THE CHINESE UNIVERSITY OF HONG KONG
Department of Mathematics
MATH1050A (First term, 2017-18)
Foundation of Modern Mathematics

This course introduces rigorous mathematical reasoning, proofs, and high dimensional geometry. The use of logic in mathematics and various methods of proof will be illustrated by concrete examples from a variety of topics in mathematics.
Topics are selected amongst: logic and axiomatic systems; sets, relations and functions; infinite sets and countability; numbers and polynomials; lines, planes, conics and quadrics.

Instructor

- Fong Wing-Chung (Office: Rm 218 LSB. Email: `wcfong@math.cuhk.edu.hk`)

Tutors

- Hui Yuet (Office: Rm 232 LSB. Email: `yhui@math.cuhk.edu.hk`)
- Yau Yu Tung (Office: Rm 505 AB1. Email: `ytyau@math.cuhk.edu.hk`)

Time and Venue

- Lectures and tutorials:
  - Mondays 1430-1615hrs LSB LT5, Wednesdays 1030-1215hrs LHC 104.
- Tutorials starts *from Week 6*.
- Supplementary lectures:
  - Time: 1830-2015hrs, Monday 9/10. *Venue to be announced.*
  - Time: 1830-2015hrs, Wednesday 15/11. *Venue to be announced.*

Course Material and Course Announcements

Course material (for example, supplementary notes, assignments, tutorial sheets) will be uploaded to the course homepage at

`http://www.math.cuhk.edu.hk/course_builder/1718/math1050a/1050ahp-mat.html`

Course announcements made in class may be put onto the course homepage and communicated via the CWEM.

Assessment Scheme

- **Coursework**: 50%
  - ∗ **Assignments**:
    You will be awarded one mark for satisfactory performance in Part 1 of each assignment.
  - ∗ **Quiz**:
    There is one quiz.
    Date: 26/10 (in Week 8). Time: 1900-2100hrs (*to be confirmed*). Venue: *to be announced*.

  Your coursework score C will be given by the formula

$$C = \min\left\{\frac{5A}{4}, 10\right\} + \left[\frac{9A}{10} + \frac{Q}{100}\left(40 - \frac{9A}{10}\right)\right].$$

  Here A is your total assignment score, and Q is your quiz score out of the full score of 100.

- **Final Examination**: 50 %
- Your grade will be determined by your overall performance in the various assessment components of the course.

Teaching Schedule

The schedule is provisional. We will adapt it along the way to suit the mathematical capability of the students.

- Weeks 1-6: various methods of mathematical proofs; set operations; logic; numbers.
- Weeks 7-11: functions and relations.
- Weeks 12-13: infinite sets.

Tutorials, Assignments and Further Exercises

- Each **assignment** contains two parts (Parts 1, 2).

  Part 1 of each assignment is usually made up of straightforward questions.

  Part 2 of each assignment is usually intended for training in the writing of proofs, and does not count in the overall assessment.

- When you write up your work for an **assignment**, please remember these points:

  * Use A4-size sheets, preferrably white, or with a background colour which is as light as possible.
  * Leave sufficient space on the sheets, especially for Part 2, so that feedback to your work can be written on the sheets.
  * Your work on the two parts may be read by different persons. So submit your work in Part 1, Part 2 separately.

  You are also expected to observe the policy of the CUHK on honesty in academic work very carefully. Detail may be found at

  `https://www.cuhk.edu.hk/policy/academichonesty/`

- The **Further Exercises** do not count in the overall assessment.

- In the **assignments** and the **further exercises**, questions which require more thought and/or work and/or tricks and/or organization and/or ... are marked by $\diamondsuit, \clubsuit, \heartsuit, \spadesuit$, in ascending order of overall difficulty level.

- Although attendance in the **tutorials** does not count in the overall assessment, you are encouraged to attend the tutorials nonetheless. It will be the occasion in which you will find out the common mistakes in your submitted work.

References

Each of these books below (and many others) cover to various extent much (but not necessarily all) of the course material, and may serve as general reference:

1. B. Bajnok, *An Invitation to Abstract Mathematics*, Springer-Verlag.
2. M. Beck, R. Geoghegan, *The Art of Proof: basic training for deeper mathematics*, Springer-Verlag.
3. K. G. Binmore, *Foundations of Analysis: a straightforward introduction (Book 1 Logic, Sets and Numbers)*, Cambridge University Press.
4. E. D. Bloch, *Proofs and Fundamentals: a first course in abstract mathematics*, (First or Second Edition), Birkhäuser/Springer-Verlag.
5. D. W. Cunningham, *A Logical Introduction to Proof*, Springer-Verlag.
6. U. Daepp, P. Gorkin, *Reading, Writing, and Proving: a closer look at mathematics* (Second Edition), Springer-Verlag.
7. L. J. Gerstein, *Introduction to Mathematical Structures and Proofs* (Second Edition), Springer-Verlag.
8. K. T. Leung, P. H. Cheung, *Fundamental Concepts of Mathematics*, Hong Kong University Press.

For a deeper discussion on set language (and set theory), you may refer to these books:

1. P. R. Halmos, *Naïve Set Theory*, Springer-Verlag.
2. K. T. Leung, D. L. C. Chan, *Elementary Set Theory*, Hong Kong University Press.
3. C. Schumacher, *Chapter Zero* (Second Edition), Addison-Wesley.

To put the material in this course in the context of the rest of mathematics, you may refer to these books:

1. H. Eves, *Foundations and Fundamental Concepts of Mathematics* (Third Edition), Dover.
2. I. Stewart, *Concepts of Modern Mathematics*, Dover.
3. I. Stewart, D. Tall, *Foundation of Mathematics* (Second Edition), Oxford University Press.

As for higher dimensional geometry, you may refer to:

- G. B. Thomas, *Thomas Calculus* (any recent edition), Addison-Wesley or Pearson.

The book below offers valuable general advice on how to get used to 'proof-type' mathematics courses:

- L. Alcock, *How to Study for a Mathematics Degree*, Oxford University Press.