree Programs](#). MSOR Connections, S. 43-51, 2018.