UNIVERSITY OF CAMBRIDGE
Department of Engineering

Engineering Part IA

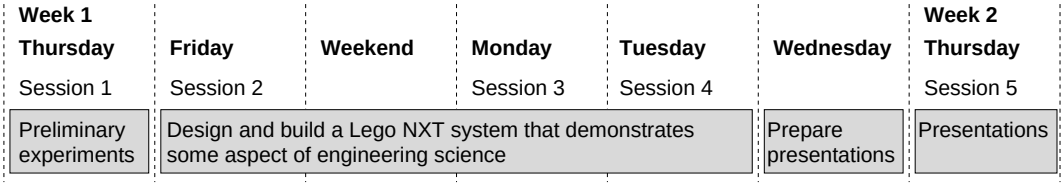
Preparing for the Week 1 Lego Mindstorms Exercise

In your first week at Cambridge, you will get a flavour of real-world engineering through the medium of Lego Mindstorms NXT. Not only will it be fun, but you will also begin to appreciate the many challenges inherent in engineering system design, from gear backlash to structural rigidity and automatic control. At this stage, you will need to come up with *ad hoc* solutions to these challenges. In due course, you will accumulate the expertise that will allow you to tackle such problems in a more disciplined manner.

The exercise will require you to demonstrate teamwork and communication skills. You will also be introduced to the programming language Python, which you will use to control your Lego Mindstorms system. Python provides a rich computational environment that many engineers find invaluable. There is a dedicated Python course that runs throughout the first year of the Engineering Tripos, building on the brief introduction offered here.

To help you hit the ground running, here are some things you should do before arriving at Cambridge.

- **Watch some YouTube movies.** Go to **www.youtube.com** and search for **Lego NXT**. Spend some time admiring the amazing things that people have done with Lego, from Rubik's cube solvers to walking bipeds to bridge-laying robots to Segways. See what you can find out about the common components of these Lego systems: the NXT programmable brick, motors, sensors, structural Lego pieces (both studded and pin-jointed) and kinematic mechanisms (e.g. gear trains).
- **Get a feel for the structure of the exercise.** You will discover your team allocation and schedule following departmental registration, just two days before the project starts. There are three students to a team and schedules will include afternoons: bear this in mind before making other arrangements.



  In the first session, you will work through some highly structured exercises that introduce you to the Python programming language and the various Lego sensors and actuators. The bulk of the activity occupies the next five days, when you will design and build a Lego system *that demonstrates some aspect of engineering science*. So no simple robots that just drive around and are little more than toys: we want you to do some real engineering! You might pick up some ideas from the web, you might have your own ideas, or you might like to try one of the projects we suggest. There will be prizes for the best systems.

- **Read everything at `http://mi.eng.cam.ac.uk/IALego/`.** This includes details of the supplied Lego equipment, a tutorial on Lego gears, and some suggested projects. Apart from the Python programming details, all the projects should be understandable with some effort.
- **Optional — play with Lego.** If you have easy access to any Lego Technic, spend some time playing with it. Practise building simple structures and mechanisms.
- **Think about what Lego system you would like to build**. This might be one of the suggested projects, a variation of something you have seen on the web, or your own idea.