D.2.

# Appendix D.2. Robot Projects Timeline at George School

Here is a general timeline for the chapter assignments and robotics projects for students enrolled in *Computer Programming & Robotics* classes at George School. (See *Appendix D Section 1* for more details about the specific **Challenge Problems** that are assigned at the end of each chapter.)

## D.2.1. Non-essential Exercises (if network is down or equipment has not arrived)

* Watch Nova’s *Great Robot Race* while waiting for equipment to arrive: <http://www.youtube.com/watch?v=uoiJeIb0wBA>
* Future discussion on the use of military drones: Nova’s *Rise of the Drones*: <http://www.youtube.com/watch?v=SiyeQQrJZC4>

## D.2.2. General Exam Timeline

* In general, students should shoot for the following benchmarks before each of the following exams:
  + Prior to the **Fall Exam**:
    - Every student should have passed the Tool Test
    - Every student should know how to make rudimentary 3D-printed objects
    - Intermediate students should shoot tofinish **Chapter 9: If Then Statements**
    - Intensive students should *at least* finish **Chapter 10: While Loops**
  + Prior to the **Winter Exam**:
    - Every student should know how to solder and built their PRT1 motherboard kit
    - Every student should have built their OneBot robot.
    - Every student should have programmed their OneBot to do the following:
      * Follow a line
        + Black electrical tape on white board
        + Time robots and give prizes to fastest
      * Navigate a tabletop
        + Minimum Success Criteria: Avoid table edges
        + Nominal Success Criteria: Avoid table edges as well as obstacles on the table
      * Interact with their environment
        + Measure some environmental parameter (ambient light or temperature, for example) and respond by activating some actuator (lamp light or fan, for example).
  + Prior to the **Spring Exam**:
    - Xxx

## D.2.3. Term 1 Activities

* Explain differences between Intermediate and Intensive classification
* Testing the Microcontroller
  + Install the hardware on personal machines
  + Begin textbook.
* **Hack-a-Thon**
  + xxx
* **Soldering**
* Watch video on LMS (“Tools and Skills Tutorials” page)
  + <https://learn.sparkfun.com/tutorials/how-to-solder---through-hole-soldering/soldering-your-first-component->
  + <https://www.youtube.com/watch?v=oqV2xU1fee8&feature=youtu.be>
* Solder sample PCB boards. For example:
  + Selectable LED
  + RGB
    - Students can keep this (they were charged for it.)
  + IR line follow
  + Pot/VDB
  + 7 segment LED or 10 Bar LED
* **Sketch-Up and 3D Printing**
  + Distribute “SketchUp2014RefCardWin.pdf” and “hole and peg sample sizes.docx” documents (double sided).
  + Introduction to SketchUp and Hardware Tools
    - Watch video tutorial or in class tutorial on how to use SketchUp
    - Play around with tools
    - Make chain
      * Learn how to use tapping tool and self-tapping screws
    - Make silhouette nameplates for toolbox
      * Learn how to drill and tap tool boxes
      * Affix nameplate to toolbox
* **Homework:**
* **Create nameplate design on paper for your toolbox. The dimensions should be roughly 35mm x 70mm. Look on Google Images for silhouette images, which make excellent nameplates.**

## D.2.4. Term 2 Activities 4-6

These are too numerous to mention. Because the robotics classes are self-paced, self-driven courses, students determine on which projects they will work. In both Computer Programming & Robotics classes, students are required to show their understanding of the basics by having to perform the following tasks:

* Solder PRT1 Motherboard
* 3D-printer design project
* 3D-printer art project
* Solder projects:
  + Solder a simple circuit such as LED, switch, voltage-divider, etc.
  + Solder an RGB LED board
    - Students purchase and keep this
  + Solder their own microcontroller motherboard
    - Students purchase and keep this
* Embedded controller sensor project
  + Microcontroller must read some sensor and control some actuator based on the sensor reading
    - For example, when the room temperature rises above/below a certain value, turn on a fan/heater.
* Autonomous robotic line-follower
  + Student’s program their robot to read two infrared sensors to follow a black line on a white board.
* Autonomous robotic tabletop-navigator
  + Student’s program their robot to read a variety of sensors to navigate on a tabletop by avoiding the edge, and avoid objects on the table.
* **Hack-a-Thon!**

## D.2.5. Term 3 Activities

During Term 3, students in this introductory class will work individually or in teams on a large-scale project of their choosing. (The robotics classes are made up of mixed grades that range from sophomores to seniors.) A small sampling of these projects include:

* Fire-fighting robots
  + Teams sent to the annual international competition at Trinity College in Hartford, CT
  + [http://www.trincoll.edu/events/robot/about-us.html](http://www.trincoll.edu/events/robot/about-us.html%20)
* Sea Perch Underwater Robotics Competition
  + US Navy sponsored
  + Competition at Drexel University
  + <http://www.phillyseaperch.org/>
* Soccer-playing robots
* Flame-throwing robots
* Robots that are controlled by EKG sensors attached to human muscles
* Solar powered robots that follow the sun’s path throughout the day.
* Wirelessly controlled robots (RF transmitter and receiver programmed by students)
* Robots that draw images
* Robots that track the movements of people and film their movements (a robot filmographer)
* Etc…
* **Hack-a-Thon!**