



Frequently Asked Questions
Information for Prospective Postgraduate Students
Honours/MSc/PhD

A/Prof Vasco Brattka

1. *In which areas do you supervise research projects?*

My research is mainly in the fields of *computable analysis*, *algorithmic randomness*, *computability theory* and *effective descriptive set theory*. I am happy to supervise projects in any of these areas and I have several fascinating topics for projects available.

2. *What is all this about?*

In these research directions we aim to understand the computational content of mathematics. For instance, we are trying to understand how mathematical theorems (such as the Brouwer Fixed Point Theorem or the Intermediate Value Theorem) are computationally related. Can one, for instance, compute one theorem with the help of the other one? Answers to such questions lead to a much better understanding of mathematics and foundational aspects of it. Another typical question would be: is the Mandelbrot set computable? If not, is it a random set? We do not know the answers to these questions. We are still seeking the best definition of a random set in general. Thus, very basic questions in this field are still open!

3. *Are you collaborating with other researchers?*

There are currently some hot new international research trends in the above fields and the knowledge is increasing very rapidly. Without international contacts one cannot keep track with the developments. Currently, we are collaborating with researchers from Germany, Italy, France, UK, Japan, USA and New Zealand. There are several international conferences where results in our research area can be presented and typically one or two MSc or PhD students from our group can travel to international conferences per year.

4. Which prerequisites do I need to become a successful researcher in your area?

You need to be fascinated by pure mathematics with a strong interest in foundational questions. You should have some excellent knowledge and strong background in at least one of the following fields and some basic knowledge in one or two of the others: *topology*, *functional analysis*, *measure theory* and *logic*.

5. Which additional subjects do I have to learn to master a project?

In order to work actively in my area of research you will have to learn basic *computability theory* and depending on the topic some *algorithmic randomness* or *effective descriptive set theory*. I do not assume that you have any prior knowledge in these fields and you can learn these subjects in our courses or by reading appropriate material.

6. Do I need some knowledge in Computer Science?

Although my area of research is related to *mathematics of computer science*, you neither need any practical knowledge in computer science, nor has my research anything to do with practical programming. A background in *theoretical computer science* (*computational complexity theory*, *algorithmic randomness*, *computability theory*, *automata theory*) would be useful.

7. How can I find out whether this is the right subject for me?

You can request some reading material and solve some exercises in order to see whether you like this research direction. If you are currently a UCT student, then you can also attend some of my lectures.

8. How can I get funding for a project under your supervision?

Usually, I have some resources available to contribute to the funding of talented and motivated students. Otherwise, the NRF, UCT and other institutions provide funding. I am happy to discuss these matters with you, if you are seriously interested in my area of research.

9. How can I contact you?

The easiest way is to contact me by email: Vasco.Bratkka@uct.ac.za

If you have some serious interest, then we can also make some appointment for a phone interview or a meeting (depending on where you are).