Approximation of Functions

Michaelmas Term 2022
Prof. Nick Trefethen
Numerical Analysis Group, Mathematical Institute

This Course
This course is aimed at Part C (4th year) and OMMS Mathematics students (C6.3) and also students in the MSc in Mathematical Modelling and Scientific Computing. It presents the foundations on which all of numerical mathematics is built.

Instructor, tutor and TA
Nick Trefethen, `trefethen@maths.ox.ac.uk`. I am happy to talk with students at any time; contact me by email and I will probably respond very quickly. The tutor is Taejun Park (`taejun.park@worc.ox.ac.uk`) and the TA is Aaron Baier-Reinio (`aaron.baier-reinio@hertford.ox.ac.uk`).

Textbook
The course is closely tied to my textbook *Approximation Theory and Approximation Practice, Extended Edition,* SIAM 2019, `http://people.maths.ox.ac.uk/trefethen/ATAP` (the first six chapters are online at this web site). All students are required to use this book, and the course will be based on chapters 1–11, 13–19 and 23–24. You can access it through the Oxford libraries but I strongly recommend you get a hardcopy. These are available from me for £20 (far below cost).

Lectures
There will be 16 lectures, Mondays and Tuesdays 4:00–5:00 in L4, Andrew Wiles Building.

Problem sheets and classes for Part C and OMMS students
There will be four 90-minute classes in C5, 15:30–17:00 Thursdays of even-numbered weeks:

Class 1: Week 2, Thu 20 Oct 15:30–17:00
Class 2: Week 4, Thu 03 Nov 15:30–17:00
Class 3: Week 6, Thu 17 Nov 15:30–17:00
Class 4: Week 8, Thu 01 Dec 15:30–17:00

For each class, a set of exercises from the textbook will be due at 9am on the Tuesday before. Turn in the first sheet to Aaron B-R by email (see above); the procedure may change for sheets 2–4. Underlined problems require computing.

Due Oct. 18: 2.1, 2.6, 3.9, 3.10, 3.11
Due Nov. 01: 4.3, 5.6, 5.9, 6.1, 6.2, 7.5, 7.6
Due Nov. 15: 8.4, 8.7, 9.2, 10.5, 10.6, 11.3, 13.1
Due Nov. 29: 15.7, 16.1, 17.4, 17.5, 18.5, 19.9, 23.6

Assessment
For Part C and OMMS students, by exam in Trinity Term, which will cover the 20 chapters listed above (141 pages total). For MSc MMSC students, by Special Topic, due Monday week 1, Hilary Term. There is great flexibility of topics you may choose.

MATLAB and Chebfun
We will make constant use of Chebfun (`www.chebfun.org`), which is built on MATLAB. It is not possible to understand this course fully without participating in this side of things. Accordingly, each problem sheet contains a mix of theory and computation. The exam will involve no MATLAB or Chebfun, so in theory one could get away with paying no attention to computing, but that won't be true in practice, for your understanding of the material will be shallow.

Access to MATLAB and Chebfun
MATLAB is available from `https://register.it.ox.ac.uk/self/software.` To get Chebfun, go to `www.chebfun.org` and click on Download for instructions.

Course web page
`https://courses.maths.ox.ac.uk/course/view.php?id=702`.