

# For prospective students

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## 1 Basic information

- PhD entry requirements (set by the university)
  - 1st / upper-2nd class honours degree or equivalent
  - English: IELTS  $\geq 6.5$  &  $\geq 5.5$  each item
- Other info
  - PhD program name: PhD in Computer Science
  - You will have two supervisors, one is me.
  - Standard PhD scholarship length: 3.5 years
  - Amount of scholarship you need: £88000 (local student) and £160000 (international student)
    - \* Tuition fee: £4700 - £5000 (local student), £25500 (international student) **per year**
    - \* Your stipend (your take home salary): £18500 - £20000 (**tax free**) **per year**
    - \* You have £1200 for conference travel, books, course, computer **per year**
    - \* IF {I have funding}, THEN {you do not need to worry about scholarship}.
    - Right now: I have no funding.
    - \* **In summary:** in the 3.5 years
      - For home student
        - you get £67000 as your salary go to you
        - £4200 for conference travel, computer and training go to you
        - The last £17000 goes to fee go to university
      - For international student
        - you get £67000 as your salary go to you
        - £4200 for conference travel, computer and training go to you
        - The last £89000 goes to fee go to university

## 2 Procedure for PhD applications

Professors do not directly admit students. You need to apply through the university. Here are the steps.

- Step 0. You (the student) contact me (the proposed supervisor) & send me the following
  - CV, Academic transcript (to date) & degree certificate (if graduated) no page limit  
These tell me about your academic background
  - Personal statement 0.5 - 1 page  
This explains your motivation
  - Research statement / research proposal 1 - 2 pages  
This explains your research interest and how it aligns to mine, and your understanding of the field
  - 2 reference letters in official letter head 1 - 2 pages each

THEN I read your file. IF I am interested, I will reply your email and arrange an online meeting. After the meeting, IF I agree to accept you as a PhD student, go to step 1a.

- Step 1a. The student make a formal application to the university
  - put my name on the application
  - say in the application how you plan to fund your studies: you are looking for funding from
    - \* Internal scholarship (Scholarship within University of Southampton)
      - University scholarship
      - Faculty funding / School of ECS funding: DTP/ECS studentships
    - I am prioritized for ECS funding**, see Section 3

- My funding

Right now I have no my own funding but I have high chance to get ECS internal funding, see Section 3

- \* External scholarship (Scholarship outside University of Southampton)
  - UK Government scholarship
  - Government scholarship from your country
  - Other external funding
  - UK government loan

Not recommended

- Step 1b. The faculty sends me your application, I accept, go to step 2. No promise of funding at this stage

- Step 2. Funding

- IF {you look for funding from me} AND {I have funding}:
  - \* IF I say yes THEN go to step 3.
  - \* IF I say no THEN go back to step 2.
- IF you look for university / faculty funding, the application goes to a committee that will decide on funding.
  - \* Each application can only be considered twice by the committee. I.e., if you failed twice, you will never be considered again.
  - \* More change for stronger student: good degree / achievement / research experience / publication record. Contact me, I will look at your application material and advise how to improve.

After you have finalized the funding, go to step 3.

- Step 3. University send you an offer letter / conditional offer letter.
  - Apply for student visa (<https://www.gov.uk/student-visa>) (English test may be required)
  - We decide the exact starting date of your PhD study.
  - You look for accommodation (see Section 4) and start preparing.

### 3 Faculty / Department funding for PhD (PGR) students

ECS has funding for several PhD students and **I am prioritized for the funding**. That means,

- if you are a home student **that is strong**, I have a high chance to have a fund from ECS to support you.
- if you are an oversea student **that is very strong**, I have a high chance to have a fund from ECS to support you.
- Terminology
  - home/local: UK students
  - oversea: non-UK students
  - PGR: postgradusate research
  - ECS: School of Electronics and Computer Science
- Priority of PGR funds goes to home student, if overseas student need other funds to cover extra international fees, see Section 1.
- Before a student can be considered for funding
  - they are required to undergo an interview with at least two academic staffs
  - read paragraphs 13 and 14 of the PGR Code of Practice
  - Complete Postgraduate Application Form, ask me for the form
  - Complete forms 2 and 3, ask me for the form
  - Complete ECS PhD Studentship Application Form 4, ask me for the form

## 4 Documents you need

- Readable academic transcript (to date) and degree certificate (if any) in English no page limit
- CV no page limit
- Personal statement Max 1 page
- Research statement Max 2 pages
- 2 reference letters Max 2 pages each
- English language certificate (if needed) for student visa
- If you apply for ECS scholarships
  - Form 2, Form 3, ECS PhD Studentship Application Form (form 4) ask me for these forms

If your documents are not in English they need to be translated to English.

## 5 Some tips and links

- Don't throw me your research proposal before knowing what I do.
  - An immediate reject: this means that you didn't even do research on knowing what my research is.
  - Explain why you want to work with me
  - Explain what topics within my expertise interested you
  - Elaborate your understanding of the research field
- Online resources
  - How to apply for a research degree  
<https://www.southampton.ac.uk/study/postgraduate-research/apply>
  - How to write a PhD CV  
<https://uk.indeed.com/career-advice/cvs-cover-letters/phd-cv>
- Scholarships
  - Southampton PhD Scholarships  
<https://www.southampton.ac.uk/doctoral-college/presidential-scholarships.page>
  - Southampton funding opportunities  
<https://www.southampton.ac.uk/doctoral-college/funding-opportunities.page>
  - Postgraduatesearch.com  
<https://www.postgraduatesearch.com/funding>
  - PROSPECTS (scholarship search)  
<https://www.prospects.ac.uk/postgraduate-study/funding-postgraduate-study>
  - British Council (Search for UK courses and scholarships)  
<https://study-uk.britishcouncil.org/scholarships-funding>
  - Look for industrial scholarship
  - Look for government scholarship from your country

## 6 After your application is successful: prepare your PhD life

- Apply for a UK bank online before the trip.  
UK banks have low efficiency, it may take few weeks or even a month to open your bank account.
- Prepare a UK sim card
- Prepare some £, I recommend £1500 - £2000 for your first month bills, rents and living expenses.  
(Some landlords may ask you to pay for 3 months of rent in advance.)
- Plan your finance: your PhD stipend (£18500 - £20000) is tax free. Your salary each month is £1541 - £1666.

- Cost of living
  - Accommodation
    - \* Student accommodation in Southampton recommended
    - \* VITA student high-end, only if affordable
    - \* unihomes
    - \* rightmove

The first two options will lump everything together into one single cost and free yourself from dealing with electricity bill, gas bill, water bill, internet bill, phone bill, TV bill, etc.
  - Local transportation: £2 per bus trip or £360 for one year bus pass (infinite many bus trips)
  - Personal advice: do not put more than 35% – 40% of your salary on rent (excluding bills). That is about £600 - £750.
  - For lower rent, you can look for house share in rightmove.
- In UK all adults have to pay Council Tax. PhD students are exempt from paying Council Tax. However, if you are moving with your partner, your partner may need to pay council tax. See Southampton City Council.
- Familiarize yourself with Southampton map, zip code, and important locations
  - post office (apart from mail, UK post offices also deal with bills, phone, ID card, internet, currency exchange)
  - hospital
  - bank

## 7 Work expectation

- Flexible 40 hours of work per week 8 hours each day Mon-Fri  
Flexible, lunch time / sport time counted in working hours
- A year has 52 weeks, so in theory you have 2080 work hours. In practice you have 1500-1600 work hours.
- A course takes < 50 hours. For a “intro-intermediate-advanced” 3-unit course structure, it takes 150 hours to master a subject.
- Counting half of the time to study (other half go to research), you need to master at least 8 subjects.

## 8 My view about PhD study

- PhD should be about theoretical frontier, not on application.  
PhD focusing too much on a particular application should be considered “industrial practioner”.  
I am not saying you should do no application, I am saying you should not do no theory.
- Math is important. No math, no PhD.  
Math is the queen of science. Math is a formal language system for doing research. Every researcher has to master at least TWO FIELDS of mathematics (not two topics, two areas, but two fields).
- Depth is important. No depth, no PhD.  
In the future every shallow thing will be replaced by automation and artificial intelligence. People with no depth skill-sets will have no competitiveness.
- Breath is important. No breath, no PhD.  
I believe mathematics is not invented but discovered. You make discovery by connecting the dots. To connect dots you have to know at least TWO DOTS, hence you have to know at least TWO FIELDS of mathematics.
- My minimum requirement for PhD
 

– Math genius? Not necessary.	– Good at English? Should.	– Hardworking? Must.
– Good at math? Not necessary.	– Good at reading? Should.	– Willing to learn? Must.
– Good math grade? Not necessary.	– Good at writing? Should.	– Motivated to learn? Must.
– Good at programming? Not necessary.	– Good at presenting? Should.	– Ambitious? Must.

## 9 Lists of things I am interested to do research (not in any order)

### Optimization topics

- Nonlinear optimization
- Nonsmooth optimization and subdifferential
- Optimization algorithm design
- Convergence analysis of optimization algorithm
- Acceleration of optimization algorithm
- Block-coordinate descent
- Nonconvex optimization

### Expository optimization topics

- Convex analysis for optimization
- Inexact proximal gradient method
- Trust-region methods
- Nonproximable optimization and proximal average
- Differential equation technique for optimization
- Proximal bundles
- Zeroth order method
- Semi-smooth Newton's method
- Semidefinite optimization

### Linear algebra topics

- Nonnegative matrix factorization
- Nonnegative tensor factorization
- Identifiability
- Convex geometry
- Algorithm

### Graph topics

- Spectral graph theory
- Sum-of-norms clustering

### Expository topics

- Multi-level/scale/grid methods for optimization
- Manifold for optimization on non-Euclidian space
- Fractional derivative for optimization
- Randomization for optimization
- Exterior algebra and derivative for optimization
- Wasserstein metric
- Matorid
- Complex derivative for optimizat on  $\mathbb{C}$
- Pseudospectrum
- Pseudomatrix

## Applications

- Signal processing
- Blind source separation
- Hyper-spectral imaging
- Text mining
- Bioinformatics
- Snake / active contour model
- Sparse optical flow

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