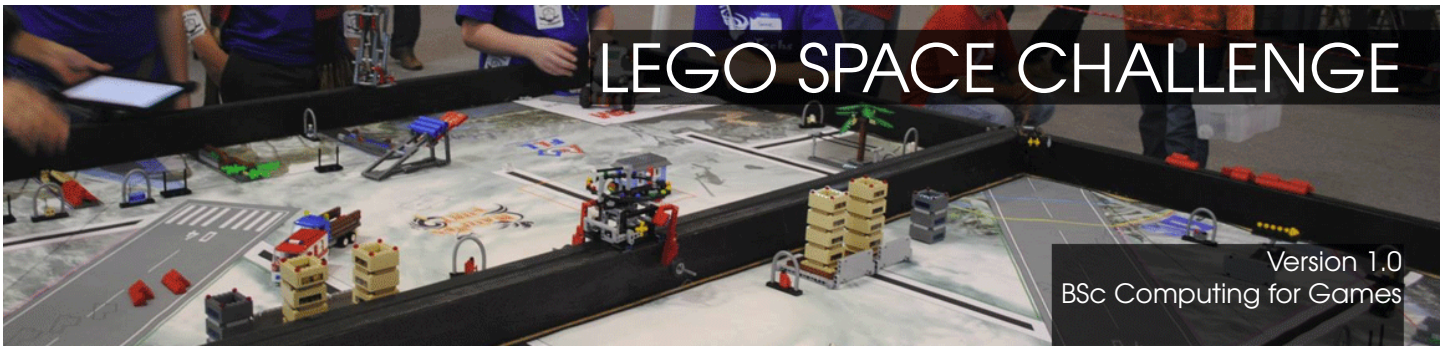

LEGO SPACE CHALLENGE

Version 1.0
BSc Computing for Games

Dr Michael Scott & Dr Mark Zarb

Introduction

Welcome to the LEGO Robot Olympiad: *Space Challenge*! In small teams (typically, 4–5 people), you will **design** and **build** a LEGO EV3 robot and **write** a program that will command the robot on a simulated space mission.

Computing professionals, of every specialism, are expected to have strong interpersonal skills. Software is not only too complex for so-called 'bedroom programmers' to develop on their own, but it is also created for, and with the support of, a wide variety of stakeholders in almost every domain! It is, therefore, important to develop these skills in an applied and relevant way. Playing with LEGO is a fun and creative way to achieve this. You will, therefore, leverage our LEGO robotics kit to exercise these skills while also developing a basic understanding of software development. Further to this, you will break the ice with your new peers and get to know them.

"I didn't fail. I found a thousand ways how not to make a LEGO brick..."

— Patrick Henry

This activity is formed of several parts:

(A) **Build**, as a **group**, a robot that will:
  i. **conform** to the basic robot template;
  ii. **implement** the basic sensors and actuators that are available;
  iii. and *optionally* **demonstrate** your creativity.

(B) **Implement**, as a **group**, a program for the robot so that it will:
  i. **detect** the distance to an obstacle;
  ii. and **avoid** colliding with an obstacle when moving.

(C) **Design and Build**, as a **group**, a draft robot that will:
  i. **implement** more sophisticated and advanced behaviours;
  ii. **demonstrate** your ingenuity **and** creativity;
  iii. **fulfil** at least **one** requirement of the LEGO Space Challenge.

(D) **Design and Build**, as a **group**, a final robot that will:
  i. **revise** any issues raised by your tutor and/or your peers.

(E) **Present**, as a **group**, a practical demo of the robot to your tutor that will:
  i. **fulfil** more than **one** requirement of the LEGO Space Challenge;
  ii. as well as **demonstrate** your interpersonal skills.

Assignment Setup

This assignment is an **induction task**. No course credit is awarded for such tasks, but they are nevertheless great opportunities for learning.

Fork the GitHub repository at:

`https://github.com/Falmouth-Games-Academy/lego-space-challenge`

Download the resources in this repository.

Please also ensure that you have access to: a LEGO EV3 robot kit and the associated cables; as well as a computer with the LEGO Mindstorms EV3 Education-Edition software.

What will you build with your EV3 lego set?

Part A (Session 1)

Part A consists of a **single formative submission**. This work is **collaborative** and will be assessed on a **threshold** basis.

To complete Part A, build your robot and then demonstrate your robot at the end of the session. If acceptable, this will be signed-off.

You will receive immediate **informal feedback** from your **peers**.

Part B (Session 2)

Part B is a **single formative submission**. This work is **collaborative** and will be assessed on a **threshold** basis. The following criteria are used to determine a pass or fail:

(a) The robot is cable of moving;
(b) The robot stops when it approaches an obstacle.

To complete Part B, implement a program for your robot. Then, demonstrate your robot at the end of the session. If acceptable, this will be signed-off.

You will receive immediate **informal feedback** from your **peers**.

Part C (Sessions 3—4)

Part C is a **single formative submission**. This work is **collaborative** and will be assessed on a **threshold** basis. The following criteria are used to determine a pass or fail:

(a) The robot fulfils the requirements of at least one space challenge;
(b) Evidence for emerging programming knowledge **and** interpersonal skills.

To complete Part C, re-design and re-program your robot. Then, demonstrate your robot at the end of the session. If acceptable, this will be signed-off.

You will receive immediate **informal feedback** from your **tutor**.

Part D (Session 5)

Part D is a **single formative submission**. This work is **collaborative** and will be assessed on a **threshold** basis. The following criteria are used to determine a pass or fail:

(a) Enough work is available to hold a meaningful discussion;
(b) Some evidence of programming knowledge **and** interpersonal skills.

To complete Part D, prepare a small-scale demo of the robot. Ensure that you attend the scheduled demonstration session and complete a peer-review.

You will receive immediate **informal feedback** from your **tutor and peers**.

Part E (Session 6)

Part E is a **single summative submission**. This work is **collborative** and will be assessed on a **criterion-referenced** basis. Please refer to the criteria specified at the end of the brief for further detail.

To complete Part E, revise the robot design and its program based on the feedback you have received. Then, prepare a practical demonstration of robot and showcase your robot.

You will receive **formal feedback** from your **tutor** within three working days.

Additional Guidance

It is critically important that you do not neglect your individual roles in the development process. Programming in groups means that you work together. Pair programming is a great aid in this respect—switching between driver and navigator. It is a great opportunity to develop your technical communication skills and overcome common misconceptions about programming. It should not, however, be treated as a 'free ride'.

There are no marks or grades, and no course credit for this activity. This does not mean that it is unimportant! Rather, it is a critical juncture where you become a member of our community and make friends. Our aim is to make you a little more comfortable. Settling into university life is not easy. Most people find it hard, and some will find it more challenging than others. Peer support is critical. This induction task is, therefore, an opportunity to have fun and to get to know each other.

Play! Experiment! You are *supposed* to make mistakes! If you are *not* making mistakes then you are *not* learning! The most fun you can have with robots is seeing them do stupid things and spectacularly mess up. Then, trying to work out *why*!

Not everyone on the course will come in with a programming background. Please permit everyone on your team the opportunity it 'drive'. Be patient, constructive and helpful. Just because someone isn't as comfortable with computer code now, they will catch up and you may even depend on their experience in the future (e.g., composition, illustration, writing, etc.).

Our emphasis on peer-review and peer feedback does sometimes raise alarm. However, this is standard practice in the industry. Furthermore, the only way to learn how to review code effectively is by actually reviewing code. Critical evaluation is a core learning outcome for the course. Your tutor will guide you through the process and provide advice. With practice, it will become clear what is satisfactory by discussing the quality of work with your peers and your tutor during the peer review sessions.

FAQ

- **What is the deadline for this assignment?**
  You must demonstrate your progress in the final session.
- **What should I do to seek help?**
  You can email your tutor for clarifications. For informal feedback, create an issue or make a pull request on GitHub.
- **Is this a mistake?**
  If you have discovered an issue with the brief itself, the source files are available at:
  `https://github.com/Falmouth-Games-Academy/bsc-assignment-briefs`.
  Please raise an issue and comment accordingly.

Additional Resources

- Valk, L. (2014) LEGO Mindstorms EV3 Discovery Book. No Starch Press.
- Alphin, T. (2015) The Lego Architect. No Starch press.
- `https://www.youtube.com/channel/UCm5LnQhKAJoGKtCFytVngQQ`
- `https://education.lego.com/en-gb/middle-school/explore/c/ev3-space-challange-missions`
- `http://www.dexterindustries.com/howto/connecting-ev3-arduino/`

Assessment Criteria (Space Challenge)

Criteria marked with a ‡ are shared by the group. Criteria marked with a † are weighted by individual contribution to a shared deliverable. All other criteria are individual.

Criterion	Weight	Refer for Resubmission	Basic Competency	Basic Proficiency	Novice Competency	Novice Proficiency	Professional Competency
Functional Coherence	30% ‡	Program will not deploy to the robot and/or the robot is inoperable.	The robot will move and detect obstacles. A reasonable attempt is made to solve at least one challenge.	Features beyond movement and obstacle detection are integrated into the robot. At least one challenge is completed successfully.	Features beyond movement and obstacle detection are integrated into the robot. At least three of the challenges are completed successfully.	Features beyond movement and obstacle detection are integrated into the robot. At least fsix of the challenges are completed successfully.	Sophisticated sensors and actuators are integrated into the robot. The robot conducts considerable computation. All challenges are completed successfully.
Creative Flair & Ingenuity	30% ‡	No innovation and/or creativity. The robot is a clone of an existing design, with only very minor cosmetic alterations.	Little innovation and/or creativity. The robot is derivative of an existing design, with additional sensors or actuators.	Some innovation and/or creativity. The robot is based on an existing design, but shows some divergent and/or subversive thinking in terms of its design elements.	Much innovation and/or creativity. The robot is somewhat original, but may be reminicient of on an existing design. Nevertheless, there is evidence of divergent and/or subversive thinking in terms of its design elements. The robot shows promise of fun and engagement.	Considerable innovation and/or creativity. The robot is original, with considerable evidence of divergent and/or subversive thinking in terms of its design elements. The robot is somewhat fun and engaging.	Significant innovation and/or creativity. The robot is highly original, with significant evidence of divergent and/or subversive thinking in terms of gameplay. The gameplay is fun and engaging.
Collegiality & Interpersonal Skills	40% †	No evidence of collegiality and interpersonal skills No review of a peer's robot Breach of academic integrity.	Submission is timely. Enough work is available to hold a meaningful discussion. Clear evidence of programming knowledge and communication skills. Clear evidence of reflection on own performance and contribution. Only constructive criticism of pair-programming partner is raised. No breaches of academic integrity.				