Programsensorrapport for Bachelorprogram i statistikk, Integrert master i aktuarfag og Masterprogram i statistikk ved Matematisk institutt, UiB.

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1 Background
This report considers the master and bachelor programs in statistics as well as the integrated master program, as the three share many elements and may be regarded as tightly interwoven.

While writing this report, I have obtained student application numbers from Kristine Lysnes, and have had discussions with group leader Bård Støve and Hans J. Skaug.

2 Main findings
All in all, the studies appear in good shape, with a mature and well integrated course portfolio, many applicants and good labor market outlook for graduates. On the other hand, it appears that the teaching staff situation could be better in light of a high demand for the educations and forthcoming needs to adapt the curricula to the ever-changing demands from society. Cooperation between universities could to some degree alleviate this situation, and also improve educations on both sides

3 Data science et al
As discussed thoroughly in the previous report, much focus and demand from industry and public sector these days is on Data Science. In response to this, one course in statistical learning will be given in the coming academic year 2017/2018, which seem highly sensible (similar developments are either implemented or about to be implemented elsewhere, e.g. UiO, NTNU, UiS).

The master graduates from the statistics educations will be equipped with the toolbox to handle such positions, and in particular the learning course will further enhance this. Still I'm a little bit worried about the future job market competition from graduates from educations with "data science" and "machine learning" etc. in the title. Such degrees are either ongoing or about to be implemented (e.g. UiO, UiS, BI), and the statistics group needs to take a firm stand on how to approach this situation. At least two approaches are possible in this regard:
- Make (and brand) the statistics educations (as) direct competitors to the present and future Data Science educations, while retaining current specialties. This would likely require some further curriculum in the more informatics/computer science directed topics such as databases, handling large amounts of data, parallel processing etc. Moreover, it would require more focus on the differences between statistics and machine learning, in particular with emphasis on the difference in language/jargon between statisticians and learners, both within the education and the actual branding of the education to potential students.
- Make (and brand) the statistics educations (as) somewhat more orthogonal alternatives to the Data Science educations. I.e. instead focus more on the current specialties of the educations, namely finance and insurance, large models and situations with limited

amounts of data and so on, which will still be in demand from more specialized employers.

Both choices seem sensible, though I would hold the former as a better choice. In particular, in this regard, there seem to be flexibility in the "data analysis"-specialization of the master degree that could be leveraged in this respect.

4 Adapting to new education guidelines for actuaries

Currently, the large actuarial organizations IAA and EAA are revising the core curriculums[1] required to qualify as an actuary. These involve stronger requirements that most likely will influence the contents of the actuary-qualifying master programs. In particular, it seems stronger requirements in Data Science-type topics (such as machine learning) will be included. Thus, it seems difficult to avoid substantial revision of both actuary-specific courses and the course mix of these educations in the near to intermediate future.

5 Staff situation

The current permanent, full position staff consists of Bulla, Karlsen, Li, Skaug and Støve, which should be considered in the light of:

- A large and diverse course portfolio.
- Many master students with supervision-intensive 60ECTS theses (the statistics group supervises a disproportionate number of the MI master students relative to its size).
- Current and likely forthcoming restructuring of courses and course mix (see points 3 and 4 in particular).
- Maintaining a group leader position (mini-department inside the department).

Five permanent staff members seem too few to cover this ground and still have time to do their own research. Moreover, the staff situation seems somewhat fragile and reliant on externals in the case of sabbaticals etc. Thus hiring at least one more permanent staff member seems in order, and also seems like a safe bet for increasing the throughput of candidates for the whole department.

6 Cooperation and reusing resources

As discussed in the previous report, and in light of points 3-5, it seems sensible to cooperate more on teaching across universities in order to exploit synergies. The advent of more and better digital teaching tools suggest that the barriers related to distance should be less significant today. These issues have in particular been discussed with the corresponding UiS group, but little has materialized (with at least half the portion of blame to be given to the UiS group). Here I mention a few possibilities in the context of UiB-UiS cooperation.

- In light of point 3 above, the computer science department at UiS will start a master education in Data Science, where the stats group will participate with 3-4 courses. This master will contain a full set of relevant, more computer science oriented courses, which the UiB educations may benefit from. Conversely, the UiS Data Science education could benefit from intermediate level UiB courses (time series, inference, statistical computing) as elective courses for the more statistically interested students.
- At the UiS, starting fall 17, we will have 3 PhD students in statistics. Combined, the PhD students of UiB and UiS should be sufficient to warrant a proper PhD level course covering advanced topics with regular lectures.
- The UiS mathematics and physics bachelor and master educations will be revised soon, with at least partly the objective of allowing more specialization. This may, in

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[1] See e.g.
http://www.actuaries.org/CTTEES_EDUC/Documents/SRTF_New_Elements_Syllabus.pdf

principle, open the possibility for UiS students to choose more statistics courses, which could be courses from the UiB portfolio (provided some formal arrangement for this could be negotiated). Conversely, the UiS has some more specialized courses, which could be beneficial for some of the UiB students (reliability, pattern recognition, a potential new course in Bayesian methods currently being discussed).

Provided some degree of cooperation could be implemented (i.e. formalities and distance teaching), it also seems reasonable to coordinate planning of future courses.

7 Miscellaneous

- The group has been discussing allowing Bachelor students to take INF109 instead of INF100. This seem reasonable, and probably INF109 should be the default IT course, given that the programming language R used by most statisticians both in academics and in industry is much more similar to Python used in INF109, than Java used in INF100.
- Would it be a good idea to elect a single statistics student to serve as a (rather informal) link between the stats group leader and the statistics students? I.e. in order for the group to gain insights into what the students think of the programs, courses etc.

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