1 General

A mathematics semester project involves work equivalent to roughly one-third of the work for a semester comprising 30 credits. Thus about 30% of the semester should be spent on the project—five to six solid weeks of work. Therefore a student should work regularly throughout the semester at a rate of 1–2 days per week. A possible timetable is:

**Week 1** Choice of project, sketch of work to be undertaken. Obtain reading list (and maybe data) and begin reading and note-taking.

**Weeks 2–4** Clarify structure of problem and steps needed for project. Do preliminary data analysis. Continue reading, take careful notes, and start bibliography.

**Weeks 3–7** Plan structure of report, draft and type early chapters. Continue reading, programming, and data analysis. First results.

**Weeks 7–12** Bulk of (numerical) work, plus writing in parallel.

**Week 8** Intermediate oral presentation\(^1\) and written report (parts will be blank, but the structure should be clear, and some chapters and the bibliography should be drafted). Adjust plan and structure (and maybe workrate) in light of feedback.

**Week 13** Only final numerical results and conclusions should remain.

**Week 14 or 15** Final oral presentation and penultimate version of the written report. Minor changes suggested before the final version of the report is presented.

The oral presentations and written reports to be presented in weeks 8 and 14/15 are compulsory, but only the final version counts for credit—the idea is to give feedback early enough to ensure that the final report is of high quality. However,

*work is not accepted, or is given a failing mark, if the presentation—including spelling, grammar, syntax, figures, tables—is unacceptable and/or if the referencing is inadequate.*

For a master project, the comments above apply, but the project represents 30 ECTS credits, and is full-time over a period of 4 months.

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\(^1\)A semester is considered to run from the start of lectures to the end of the following exam session, and so comprises around 18 weeks of full-time study.

\(^2\)Becker and Keller-McNulty (1996) give some advice on giving talks.
Writing

Writing well is difficult and needs lots of practice, so start early and be prepared to rewrite repeatedly. Use the active voice as much as possible: over-use of the passive voice leads to flabby, over-long sentences. Check every word/sentence/paragraph and ask: is this essential? Is it clear? Can it be shortened without detracting from clarity? Find an author whose style you find clear and concise, and analyse it with a view to emulating it.

Below I assume that you will write in English and use LaTeX, but most of the comments apply to reports written in any language using any word-processor.

- The purpose of scientific writing is to get your ideas from your head to your reader’s head as directly as possible, and you should avoid anything that hampers this—use of long words where short ones will do, circumlocutions and elegant variation, heavy or unnecessary notation, and excessive use of abbreviations.

- The intelligent reader of your report should be able to reproduce your results, so give enough detail to achieve this. There is no need to give every detail of long routine computations, but the key steps should be fully explained.

- The purpose of referencing is to give appropriate credit to others, and to allow the reader to check your sources, so give references to definitions, theorems, or anything you take from elsewhere. Sometimes it will be enough to put a sentence such as ‘The definitions and theorems in the rest of this section are taken from Coles (2001, Chapter 4), but in other cases you will need to reference main results individually.

- For guidance on writing reports, see Ehrenberg (1982) (a good place to start, though a bit simplistic), relevant sections of Chatfield (1988). Higham (1998) and Krantz (1997, Ch. 1, 2) are helpful on writing mathematics, while classic books on style (Strunk and White, 1979; Gowers, 1986) are also valuable.

- Sentences with mathematics should be punctuated like any others; in particular displayed equations should be punctuated correctly. When writing mathematics in English it is incorrect to precede every displayed equation with a colon or a comma; look up the use of these punctuation marks to see when their use is appropriate.

- When writing mathematics, beware changes of notation, particularly if you are using material from several sources (all of which you will cite, of course). Check that every symbol you use is defined on first appearance, and remind the reader of its meaning if you have not used it for several pages. Use natural notation—for example, it is unhelpful to use \( b_1, \ldots, b_n \) instead of \( t_1, \ldots, t_n \) for times.

- Use a spell-checker, and a grammar-checker if your grammar is weak. Over-use of ‘note that’ and ‘is given by’ is the written equivalent of a speaker saying ‘um’ every few words. Usually the first can be cut and the second can be replaced by ‘is’.

- Avoid abbreviations: the reader may not know them, they save little space, and they lead to sloppy mechanistic writing. Sentences such as ‘MLE for a GLMM may be performed using the BFGS, NR, CG or EM algorithms, but MCMC is an alternative’ are tiring for the reader.
• For French speakers: in English we write Table 1, Figure 2, Chapter 3 (as they are proper nouns), and then refer to them as ‘the table’, ‘the figure’, or ‘the chapter’. Some common ‘faux amis’ are:

<table>
<thead>
<tr>
<th>French term</th>
<th>faux ami</th>
<th>correct English</th>
</tr>
</thead>
<tbody>
<tr>
<td>estimation</td>
<td>estimation</td>
<td>estimate</td>
</tr>
<tr>
<td>explication</td>
<td>explication</td>
<td>explanation</td>
</tr>
<tr>
<td>pathologique</td>
<td>pathologic</td>
<td>pathological</td>
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<tr>
<td>sensible</td>
<td>sensible</td>
<td>sensitive</td>
</tr>
</tbody>
</table>

• For everybody: data are plural; dataset is singular. Thus ‘The data are from . . .’, but ‘The dataset is from . . .’.

• Use the \LaTeX \texttt{\textbackslash label} and \texttt{\textbackslash ref} constructions when referring to equations, sections, figures, etc.; it is then much easier to revise and rewrite your work.

• Every table and figure should be referred to in the text, and should appear shortly after it is first mentioned.

• The caption for a figure or table should explain the contents in enough detail that the reader does not need to look at the text, but interpretations should appear in the text. There is no need for the text to repeat a description of the contents of a graph (lines, symbols, etc.) or table (standard errors, etc.) given in its caption.

• Tables:
  – check that they cannot be simplified—e.g. by multiplying all the numbers in a column by 10³, or by representing probabilities 0.01–0.99 as percentages 1–99.
  – A common error when reporting simulation results is to give far too many digits—are all the digits in 10.33345 really justified based on a simulation of size 1000? Probably the number should be rounded to 10.3, and maybe to 10.
  – If a table contains simulation results, their standard errors should also be given. A compact way to do this is to put a phrase such as ‘The largest standard error for the figures in the table is 0.01’ in the caption.

• Figures:
  – all the panels of a graph (including axis labels) should be large enough to be read easily—try and give the graph a shape that will use the page space well;
  – use a consistent style (same size margins, same font for labels, etc.);
  – check that all the axes are labelled correctly, including the units of measurement. Verify that the caption and the graph agree, that every line and symbol is described correctly (e.g. if the caption says it’s dotted, it’s dotted), and that all lines or symbols in the graph are described in the caption.
  – If both axes show the same quantities, the graph should be square.
  – Cleveland (1993, 1994) are good on graphs and graphics; Tufte (1983, 1990) are also worth reading, but are less practical.
• Bibliography:
  
  – Every reference given in the text should appear in alphabetical order in the list at the end of the document.

  – Use BibTeX from the start: you will save time overall. There are plenty of good packages for bibliography management (e.g. Jabref or BibDesk).

  – The citation and bibliography styles natbib and CUP to be used are those used in this document—use the files from http://stat.epfl.ch/page571.html; you should then have a bibliography like that on page 6.³

• Hyphens - (− in \TeX{}), n-dashes – (--) , m-dashes — (---) , and minus signs – ($-$) have different uses. Hyphens are used to join two words, or in the double-barrelled name of a single person (e.g. non-user, Barndorff-Nielsen); n-dashes are used in ranges of numbers or to join the names of two different people (1–7, Neyman–Pearson); m-dashes are used for punctuation, either to make a parenthetical point—like this—or to divide two halves of a sentence, in place of a colon; and minus signs are used in mathematics (e.g. $-2$).

• Mathematical operators should appear in the usual upright font, so use \texttt{\min}, \texttt{\max} and so on, not \texttt{min}, \texttt{max} in \TeX{}; we should see \texttt{max}(a, b) not \texttt{max}(a, b).

• Lists such as \texttt{x_1, \ldots, x_n} have \texttt{\ldots}, but sequences of binary operators such as \texttt{x_1 = \cdots = x_n} have \texttt{\cdots}.

• For ironing out \TeX{} and \LaTeX{} problems, see for example Kopka and Daly (2003), Lamport (1994), or Knuth (1994).

3 Mathematical style

Here are some more detailed notes on mathematical style, adapted from the Biometrika style guide:

• Avoid verbal phrases inside brackets or dashes, or in italic type, and shun footnotes except for tables. Abbreviations like a.s., i.i.d., d.f., ANOVA, MCMC and ML and the special symbols \texttt{\exists} and \texttt{\forall} should not be used.

• References in the text should follow the style used in this document. In citing references use ‘First author et al.’ if there are three or more authors. The list of references at the end should correspond to those in the text. References to books should be to the latest edition; a page, section or chapter number is nearly always necessary. References to books of papers should include title of book, editor(s), first and final page numbers of paper, where published and publisher. Complete lists of authors and editors should be given.

• Acknowledgements should appear at the end and be as brief as possible subject to politeness. If there is an appendix it should follow the Acknowledgement but precede the References. Appendices should have titles.

³Using the BibTeX default style [3,4] makes even an expert reader check the list of references continually, whereas seeing Cox (1972, 1975) will ring (scientific) bells for her immediately.
• Arrange brackets in the order \[ ( ) \], and follow the usual conventions for \( e \), \( \exp \), use of solidus, square root signs, etc.

• Shun multiple overbars such as \( \overline{x} \), and also \( \hat{ab}, (a + b), \bar{ab}, (a + b) \) and symbols with underbars. Avoid sub- and superscripts of third, and greater, order.

• Symbols should not start sentences. Vectors are assumed to be column vectors, unless explicitly transposed.

• Use: \( \text{var}(x) \) not \( \text{var} x \) or \( \text{Var}(x) \); \( \text{cov} \) not \( \text{Cov} \); \( \text{tr} \) not \( \text{trace} \); \( \text{E}(X) \) for expectation not \( EX \) or \( \mathcal{E}(X) \); \( \log x \) not \( \log_e x \) or \( \ln x \). Avoid: \('.\)' for product; \( a/bc \), which should be written \( a/(bc) \) or \( a(bc)^{-1} \). Use: zeros preceding decimal points, \( 0.2 \) not \( .2 \); the form \( x_1, \ldots, x_n \) not \( x_1, x_2, \ldots, x_n \); \( \sum_{i=1}^{n} \) not \( \sum^{n}_{1} \).

• Equation numbers should be included only when equations are referred to; the numbers must be placed on the right. Long or important mathematical (not verbal) expressions should be displayed (i.e. shown on a separate line). Short formulae should be left in the text to save space where possible, but must not be more than one line high and not contain reduced-size type. For example \( \frac{dy}{dx} \) must not be left in the text, but should be written \( dy/dx \) or it should be displayed. Also \( \begin{pmatrix} a \\ b \end{pmatrix} \) must not be left in the text. Equations involving lengthy expressions should, where possible, be avoided by introducing suitable notation.

• Tables should be numbered in the order they are to appear, and referred to consecutively by number. Each table should have a self-explanatory title. Its arrangement should make effective use of the page.

• Diagrams should be numbered Figure 1 etc., and referred to by number consecutively. Each figure should have a self-explanatory (verbal if possible) title. Its arrangement should make effective use of the page.

4 Marking scheme

The marking scheme to be used is given at the end of this document. Note particularly that:

• an interim report whose presentation is inadequate will be returned without comment; it is then up to the person presenting it to re-read this document and to improve their report enough that we can comment on the contents and structure without having to deal with details of presentation;

• a final report whose presentation is inadequate will be failed without discussion and with no opportunity given for improvement.

The above comments apply particularly but not only to the quality of the English (or French) grammar and expression. It is not our job to teach you how to write grammatically; you should have learned this before arrival at EPFL, or at the Language Centre before starting your project.
References


# Marking scheme

1. **Presentation/Exposition**

<table>
<thead>
<tr>
<th>1.1 Accuracy</th>
<th>Good grammar and punctuation, including mathematics</th>
<th>Poor grammar and punctuation</th>
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</thead>
<tbody>
<tr>
<td>5 4 3 2 1 0</td>
<td>Score: ______</td>
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</table>

<table>
<thead>
<tr>
<th>1.2 Clarity</th>
<th>Good plan; ideas well organized; coherent</th>
<th>Weak plan; confused presentation</th>
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</thead>
<tbody>
<tr>
<td>5 4 3 2 1 0</td>
<td>Score: ______</td>
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</table>

<table>
<thead>
<tr>
<th>1.3 Style</th>
<th>Highly readable and interesting</th>
<th>Heavy going; not very interesting</th>
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<tr>
<td>5 4 3 2 1 0</td>
<td>Score: ______</td>
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<tr>
<th>1.4 Mathematics</th>
<th>Correct, consistent notation. Few or no errors</th>
<th>Notation incoherent, many errors</th>
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<tr>
<td>10 9 8 7 6 5</td>
<td>Score: ______</td>
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<table>
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<tr>
<th>1.5 Graphics</th>
<th>Clearly labelled, well-chosen, good captions and discussion</th>
<th>Poorly labelled, no discussion, unmotivated</th>
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2. **Treatment of Literature**

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<thead>
<tr>
<th>2.1 Understanding</th>
<th>Clear grasp of ideas; succinct paraphrasing. Reading material well handled</th>
<th>Poor understanding of reading material. Regurgitation of undigested ideas</th>
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</table>

<table>
<thead>
<tr>
<th>2.2 Referencing</th>
<th>Full, accurate, and detailed references given</th>
<th>Inadequate citation of sources</th>
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3. **Originality and Initiative**

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<thead>
<tr>
<th>3.1 Originality of approach</th>
<th>Independent ideas; original approach to subject</th>
<th>Derivative; no great originality in approach</th>
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<tbody>
<tr>
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<table>
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<tr>
<th>3.2 Initiative</th>
<th>Worked largely independently</th>
<th>Needed close supervision</th>
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<tbody>
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<td>10 9 8 7 6 5</td>
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7
4. Scope of subject and treatment of it

4.1 Conceptual difficulty

High conceptual density; complex ideas intelligently handled

Low conceptual density; simple ideas. Unambitious discussion

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4.2 Numerical/computational aspects

Excellently performed and highly relevant

Poor, incorrect, or inappropriate results

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4.3 Skill in overall handling of the subject

Masterly treatment of the subject.

Weak treatment of the subject.

Excellent overall impression

Poor overall impression

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<th>7</th>
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</table>

Summary score:

1. Presentation/Exposition (maximum 35)

2. Treatment of literature (maximum 15)

3. Originality/Initiative (maximum 20)

4. Scope and treatment (maximum 30)

Grand total (maximum 100)

Work is not accepted, or is given a failing mark, if the presentation—including spelling, grammar, syntax, figures, tables—is unacceptable and/or if the referencing is inadequate.

Comments: