STUDENT ROBOT

It's all about flags!

This year's game is all about flags. We've some fun challenges for you to complete which should introduce you to the new components in the kit.

You'll need to complete each of the following tasks (which can be approached in any order) in order to reveal a sentence relating to this year's competition. For most of the challenges you'll need to show a Blueshirt that you've completed the task and they will give you the word or partial words for the task. Other tasks may directly give you their word(s). At the end of this document is a template for the sentence showing the placement of each of the answers.

Most tasks are grouped into two streams, "A" and "B", and you will have been told which stream you should approach first. This is because the "A" stream requires access to components which aren't part of your kits, and we only have a limited supply of those. Where indicated, you should collect the items for your next task from the *challenge desk*. Please be sure to return the items once you've completed the challenge so that the next team can use them.

Once you've completed both streams, you can move on to task "C", which will pull together all the things you've learnt in completing "A" and "B".

There is also a separate strategy task which the Blueshirts will come and collect your team for at some point through the day. The task will take about 10 minutes, but as a number of teams will be doing it together please be come promptly when asked.

Before You Start

You need to create a switch for the power board. For kickstart, this will just consist of a jumper wire. Use a 5mm camcon (medium-sized green connector) and some power wire. Simply connect the same piece of wire to both terminals of the camcon and plug this into the on|off connector of your power board.

Stream "A"

A1: Charge Battery

Find out how to use the battery charger in your kit, then show a Blueshirt how you would charge one of your batteries.

A2: Hello Flags!

In typical programming fashion, this involves printing a simple message to the logs (on the tablet and USB stick). Historically, "Hello, World!" is used as an initial check that things are working, so you might want to start with that.

You can uncover the code words for this task by also including the following code in your print program:

```
print('{1!s}{0:02X}0{2:+4.0f}'.format(11, 'SR', 1007.5*-2))
```

A3: This Flag is a code

Note: *Collect a flags marker stick from the challenge desk*

This task involves the vision system on your robot, combined with some simple conversion of the information you get back. In this task, each of the flags' markers represents a letter, with marker 0 representing "A", marker 1 for "B", 2 for "C" and so on. The word for this challenge is spelled out in the flags.

A4: !PC LOAD LETTER!

Note: *Collect a Rugguedуino expansion board from the challenge desk*

For this task, you'll be creating a basic keyboard. The five switches represent the first five letters of the alphabet.

The expansion board should be connected to the ground pin and pins 9 to 13.

Configure your keyboard as follows:

No.	Pin	Letter
0	13	A
1	12	B
2	11	C
3	10	D
4	9	E

The robot should print the letter being typed to the screen.

Once you're happy this is working as expected, get a Blueshirt to type the code word using it.

A5: Watch me move

Note: *Collect a servo mounted camera and a printed marker from the challenge desk*

For this challenge, you need to ensure that your camera remains pointed at the marker held in front of it by moving the servo to change which direction it faces.

Show this to a Blueshirt once it works.

Stream "B"

B1: Forum Flag

During the course of the competition the forums are a great place to chat with other competitors about their robots. You can exchange ideas on strategy, design or construction and get help if things aren't working.

The Blueshirts also use the forums, making them the best place to go to ask any questions you have about anything.

To complete this challenge, introduce your team on the forums in the thread "Kickstart Team Introduction".

B2: Caught in trouble?

Your robot is meant to be moving forward in a straight line, but it keeps veering off to the left! The batteries are fully charged, so you know that's not the problem. Use the Interactive Troubleshooter to find out what's wrong.

B3: Simulated Flags!

For this task you will need to download a copy of the Student Robotics simulator. If you're using Windows, you can find it at http://users.ecs.soton.ac.uk/hc13g11/simulator-windows-2015.zip. If you're on Mac OS X, go to http://users.ecs.soton.ac.uk/hc13g11/simulator-macosx-2015.zip. For Linux systems, clone or download the GitHub repository at https://github.com/Fodaro/sr-turtle.

In each ZIP, you should find an instructions file, telling you how to run code in the simulator. (Linux users should read the `README.md` file.)

Start by running `test.py`. You will see a robot (in an arena) drive towards the centre flag and move it.

Programs for the virtual robot are written in the same way as those for a real one, except that servos are not supported. Instead, you can operate the grabber using the `R.grab` method (see the Robot API section of the `README.md` file). Your instructions file will tell you how to create your program files. To start with, try making your robot move in some way.

For this task, you need to make your robot drive forward, grab the flag and return it to your zone (as described in the rules).

B4: Error Flag

"Debugging" is the name given to the process of finding and fixing "bugs" – things within a system which are not working as intended. It is one of the most important skills needed in engineering.

For this task, you need to login to the IDE and create project `kickstart-task-b4`. For this task, you need to write a program which will identify markers and illuminate LEDs to corresponding to the marker type. LEDs are a useful tool for debugging as they give a visual sign of what your robot is doing.

You should connect up the LEDs as follows:

LEDs have a long leg and a short leg. The long leg should be connected to a Ruggeduino pin configured as an output, and the short leg should be connected to ground.

By setting the output high, the LED can be turned on, by setting the output low, the LED can be turned off.

You should connect three LEDs to your Ruggeduino. Connect a red LED so that it can be controlled by pin 13, a yellow LED on pin 12 and a green LED on pin 11. Remeber that you can connect multiple LEDs to the same ground pin.

The RED LED should come on when you see an ARENA marker. The YELLOW LED should come on when you see an ROBOT marker. The GREEEN LED should come on when you see an FLAG marker.

If you can see more than one type of marker, more than one LED should be illuminated.

Once your code is ready, tell a Blueshirt and they will test it!

B5: Almost there

A "state machine" is a way of organising your robot's strategy code that makes it clear what the robot is "thinking" at any given moment. It also simplifies the task of changing how the robot behaves as adding a new "state" is fairly easy.

A "state machine diagram" is composed of bubbles, which represent states, and arrows, which move (or "transition") from one state to another. These provide a way to visualise and discuss a state machine.

An example of a state might be "looking for a token marker", while a transition might be "saw a token marker".

To complete this challenge you need to make your robot act as a set of traffic lights by using a state machine.

States

1. Red
2. Red-Amber
3. Green
4. Amber

Task C: Capture the flag!

The challenge desk has a motor which will act as a winch connected to a flag. The flag start on the floor and will be winched up by a desk-mounted motor. You must use the motor board and feedback from the camera to move the flag to a given height. Ask the Blueshirt in charge of this task how far it needs to be lifted.

Answer Template