Focusing/differentiating the MSc degrees

Sharon Goldwater (in discussion with DoT); BoS proposal, 5 Sep 2018

Summary

The problem:

- Our Masters students experience very large class sizes on some courses.
- We would like to have more control over these, but because our programmes are so flexible students are encouraged to believe we will not constrain their choice.
- To allow us to manage numbers on courses more effectively we need to more clearly define the courses students on a programme have a “right” to access.
- If we can manage class sizes more effectively this will improve the teaching and learning experience for students, academics, admin staff and support staff.

Proposed solution and time constraints: Make a clearer focus for each degree, reflected in both the marketing materials and DPTs for 2019 entry, to prepare for putting separate quotas on the separate degrees (admissions have agreed we can do so). The precise DPTs need not be agreed urgently, but text for the Online Degree Finder goes live on 1 Oct, after which it cannot be changed (unless we delay opening to applications). Therefore, we do fairly urgently need to agree the general principles enough to finalize the marketing materials. (The actual quotas are not part of this proposal.)

Proposed focus of each MSc degree:

- (Advanced) Design Informatics, Data Science: as now.
- Artificial Intelligence: as now, but with stricter DPT (see below).
- Cognitive Science: be clearer that there are two typical tracks: (1) speech and language processing in humans and machines, or (2) computational models of mind and brain. Explicitly permit courses from PPLS in the DPT.
- Computer Science: focus marketing on “core” computer science (i.e., systems, foundations, and theory). Software Engineering courses would also be included as "core" options but marketing would mostly emphasize the systems and foundations courses, to avoid false impressions of having a SE degree. This focus simply codifies the existing Specialist Areas for CS more firmly into the marketing and DPT.
- Informatics: require courses in the wider scope of Informatics, i.e., those outside of core AI that deal with information processing in natural systems (biological or social).

Draft programme descriptions for the Online Degree Finder can be found in Appendix B.

Deadline for comments on this proposal: 1 week from date of circulation.

The proposal will be taken as accepted if any objections are minor and can be satisfied within the broad strokes of the proposal; in this case a full proposal will be tabled at BoS by the end of the semester.

If major objections are raised, a response will be provided within a week after the close of the consultation period. This outcome may require us to delay opening applications for 2019 entry.

Details: specification

Start by considering five categories of courses in the School. A course may belong to more than one of these. A preliminary labelling of courses is in Appendix A.

- Software Engineering (SE), ~18 courses at level 11
- Computer Systems (SY), ~11 courses at level 11
- Computer Science Foundations and Theory (FT), ~18 courses at level 11
- Artificial Intelligence (AI), ~19 courses at level 11, many of them 20 points
- Natural Systems (NS), ~20 courses at level 11

Given these categories, we propose that:

- the **AI degree** should require a minimum of 60 credits from AI or NS (~38 courses), of which 40 must be from AI (~19 courses).
- the **CS degree** should require a minimum of 60 credits from SY, FT, or SE (~34 courses), of which 40 must be from SY or FT (~26 courses).
- the **Inf degree** should require a minimum of 40 credits from NS (~18 courses).

In addition, each of these would require IRR and IPP. For the remaining 40 (or 60, for Inf) credits, students could take: up to 40 (or 60) credits of other level 11 Informatics courses, up to 30 credits of level 9-10 Maths or Informatics courses, and up to 20 credits of level 11 courses from any school.

We propose that the **Cognitive Science degree** should require 20 credits of courses on human cognition or NLP (HCI, THF, USec, ALE, CCN, CCS, NC, ANLP), plus 40-80 credits of level 11 AI or NS courses. They could also opt to take: up to 40 credits of level 11 courses from PPLS, up to 30 credits of level 9-10 Maths or Informatics courses, and up to 20 credits of level 11 courses from any school.

(Note that the current DPTs require only 40 credits from the corresponding area, and the courses in each area are also far less restrictive. For example, the "Computer Science" area includes nearly all of the machine learning courses. We also currently permit level 9-10 courses from any school, but in 2017-18, only Maths or Informatics courses were ever chosen.)

Details: implementation

At present, allowed courses for both UG and PGT degrees are dictated by the four course "tags": AI, CS, CG, and SE (with 48, 57, 36, and 16 courses at levels 9-11, respectively). Two main possibilities exist for implementing the above proposal:

- Replace the current tag system with a new one based on the categories proposed above. This would require adjusting the UG DPTs, because the current tags are more permissive, but may be the cleanest solution in the end. The proposed categories are arguably easier to understand than the current tags, which could help students with choosing courses. But changing and agreeing on new UG DPTs (especially while also undergoing curriculum changes) could be a big pain.
- Leave the existing tags as is but use them only for the UG DPTs, and use a different system (whether based on tags or simply lists of courses) for the MSc DPTs. This may be more confusing and harder to maintain but would require fewer changes in the immediate term and is possible in principle. [Note: SGilmore prefers this solution as it is effectively already being used for the course collections in the DI/ADI/DS degrees]

Deciding on an appropriate implementation will require discussion with ITO to better understand how tag/category information is translated into DPTs, and consideration of maintenance issues. A further proposal will be brought to BoS later in the year with these details, but as noted above, we need to decide the general principles now.

Initial comments on the options are welcome at this time to feed into the later proposal.

Comments so far from:

SGilmore, BFranke, SAnderson

Appendix A: preliminary course categories

The following lists are preliminary/indicative, and include level 11 courses only.

Software engineering

Adaptive Learning Environments 1 (Level 11)
Advanced Databases
Advanced Topics in Foundations of Databases
Advances in Programming Languages
Case Studies in Design Informatics 1
Case Studies in Design Informatics 2
Formal Verification
Human-Computer Interaction
Internet of Things Systems, Security, and the Cloud (IoTSSC)
Parallel Programming Languages and Systems
Performance Modelling (Level 11)
Principles and Design of IoT Systems
Secure Programming
Software Architecture, Process, and Management
Text Technologies for Data Science
The Human Factor: Working with Users
Types and Semantics for Programming Languages
Usable Security and Privacy

Computer systems

Note: if the only purpose of these categories is to define course choices according to the proposal above, then we could combine the Computer Systems and Foundations and Theory categories into a single category: Systems, Foundations, and Theory. If the categories are also used for (say) a student-facing system of tags or course guidance, then keeping them separate is probably more helpful to students.

Advanced Databases
Advanced Topics in Foundations of Databases
Compiler Optimisation
Computer Networking (Level 11)
Distributed Systems
Extreme Computing
Internet of Things Systems, Security, and the Cloud (IoTSSC)
Parallel Architectures
Parallel Programming Languages and Systems
Principles and Design of IoT Systems
Scalable Data Management Systems

Foundations and Theory

Advanced Databases
Advanced Topics in Foundations of Databases

Advances in Programming Languages
Algorithmic Game Theory and its Applications
Blockchains and Distributed Ledgers
Categories and Quantum Informatics
Computational Complexity
Computer Algebra
Distributed Systems
Formal Verification
Information Theory
Introduction to Modern Cryptography
Introduction to Quantum Computing
Natural Computing
Performance Modelling (Level 11)
Randomness and Computation
Social and Technological Networks
Types and Semantics for Programming Languages

Artificial Intelligence

These courses reflect the core areas of our current AI Specialist Areas (NLP, ML, robotics/vision, and symbolic AI). Most 'related' areas and additional applications of ML are in 'Natural Systems'.

Accelerated Natural Language Processing
Advanced Vision
Artificial Intelligence, Present and Future
Automatic Speech Recognition
Data Mining and Exploration
Decision Making in Robots and Autonomous Agents
Image and Vision Computing
Introductory Applied Machine Learning
Machine Learning & Pattern Recognition
Machine Learning Practical
Natural Computing
Natural Language Understanding, Generation, and Machine Translation
Neural Information Processing [which is, I believe, basically a machine learning course?]
Probabilistic Modelling and Reasoning
Reinforcement Learning
Robot Learning and Sensorimotor Control
Robotics: Science and Systems
Semantic Web Systems
Topics in Natural Language Processing

Natural Systems

These courses are often 'AI-related' but are not in one of the main AI specialist areas (and 'core AI' courses are excluded from this list, to differentiate Informatics and AI degrees). There are a few courses here that aren't a completely obvious fit (e.g. Computer Graphics, Music Informatics) but seem to fit better here than in other categories.

Current specialist areas corresponding to these courses are: Bioinformatics, Neuroinformatics, Cognitive Science, Music Informatics. Students on the Informatics degree would still be able to follow these specialist areas by using their 60 free credits to do the related AI courses.

Algorithmic Game Theory and its Applications
Bioinformatics 1
Bioinformatics 2
Case Studies in Design Informatics 1
Case Studies in Design Informatics 2
Computational Cognitive Neuroscience
Computational Cognitive Science
Computational Neuroscience of Vision
Computer Animation & Visualisation
Computer Graphics
Human-Computer Interaction
Music Informatics
Natural Computing
Neural Computation
Neural Information Processing
Performance Modelling (Level 11)
Social and Technological Networks
Text Technologies for Data Science?
The Human Factor: Working with Users
Usable Security and Privacy
(Probably also some Business Inf)

Appendix B: draft text for Online Degree Finder

(Text in orange is identical across all degrees.)

Informatics

Programme description

Informatics is the study of how natural and artificial systems store, process and communicate information. More than just computer science, informatics embraces interdisciplinary connections to understand and model computation and information processing in all its forms.

Edinburgh has a long-standing tradition of world-class research and teaching in many areas of informatics. This programme builds on our interdisciplinary strengths to emphasize developing students' ability to understand and model computation in natural (biological or social) systems. You will choose a base of courses in areas such as bioinformatics, social networks, neuroinformatics, or cognitive science. You can supplement these with additional courses from across the whole School.

Programme structure

You will follow two taught semesters of lectures, tutorials, project work and written assignments. During this time you will also learn research methods to prepare for your final project and dissertation, which is completed during the summer.

Compulsory courses:

- Informatics Research Review
- Informatics Project Proposal
- Introduction to Java Programming (for students who do not already meet the programming requirements for the taught masters)
- Dissertation

In addition, about half your taught course credits must be chosen from areas focusing on computation in natural systems. Example courses offered recently include:

- Algorithmic Game Theory and its Applications
- Bioinformatics 1
- Computational Cognitive Science
- Neural Computation
- Social and Technological Networks

Additional courses may be chosen from a wide range of options, including courses in computer systems, theoretical computer science, artificial intelligence, and software engineering. Guidance is provided to help you choose a set of courses that work well together.

Please note:

This degree has flexible course options. Students are only admitted onto the degree if they will have a viable set of options, but not all courses on offer are appropriate for all admitted students. Please check the University's Degree Regulations & Programmes of Study (www.drps.ed.ac.uk) for descriptions of individual courses and their prerequisites. The School of Informatics offers a wide selection of courses, but not all optional courses are guaranteed to run every year, and a few high-demand courses may limit enrolment to students on the most relevant degree(s).

The degree description and structure given here reflect changes being made for 2019 entry based on feedback from recent graduates. These changes aim to improve the student experience by providing a more focussed set of course options and a clearer structure. Degree programme information provided to current students (e.g., the 2018-19 MSc Handbook) should not be taken to fully reflect the nature of the programme starting in 2019.

Computer Science

Programme description

Edinburgh's expertise in core computer science is recognized internationally, and spans the range from computer architecture through theoretical computer science. This MSc offers you the opportunity to obtain specialist knowledge in the design, analysis, implementation, and use of computer systems ranging from the components of a single processor to computer networks as vast as the Internet. You can also pursue a more theoretical direction by choosing courses in areas such as algorithms, programming languages, or cryptography.

The programme provides a solid foundation in theoretical understanding and a wide variety of practical techniques applicable in many career settings.

Programme structure

You will follow two taught semesters of [… see Informatics degree]

In addition, about half your taught course credits must be chosen from areas in core computer science (foundations and systems). Course offerings follow the main research areas of our staff, which include parallelism and distributed systems, security and privacy, theoretical computer science, and programming languages. Example courses offered recently in computer science foundations and systems include:

- Advanced Databases
- Blockchains and Distributed Ledgers
- Computational Complexity
- Computer Networking
- Distributed Systems
- Internet of Things Systems, Security, and the Cloud
- Introduction to Quantum Computing
- Parallel Programming Languages and Systems
- Secure Programming

For your remaining courses, you may choose further options from foundations and systems or from a wide range of courses offered in other areas of Informatics, including artificial intelligence, software engineering, and social and biological computation. Guidance is provided to help you choose a set of courses that work well together, giving you specialised expertise in your chosen area.

Please note: [… see Informatics degree]

Artificial Intelligence

Programme description

This MSc is taught at the UK's longest established centre for artificial intelligence, which remains one of the best in the world.

Many of your courses will be taught by internationally known researchers spanning a wide range of areas in artificial intelligence and also drawing on research in related fields such as neuroscience, cognitive science, linguistics, and mathematics. We aim to give you the fundamental knowledge and practical skills needed to design, build, and apply AI systems in your chosen area of specialization.

Programme structure

You will follow two taught semesters of [… see Informatics degree]

In addition, about half your taught course credits must be chosen from areas of artificial intelligence. Course offerings follow the main research areas of our staff, with multiple course options available in natural language processing, machine learning, robotics, and related areas. Example courses offered recently in artificial intelligence include:

- Accelerated Natural Language Processing
- Advanced Vision
- Automatic Speech Recognition
- Decision Making in Robots and Autonomous Agents
- Machine Learning & Pattern Recognition
- Natural Language Understanding, Generation, and Machine Translation
- Probabilistic Modelling and Reasoning
- Reinforcement Learning
- Robotics: Science and Systems

For your remaining courses, you may choose further options from artificial intelligence or from a wide range of courses offered in other areas of Informatics, including computer systems, theoretical computer science, software engineering, and social and biological computation. Guidance is provided to help you choose a set of courses that work well together, giving you specialised expertise in your chosen area.

Please note: [… see Informatics degree]

Cognitive Science

Programme description

Cognitive Science is an exciting and interdisciplinary area spanning fields including computer science, linguistics, psychology, neuroscience, and philosophy. Edinburgh is a widely recognised leader in the area, and the School of Informatics has particular strengths in the computational study of higher cognition and reasoning, speech and language, and neuroscience; as well as related areas such as human-computer interaction, robotics, and computer vision.

The Cognitive Science degree offers courses in many of these areas, providing a strong grounding in the shared computational and mathematical foundations while also allowing students to pursue specialized courses in their particular interest areas. Many students also take advantage of relevant courses offered in the School of Philosophy, Psychology and Language Sciences or other parts of the University.

Programme structure

You will follow two taught semesters of [… see Informatics degree]

- […]
- Introduction to Java Programming or Computer Programming for Speech and Language Processing (for students who do not already meet the programming requirements for the taught masters)

Students on this degree typically follow one of two tracks, either focusing on speech and language processing in humans and machines, or more broadly on models of cognition, mind and brain. Example courses offered recently in these areas include:

- Accelerated Natural Language Processing
- Automatic Speech Recognition
- Computational Cognitive Neuroscience
- Computational Cognitive Science
- Natural Language Understanding, Generation, and Machine Translation
- Neural Computation

You will round out your degree with courses in related areas from the School of Informatics and the School of Philosophy, Psychology, and Language Sciences (PPLS). Example courses offered recently include:

- Bioinformatics 1
- Cognition, Culture and Context (PPLS)
- Human Computer Interaction
- Image and Vision Computing
- Introductory Applied Machine Learning
- Reinforcement Learning
- Simulating Language (PPLS)
- Speech Processing (PPLS)

Please note: […see Informatics degree]