# Stronger Prerequisite Skills for "Discrete Structures"

“Discrete Structures” is an introductory course for our BITL students. Some people find it overwhelming – because of the scope and the variety of topics. On one hand, the scope of “Discrete Structures” itself can be adjusted. All the major topics already match existing courses ([6.042J / 18.062J](https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-spring-2015/index.htm) taught at MIT or [CSE 191](https://cse.buffalo.edu/~knepley/classes/cse191/index.html) taught at SUNY Buffalo), but we can certainly put more emphasis on some key topics.

On the other hand, we saw that students in BITL1, BITL2 have had very different exposure to mathematics and programming in high-school, their attitudes, likes and dislikes are very different. We could attempt to close that gap. Here are some thoughts, how to make “Discrete Structures” friendlier to those students who may otherwise fall behind.

**Step 1: Test during Orientation Week.** We might introduce an “IT aptitude” test for all BITL3 students in early September. It could check the comprehension of formal, mathematical English; ability to follow instructions carefully; do logical reasoning, see patterns.   
Are we doing such testing already? (“IT Aptitude” tests are easily available, but to avoid copyright issues, we could make such a test ourselves.)

**Step 2: A 1-2 credit Remediation Course.** During the test we identify some 8-15 students who had difficulties with important tasks and invite them to take a “Mathematics in IT” course – it is one 90-minute class every week plus about the same amount of self-guided learning. We can name it in many other ways, but it should have a separate brand identity (no “discrete” or “structures” in its name); as Paula explained – we do not want this to sound hard.

The epidemic might continue during Fall 2021, so we should keep everything as simple as we can. We do not aim this for everyone. The current instructors of “DS” (Kalvis and Jānis) already teach some major courses (Data Structures/C++ and Linear Algebra respectively) – so we probably do not want to add any major things. But even with these limitations it is possible to help some people – before they encounter “Discrete Structures” or tricky progamming courses.

*Note:* This “Mathematics for IT” is not currently meant to become a necessary prerequisite to “Discrete Structures” or any other course. It tries to avoid information overload; it keeps the number of concepts that are discussed to a reasonable minimum (and does not depart far from the high-school curriculum). On the other hand, it introduces multiple storylines, shows various interrelations between simple concepts so that people can gain confidence dealing with logical reasoning, numbers, strings, counting problems and probabilities; can apply them for some IT tasks.

**Our Objectives:**

* Aptitude test shows the readiness of every BITL student before s/he starts to learn any discrete math or programming subjects; can measure their progress.
* Can gather input in Fall 2021 (from the participants of “Mathematics for IT”) and from everyone else in Spring 2022.
* Can evaluate, if this activity was helpful for “borderline” candidates – did this “Mathematics for IT” (or whatever is the name of this remediation course) provide any advantage to the people who took it; compared with other “borderline candidates” who did not.

## Our Steps

We do not expect that the epidemic will be over by Fall 2021, so we keep everything simple.

1. **An “IT aptitude” test during the orientation week.** In early September BITL3 students are offered a test.
2. **“Mathematics for IT” course.** Some 8-15 students who had insufficient test results are invited to take a “Mathematics in IT” course – it is one 90-minute class every week plus about the same amount of self-guided learning.   
   We can name it in many other ways as well, but it should probably have a separate brand identity (no “discrete” or “structures” in its name).
3. **Summarizing our Experience in Spring, 2022.**

## Our Objectives?

* **Quality Assurance.** We measure the mathematical readiness (and, more generally, “IT aptitude”) for the BITL participants before they start the 1st year (and right after the 1st year).

## “IT aptitude” Test Details

Could be 2 hours; about 40 short-answer questions with instant feedback. The questions are “scaffolded” into short sequences: questions may be based on earlier ones; students can benefit from reading skills and quick learning capacity.

Skills Taught during the Remediation Activity

“Introduction to Discrete Structures” often relies on students being able to perform various tasks, but we never explicitly teach those tasks.

(1) Ability to read and to understand formalized English language. Language samples could be similar to the high-school math textbooks, task descriptions, dictionary definitions, user manuals.  
(This relates to the ability to read and to interpret STEM-related text snippets, avoid common misinterpretations or logical mistakes.)

* 1. Given a definition of a new concept, check what items satisfy it.
  2. Given a proposition, find what immediately follows from it.
  3. Given a set of examples, generalize the concept as
  4. Being able to analyze technical information -

1. Self-Directed Learning Skills
   1. Ability to identify the goal from a task description
   2. Ability
2. Understanding Numbers, Strings and Counting
3. Ability to analyze expressions
4. Ability to execute some procedures precisely