LECTURE GEOMETRY AND TOPOLOGY – MATH3061

Disclaimer

Nobody is perfect, and I might have written or said something silly. If there is any doubt, then please check the references or contact me. All questions welcome!

Disclaimer

This document is for the topology part of the course only. The first 6 weeks are on geometry.

Who?

Second semester students in Mathematics interested in a mixture of (linear) geometry and discrete mathematics, but everyone is welcome.

Where and when?

- The lecture.
  - Monday 10:00-11:00, Thursday 09:00-10:00, Friday 09:00-10:00.
  - Starting 7th week, ending 12th week.
  - Carslaw Lecture Theatre 275/373 and online via zoom.
- My tutorial.
  - Friday 13:00-14:00.
  - Starting 8th week, ending 13th week.
  - Carslaw Seminar Room 350.

Material for the lecture

- There is a script [Hi11] available via Canvas that the lecture will follow.
  Additional literature (not mandatory but recommendations only). The recommended literature from the course outline is [Ad94], [Bl67] and [FiGa91]. The lecture sometimes takes a different perspective and I sometimes borrow the exposition from [Ba10], [BoMu08], [BrHa12], [We96] or [Wi96] for graphs, and from [A+21], [FaSt96] and [Ka93] for surfaces and knots.
- Website www.dtubbenhauer.com/lecture-geotop-2023.html
- Prerecorded lectures on the "What is...algebraic topology?" and "What is...geometric topology?" playlists here:
  www.youtube.com/c/VisualMath/playlists
- One exercise sheet per week; six in total.

Schedule.

- Week 7. Basics about graphs – Graphs, subdivision, trees, Eulerian circuits.
- Week 8. Surfaces I – Various surfaces, homeomorphism, Euler characteristic.
- Week 9. Surfaces II – Invariance under subdivision, cutting and pasting, orientation.
- Week 10. Surfaces III – Classification of surfaces.
- Week 11. Graphs and surfaces – Graphs on surfaces, planar graphs.
- Week 12. Knots – Knots diagrams, knot coloring, Seifert surfaces.

References

[Ad94] C.C. Adams. The knot book. An elementary introduction to the mathematical theory of knots. Revised reprint of the 1994 original. American Mathematical Society, Providence, RI, 2004. xiv+307 pp.

[A+21] Edited by C. Adams, E. Flapan, A. Henrich, L.H. Kauffman, L.D. Ludwig and S. Nelson. Encyclopedia of knot theory. CRC Press, Boca Raton, FL, [2021], @2021. xi+941 pp.

[Ba10] R.B. Bapat. Graphs and matrices. Universitext. Springer, London; Hindustan Book Agency, New Delhi, 2010. x+171 pp.

[Bl67] D.W. Blackett. Elementary topology. A combinatorial and algebraic approach. Academic Press, New York-London 1967 ix+224 pp.

[BoMu08] J.A. Bondy, U.S.R. Murty. Graph theory. Graduate Texts in Mathematics, 244. Springer, New York, 2008. xii+651 pp.

[BrHa12] A.E. Brouwer, W.H. Haemers. Spectra of graphs. Universitext. Springer, New York, 2012. xiv+250 pp.

[FaSt96] D.W. Farmer, T.B. Stanford. Knots and surfaces. A guide to discovering mathematics. Mathematical World, 6. American Mathematical Society, Providence, RI, 1996.

[FiGa91] P.A. Firby, C.F. Gardiner. Surface topology. Second edition. Ellis Horwood Series: Mathematics and its Applications. Ellis Horwood, New York; distributed by Prentice Hall, Inc., Englewood Cliffs, NJ, 1991. 220 pp.

[Hi11] J. Hillman. Topology. Lecture notes for the Topology component of Geometry and Topology. Available via Canvas.

[Ka93] L.H. Kauffman. Knots and physics. Second edition. World Scientific Publishing Co., Inc., River Edge, NJ, 1993. xiv+723 pp.

[We96] D.B. West. Introduction to graph theory. Prentice Hall, Inc., Upper Saddle River, NJ, 1996. xvi+512 pp.

[Wi96] R.J. Wilson. Introduction to graph theory. Fourth edition. Longman, Harlow, 1996. viii+171 pp.

Daniel Tubbenhauer, The University of Sydney, School of Mathematics and Statistics, F07 - Carslaw Building, Office Carslaw 827, NSW 2006, Australia, www.dtubbenhauer.com

Email address: daniel.tubbenhauer@sydney.edu.au