Chapter 2

Software Design Process

Where to start? Before you can jump in and start creating your program, you have to spend some time figuring out what the program needs to do and how you plan to do it. This thought process, mapping out and thinking through the program logic is your design process. If you’re working as a member of a team, you will have to do this process as a group, and it can be a challenge for team members to agree on the best way to do things. Remember to be open to all ideas during the design process. An idea that seems a bit crazy could actually be the best solution to the problem at hand.

Choosing the Right Problem

The first step in writing good code is to make sure you understand the problem you are trying to solve. If you are on a FIRST LEGO League (FLL) team, you will have a series of missions your team is trying to complete to gain points. It’s a wise idea to sit down as a team and organize the tasks in order of difficulty, easier mission first and the harder missions last. Some teams might sort the missions by their value in points, but if you focus solely on the missions that give you the most points, you might find yourself spending way too much effort on a harder mission when you could have done some of the easier missions and scored more combined points.

FIRST LEGO LEAGUE (FLL)

The FLL is an international competition organized by FIRST for elementary- and middle-school students (ages 9–14 in the United States and Canada, 9–16 elsewhere). It is a joint effort through a partnership between FIRST and the LEGO Group.

Every year, a new robotics challenge is given to teams. These challenges are based on real-world scientific issues. Teams work on building LEGO MINDSTORMS robots to complete as many of the challenges as they can with in a given time frame.
If you look at the points-ordered list of missions in Figure 2-1, you see that “Bring the car to base” is worth the most points. But when you look at the list of missions ordered by difficulty in Figure 2-2, you notice that the “Bring the car to base” is the most difficult while the “Carry recycled parts to center” is easier, and if you’re able to do all six items, you get a cumulative score of thirty points.

25 pts - Bring car to base
15 pts - Empty barrels from bin
10 pts - Turn house window 90 degrees
8 pts - Deliver boxes to depot area
8 pts - Deliver minifigs to home
5 pts - Rotating windmill
5 pts - Carry recycled parts to center (6 items @ 5pts ea)
5 pts - Grab spinning top first

Figure 2-1. List of missions in order of points

Easy - Carry recycled parts to center (6 items @ 5pts ea)
Easy - Grab spinning top first
Med - Turn house window 90 degrees
Med - Deliver minifigs to home
Med - Rotating windmill
Hard - Bring car to base
Hard - Empty barrels from bin
Hard - Deliver boxes to depot area

Figure 2-2. List of missions in order of difficulty

However your team decides to order the missions, it’s important to have a road map of each mission you will attempt to complete with your robot. The goal is to design a program that cannot only solve a mission but that can do it consistently over and over. A program that can complete its mission every once in a while is not going to give you any awards; it will give you only headaches. Try not to get frustrated if the first solution you come up with doesn’t work as expected. During the design phase of your programs, you will make multiple attempts at finding the desired solution.

What you’re doing here is called Iterative design. This is a design methodology based on a circular process of designing, writing, testing, analyzing, and refining a program. Based on the results of testing the most recent iteration of a design, changes and refinements are made. This process is intended to ultimately improve the quality and functionality of a program.

Define the Problem

When starting, you need to fully understand the problem you are trying to solve. With FLL, the problem will be the mission you are trying to complete. Make sure you read and understand the game rules for each mission. Also, be aware of any changes to the rules before you attend your