UG curriculum proposal (summary) and transition plan

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1 Background and overview

A first draft curriculum proposal was circulated to all staff for consultation in May 2018. Many aspects of the proposal were strongly supported, and most respondents supported the proposal overall, but some objections were raised.

Based on this feedback, an updated proposal was circulated. Comments were particularly requested from opponents of the original proposal, and the updated proposal was tabled at the Sept Teaching Committe meeting along with a summary of the initial consultation. During this second consultation, several staff who objected to the original proposal said their concerns had been addressed, and only one member of staff continued to voice objections.

This document:

- summarizes the revised proposal for pre-honours and compulsory ug3 courses (Sec 2)
- proposes a two-year plan for transitioning courses and DPTs to the new curriculum, to provide context for the course proposals also being tabled at this meeting (Sec 3)
- includes an appendix with transition plans for all joint degree DPTs (App A)

2 Curriculum overview: goal state

The new year structures are given below, showing only those courses that are compulsory for at least one degree. Courses shown are compulsory for all degrees unless otherwise specified.

UG1 courses

Sem 1	Sem 2
Intro to Linear Algebra (20)	Calculus and Applications (20)
	[or Inf1-cg (20), for CogSci degree]
Inf1a: Introduction to Computation (20)	Inf1b: OO Program Design (20)
[already running]	**[see course proposal]**
outside course (20)	outside course (20)
[or joint degree course]	[or joint degree course]

Non-assessed activities in UG1: In addition to the recently introduced Programming Club, it is suggested to run a series of occasional afternoon/evening events, with two goals: (1) introduce students to greater social and intellectual diversity within Informatics, (2) develop a stronger learning community amongst students, and between students and staff. For example, each event could feature one or two lecturers presenting aspects of their research interests as well as their personal story or advice, followed by discussion. Students would be encouraged to help plan the series and provide questions or topics. A one-off version of this was piloted during induction week this year.

UG2 courses

Sem 1	Sem 2
Foundations of Data Science (20, full year)	
Introduction to Algs and Data Structs (20, full year) **[see course proposal]**	
Computer Systems (20) [for CS/SE degrees]	SE and Professional Practice (20)
Discrete Maths and Probability (20)	Inf2D: Reasoning and Agents (20) [for AI degrees]

UG3 courses

Sem 1	Sem 2
Informatics Large Practical (10)	System Design Project (20)
Data, Privacy, Ethics (10)	Computer Security (20) [for CS/SE degrees]
IAML (20) [for AI degrees]	

Summary of the courses:

- Computer Systems (already approved) is a slightly scaled up version of the current 10-credit course. The number of topics has not increased much, but more time will allow a deeper treatment of current topics and bring it better in line with our workload guidelines.

- Discrete Maths and Probability is similar to our current DMMR, but uses the entire second half the course to fully cover discrete probability theory. The current graph theory content of that half is shifted into IADS.

- Introduction to Algorithms and Data Structures covers all material in our current ADS part of Inf2b (10pts), plus graph algorithms, dynamic programming (incl applications for grammars/parsing, as a way to include a brief intro to CFGs), and a high-level view of NP (not in any compulsory course at present). See course proposal for details.

- Software Engineering and Professional Practice will include material from our current SE course as well as parts of what is now in ug3's Professional Issues (business and legal practice). By moving SE from S1 to S2 and adding more programming in ug1, we hope that students will be able to handle larger/more complex tasks where the benefits of SE are more obvious. Learning outcomes and topics will be further specified once Inf1b has been nailed down, but will likely include designing larger programs, interfacing with others' code, and understanding/accounting for the contexts in which software is used.

- Foundations of Data Science (called Data Analysis and Inferential Thinking in previous versions; title to be finalized) will run as a thin full-year course. The first semester would cover non-probabilistic topics (e.g., data visualization, data wrangling, nearest neighbors) while students are learning discrete probability in DMMR. The second semester would cover continuous probability and estimation, and (very) basic probabilistic machine learning methods and statistical analysis. Interleaved would be skill-building in use of Python, critical/scientific thinking, experimental methodology, and writing lab reports.

- Inf2D remains as is, covering topics such as FOL and unification, A* search, planning, modelling, and acting under uncertainty.

- Informatics Large Practical: in the summary above, this has been reduced to 10 credits (a) because students will get more programming practice earlier on from Inf1b and SEPP, and (b) to free up some optional credits in ug3. However, this decision is not fixed and should be reevaluated once SEPP is running.

- Data, Privacy, and Ethics is simliar (but not identical) to our current Professional Issues course, because some topics from PI are now assumed to be in the UG2 course SEPP.

DPE would be able to spend more time on privacy and ethics specifically, perhaps including some technical issues as well as non-technical ones.

Additional notes:

- The long thin structure of IADS and DAIT is likely to provide a bit more available time, for example an assignment could be due early in Sem 2. In addition, spreading out the learning over a full year is likely to result in better retention.

- Because the probability topics are now fully integrated into DMP and DAIT, the Probability with Applications course is no longer necessary.

- At least one of SEPP or DAIT should include some group work.

3 Transition plan

Transitioning to the new curriculum is a major resourcing concern, especially for the UG2 re-design. Rather than attempting to update all UG2 courses in a single year, this proposal spreads out the changes over two years. This also means that no cohort of students will experience a whole set of new courses (with settling pains) at once.

The transition year curriculum is not perfect, but reduces overlap between old and new courses to a minimum.

In the tables below, new/updated courses are shown in bold.

3.1 2019-20

UG1 courses

Sem 1	Sem 2
Intro to Linear Algebra (20)	Calculus and Applications (20)
	[or Inf1-cg (20), for CogSci degree]
Inf1a: Introduction to Computation (20)	**Inf1b: OO Program Design (20)**
outside course (20)	outside course (20)

- Inf1b proposal is tabled at this BoS.

UG2 courses

Sem 1	Sem 2
Introduction to Algs and Data Structs (20, full year)	
Inf2C-SE (10) [for CS/SE degrees]	Inf2B: Learning (10) **[half of current course]**
Computer Systems (20) [for CS/SE degrees]	Probability with Applications (20)
Discrete Maths and Math'l Reasoning (20)	Inf2D: Reasoning and Agents (20) [for AI degrees]

- Inf2A ceases to run.

- The 20pt Inf2-CS has already been approved at Oct BoS, and the Inf2-IADS proposal is tabled at this BoS.

- Inf2B needs to be cut down to just the learning half: no proposal yet.

- There is some overlap between DMMR content and IADS content: see the IADS proposal for details of how this will be dealt with.

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3.2   2020-21

UG2 courses

Sem 1	Sem 2
Foundations of Data Science (20, full year)	
Introduction to Algs and Data Structs (20, full year)	
Computer Systems (20) [for CS/SE degrees]	**SE and Professional Practice (20)**
Discrete Maths and Probability (20)	Inf2D: Reasoning and Agents (20) [for AI degrees]

- Inf2b, Inf2-SE, and PwA cease to run.
- DMMR conversion to DMP is about 25-30% content change. (We don't necessarily need to update the title but it clarifies the difference in this document.)
- FDS and SEPP are basically new courses; potential lead developers have been identified for both but further discussions are needed.

UG3 courses

- FNLP is updated to 20pts, to include material from Inf2A (NLP half), as discussed with NLP staff.
- ITCS is updated to replace some material on lambda calculus (also covered in EPL) with some material from Inf2A formal languages half, as discussed with Julian.

3.3   2021-22

UG3 courses

- Professional Issues is updated to reflect changes in SEPP.
- Possibly reduce ILP to 10pts (re-evaluate once SEPP is better defined).

3.4   Joint degrees

The DPTs for students on our single-honours degrees (CS, SE, AI, AI+CS, and MInf) are straightforward to read off the plan above. Plans for joint degree student DPTs can be found in the Appendix, and do not present any additional problems.

A Appendix: transition plans for joint degrees

The transition for UG1 is straightforward in all cases: simply replace the current Inf1 courses with the new ones.

UG2 is more complicated because different degrees require different courses. We discuss each degree in turn.

A.1 CS+Maths

There is a lot of overlap between Proofs and Problem Solving (a required UG1 course on this degree) and DMMR; CS+Maths students currently don't take DMMR, but do Probability (from Maths) instead. We keep this idea in the new UG2 structure:

UG2 courses, 2019-20

Sem 1	Sem 2
Introduction to Algs and Data Structs (20, full year)	
Inf2-CS (20) **or** Inf2c-SE (10)	Inf2b: Learning (10)
Sev Variable Calculus and Diff Eqs (20)	Fundamentals of Pure Maths (20)
Probability (10)	

- Plus 20-30 outside credits.

UG2 courses, 2020-21 and on

Sem 1	Sem 2
Foundations of Data Science (20, full year) **or** Statistics (10, S2)	
Introduction to Algs and Data Structs (20, full year)	
either Computer Systems (20)	**or** SE and Professional Practice (20)
Sev Variable Calculus and Diff Eqs (20)	Fundamentals of Pure Maths (20)
Probability (10)	

- Plus 20-30 outside credits.

A.2 CS+Physics

In UG2, these students currently take Inf2b and Inf2c, but not DMMR or PwA (there are maths for physics courses instead), and have only 100 compulsory credits.

The following DPTs have a similar spirit but 110 compulsory credits, and will work for standard entry students. Our current DPT indicates that second year entry students must replace the two 10-credit physics courses in semester 1 with two 20-credit courses instead, which would lead to an overload here. As this degree is small and we have very few second year entry students in general, I suggest we simply don't permit second year entry onto the CS+physics degree.

UG2 courses, 2019-20

Sem 1	Sem 2
Introduction to Algs and Data Structs (20, full year)	
Computer Systems (20)	Physics of Fields and Matter (20)
Linear Algebra and Sev Variable Calculus (10)	Dynamics and Vector Calculus (20)
Modern Physics (10)	Inf2b: Learning (10)

- Plus 10 outside credits. (Both maths and physics have some S1 10pt courses.)

UG2 courses, 2020-21 and on

Sem 1	Sem 2
Programming and Data Analysis (10, S1) **or** Found'ns of Data Sci (20, full year)	
Introduction to Algs and Data Structs (20, full year)	
Computer Systems (20)	Physics of Fields and Matter (20)
Linear Algebra and Sev Variable Calculus (10)	Dynamics and Vector Calculus (20)
Modern Physics (10)	

- Plus 0-10 outside credits.

A.3   CS+Management Science

In UG2 they currently take Inf2a, Inf2b, DMMR, and PwA, plus Business Analytics and Information Systems and 20 credits from a range of Business options.

UG2 courses, 2019-20

Sem 1	Sem 2
Introduction to Algs and Data Structs (20, full year)	
	Inf2b: Learning (10)
Discrete Maths and Math'l Reasoning (20)	Business Analytics and Information Systems (20)
	Probability with Applications (20)

- Plus 20 additional Business credits, and 10 outside credits.

UG2 courses, 2020-21 and on

Sem 1	Sem 2
Foundations of Data Sci (20, full year)	
Introduction to Algs and Data Structs (20, full year)	
Discrete Maths and Probability (20)	Business Analytics and Information Systems (20)

- Plus 20 additional Business credits.
- Possibly also require one of Inf2-CS or Inf2-SEPP? If not then 20 outside credits.

A.4 Cognitive Science

UG2 is very messy right now, with no options ideal. Students do *either* DMMR or PwA and *either* Inf2b or Inf2d, plus one of the following:

- Inf2a, plus 40 credits of Linguistics and/or Philosophy
- Research Methods and Stats, plus 40 credits of Psychology

The following seems an improvement:

UG2 courses, 2019-20

Sem 1	Sem 2
Research Methods and Stats (20, full year)	
Introduction to Algs and Data Structs (20, full year)	
Discrete Maths and Math'l Reasoning (20)	

- 40 credits of Linguistics and/or Philosophy, or 40 credits of psyhology.
- Optional but suggested: Inf2D. If not, 20 outside credits.
- Need to discuss with PPLS about ug1 prereq. for Res Meth and Stats, being introduced by them next year. If they're annoying about it, may need to replace this with PwA. (Note: not all honours psych courses require Res Methds.)

UG2 courses, 2020-21 and on

Sem 1	Sem 2
Foundationns of Data Sci (20, fy) **or** Research Methods and Stats (20, fy)	
Introduction to Algs and Data Structs (20, full year)	
Discrete Maths and Probability (20)	

- 40 credits of Linguistics and/or Philosophy, or 40 credits of psyhology.
- Optional but suggested: Inf2D. If not, 20 outside credits.
- Need to discuss with PPLS about whether psych courses would accept our FDS as an alternative to their Research Methods but some courses don't require it anyway.

A.5 Electronics and CS (owned by Engineering)

In ug2, this degree currently requires Inf2c, Inf2b, as well as the 10-credit S1 Probability course from maths. The latter was apparently a requirement we suggested, presumably as background for the learning half of Inf2b. It's worth noting that Engineering Maths 2b does include some coverage of statistics (albeit only about 5 points worth).

The remaining credits are entirely used up, so we have exactly 30 credits to work with in S1 and 20 in S2. The following solution is suggested:

UG2 courses, 2019-20 and on

Sem 1	Sem 2
Introduction to Algs and Data Structs (20, full year)	
Computer Systems (20)	

- Also the current compulsory 20 credits of Engineering Maths and 50 credits of Engineering.

- Plus 10 outside credits, or Engineering may want to add another of their 10pt S2 courses (but that is their choice).