Curriculum proposal (v2.0)

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This proposal aims to address some of the criticisms of the original proposal, in particular:

- Too strong a focus on systems and data science and insufficient focus on theory and symbolic AI. Or, more generally, perhaps too little intellectual diversity in pre-honours, too many requirements in UG3, and/or too much alignment with standard benchmarks (although most respondents did agree with aligning somewhat better than at present).
- Teaching of probability theory is still too spread out, so depending on course choices, students will either get insufficient rigour or redundancy.
- The Data in the Real World course is underspecified (and/or other criticisms of this course).
- The pre-honours courses may be difficult to resource as they don't match our available teaching staff as well as at present.

Meanwhile it aims to keep as much as possible the following aspects of the original proposal, which were widely applauded:

- more focus on programming and other practical skills than our current curriculum
- more streamlined than our current curriculum (ie more 20pt courses, less baroque options)
- more modernized/standard than our current curriculum (within reason)

1 Curriculum overview

This proposal keeps the same courses in UG1 as the original proposal. The UG2 and UG3 proposals have been modified. In particular, this proposal removes the UG2 Data in the Real World (DRW) course and expands the Discrete Maths course and the Algorithms course from 10 to 20pts. Privacy/ethics must now be taught as a UG3 course, but additional theory and systems requirements in UG3 have been removed. Probability with Applications is no longer needed, allowing Inf2D to be retained from our current AI curriculum.

The new year structures are given below, showing only those courses that are compulsory for at least one degree. Courses 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 degrees]
Inf1a: Introduction to Computation (20)	Inf1b: OO Program Design (20)
outside course (20) [or joint degree course]	outside course (20) [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 is being piloted during induction week this year.

UG2 courses

Sem 1	Sem 2
Data Analysis and Inferential Thinking (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]

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]	

Proposed UG2/3 courses which **have not** changed since the previous proposal:

- Computer Systems is a scaled up version of the current 10-credit course, in line with ACM guidelines. The number of topics is not expected to increase much, but more time will allow a deeper treatment of current topics.
- 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.
- Data Analysis and Inferential Thinking (DAIT) has changed only in being 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 the Discrete Maths course. 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.

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

Proposed UG2/3 courses which **have** changed since the previous proposal:

- Discrete Maths and Probability (was 10pt, now 20pt) 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. In order to match the learning outcomes of the current PwA course, the probability half of this course

would need to be more computation-oriented and less proof-oriented than at present in DMMR.

- Introduction to Algorithms and Data Structures (was 10pt, now 20pt) would cover 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 (which is not in any compulsory course at present). To be discussed: specific learning outcomes and where this course sits on the theory versus practice spectrum.
- Because the probability topics are now fully integrated into DMP and DAIT, the Probability with Applications course is no longer necessary. This leaves room to retain Inf2D as a required course for AI students, and an optional source of additional intellectual diversity for others. Inf2D covers topics such as FOL and unification, A* search, planning, modelling, and acting under uncertainty.
- The ethics topics previously proposed to be in DRW are shifted back into a 10-credit course in ug3 (Data, Privacy, Ethics). This course wouldn't be exactly the same as PI, because some topics from PI are now assumed to be in the UG2 course SEPP. It would be able to spend more time on privacy and ethics specifically, perhaps including some technical issues as well as non-technical ones.
- Unlike the previous proposal, there is no requirement for any additional systems or theory course in UG3, nor for level 9/10 theory courses to be 10 credits.

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.
- Whereas the previous proposal required two entirely new UG2 courses (DAIT and DRW) and expansion/modification of two others (CS, SEPP), this proposal requires one brand-new course (DAIT) and expansion/modification of four others (CS, SEPP, IADS, DMMR).
- This proposal is slightly less flexible than the previous one for joint degree students, but is still feasible for all of them, and probably still better than our current curriculum for many.
- By shifting all teaching of probability into our own courses, this proposal requires us to teach 120 credits of UG2 courses rather than 100, as at present. The students will hopefully benefit by getting a more contextualized view of probabilities and how they are used in our field, but it will require more resource from us. Arguably, however, we are not lacking for teaching resource in theoretical/mathematical areas.
- As a knock-on effect of having 10pt Data, Privacy, Ethics, we either need ALL other ug3 courses to be 20pts, or to maintain a small and managed list of 10pt courses, probably all in the same semester. Or we could keep ILP at 20pts and have a few 10pt courses in S1. This situation provides less pressure for people to move to 20pt courses, and thus perhaps less streamlining, but also means less required restructuring of ug3 courses in the near term. (In any case, SGoldwater is actively pushing lecturers for certain course mergers to reduce the number of 10pt level 9-11 courses, and in some cases the number of credits on offer. This should provide some streamlining in advance of the major changes to UG2, to free up resource.)