

Advanced Master in Computing: for discussion

Eric Martin

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1 Background and aims

Next year, we will not make offers any more for the MEngSc. This degree has never given us satisfaction, in particular because it is too close to the MIT, and the differences have even been further reduced with the last Faculty revision to the MEngSc. A common query has been "what is the difference between the MIT and the MEngSc?" and it has always been difficult not to provide a slightly embarrassed answer. The similarity between both degrees has not helped us market them well. Also, the MEngSc is not very popular; about 90% of our coursework Master students are in the MIT.

We believe that there would be some interest for an advanced Master degree. At the beginning, we might only compensate for the very few students who would have enrolled in the MEngSc and would not opt for the MIT, but we can also hope and attract high quality students, and make the degree more and more successful over the years. We also believe that the image of the School would benefit from offering an advanced Master degree.

Designing a genuinely advanced Master, a degree that is significantly different to the MIT, necessitates to create specialised courses. Many Schools in Europe and the US propose very specialised courses. Just for an example, here are some of the courses on offer at the EPFL (Lausanne, Switzerland):

- Applications for convex optimization and linear program
- Random walks
- Statistical analysis of genetic data
- Unsupervised and reinforcement learning in neural networks
- Color reproduction
- Digital 3D Geometry Processing
- Computational motor control

Even our most advanced courses go significantly for breadth and not into so much depth.

2 What we would need to do

We would need to teach a bit more, preferably and most easily in our area of research. Here is a suggestion that would require minimal work from us:

Four academics team up to offer 1 course once a year, increasing our teaching load by 0.25 course a year. Each of the four academics who make up a team could select one topic covered in at most one week in one of our courses (may be a course that he or she teaches himself or herself) and expand it to three weeks' material.

That would allow us to offer about 10 specialised courses every year.

Of course we could push things a bit further: team up in groups of three and cover a topic in four weeks... Cover half a session of material on our research...

Such courses would also be very valuable for our research students.

Sanjay, Ron and Richard are keen to propose a Master on security. Whether or not this will eventuate, there is a good argument that security is a unifying field, that it is to various extent a subject of research in many groups, and that it could in the future partly define CSE. Therefore, it might be a good strategy to, when we reflect on the advanced material we would like to select, try and make it as relevant as possible to security. Still, many academics' research is unrelated to security, and it does not seem pragmatically possible to effectively propose an advanced program with enough new courses on offer, without keeping the degree rather general. At this stage, we can think of security as providing some direction, and we can envision that the proposed Master will in the future become more specialised, but our objective at this stage is to most effectively offer a strong program that takes advantage of the best of our current research.

It is desirable to make sure that the new courses are quite flexible. Many of them could be called "Advanced topics in ...", and the contents could vary substantially from session to session. On the other hand, we might want not to leave a given course too open ended, and identify some core material that we have an expertise on and that we think is fundamental and for some time, should be part of all offerings of the course.

3 Suggested course of actions

- After amendements from the TC, communicate this document to all academics.
- Within two weeks, all academics are invited to send me comments on the general proposal and suggestions on:
 - name of the course they would like to offer;
 - material they would like to present, whether it is precisely identified or more generic;

- whom they would like to offer the course with (which should be reasonably consistent with the feedback I would receive from these co-lecturers).
- Within one week, compilation from me of this information sent to all academics, followed by a seminar to discuss any identified issue and come up with more suggestions.
- Within one week, second compilation of the information, followed by requests for course proposals.
- Two months later, program proposal, for a first offering in session 2 next year, and session 1 if time constraints allow it.

4 Outline of the degree

4.1 Name:

Masters in Advanced Computing

4.2 Duration:

One year

4.3 Entry criteria:

A bachelor degree honours 1 in science or engineering, or equivalent

4.4 Structure:

- Four courses from the list of *Specialised advanced courses*, to be created. . .
- Four courses from the list of *Advanced disciplinary knowledge courses with exposure to research* (this list is from the last revision to the MIT), two, three or four of which could be replaced by a research project in the second semester.

COMP4121 Advanced & Parallel Algorithms

COMP4161 Advanced Topics in Software Verification

COMP4411 Experimental Robotics

COMP4418 Knowledge Representation and Reasoning

COMP6714 Information Retrieval and Web Search

COMP9153 Algorithmic Verification

COMP9181 Language-based Software Safety

COMP9242 Advanced Operating Systems

COMP9243 Distributed Systems
COMP9315 Database Systems Implementation
COMP9318 Data Warehousing & Data Mining
COMP9319 Web Data Compression and Search
COMP9323 e-Enterprise Project
COMP9333 Advanced Computer Networks
COMP9334 Capacity Planning of Computer Systems and Networks
COMP9335 Wireless Mesh & Sensor Networks
COMP9336 Mobile Data Networking
COMP9417 Machine Learning & Data Mining
COMP9431 Robotic Software Architecture
COMP9441 Security Engineering
COMP9444 Neural Networks
COMP9517 Computer Vision