Assignment 1

**Due:** Friday, January 10 at 11:59 PM

You will continue to write small programs for the Rush Hour game like you did in Lab 1.

Rush Hour Game and Language

This assignment uses the same p5.js sketch from the lab to write and run Rush Hour programs: [https://editor.p5js.org/cs105/sketches/ZTBDL_dYl](https://editor.p5js.org/cs105/sketches/ZTBDL_dYl)

Consult the lab handout for information about the game and the Rush Hour p5.js sketch.

**IMPORTANT:** After you find a solution for every part, make sure you copy and paste the code into the Processing IDE and save the sketch using the name exactly as indicated (e.g. “A1-part1-a”). Find more instructions for saving and submitting in “How to Save and Submit“ on LEARN.
Part 1: Different Algorithms.

As discussed in class, there are almost always many different algorithms that provide solutions to a problem. Since we are expressing algorithms as a sequence of code (i.e. a computer program), this means there are several different programs that can provide a solution.

[7 marks] Exercises

- [3 marks] Using only the “Simple Rush Hour Programming Language” from the lab (the one you used for the first of the lab), write three different programs that are solutions to game board example4 (shown below).

HINT: Solutions do not have to be efficient, but they have to solve the puzzle without errors.


For all three programs:

- [2 marks] Use the correct syntax of the Rush Hour language specified in this question (e.g. correct function calls, correct colour names).

- [2 marks] Use good coding style (e.g. semicolons, whitespace), see Style Guide on LEARN.
Part 2: A New Rush Hour Language

There are also many different ways to express an algorithm using code. In this part of the assignment, you will solve Rush Hour puzzles using a new Rush Hour programming language. This new language has only three functions.

The first function selects the vehicle to move using the following syntax:

\[
\text{vehicle}(✪); 
\]

Just like in the move commands in the lab, you replace the symbol ✪ with the name of the colour of the vehicle you want to select. The vehicle colours are exactly the same as Lab 1. Think of this as putting your hand on one of the vehicles to get ready to move it.

The other two functions move the selected vehicle forward or reverse a number of grid positions:

\[
\text{fwd}(n); \\
\text{rev}(n); 
\]

where \( n \) is the number of grid locations to move.

The forward and reverse movement directions are relative to the direction of the vehicle. In the puzzle boards, the forward position of each vehicle is indicated with a triangle.

Note that there is no function to deselect a vehicle. Once selected, it stays selected until the next vehicle function. If \text{fwd} or \text{rev} are called without any \text{vehicle} function being called earlier in the program, the selected vehicle is “UNDEFINED”: this means your program will crash with the “No UNDEFINED vehicle on board” error.

Here’s an example solution using this new programming language. It solves the same game board \textit{example1} from the lab:

\[
\text{vehicle(GREEN);} \\
\text{rev(1);} \\
\text{vehicle(YELLOW);} \\
\text{fwd(2);} \\
\text{vehicle(RED);} \\
\text{fwd(3);} 
\]

Game Board \textit{example1}

You can run this program in the Rush Hour p5.js sketch.
[12 marks] Exercises

Now, use only this new programming language to solve the following game boards below. These are the same game boards as the lab exercise, so you already know how to solve them in terms of vehicle movements. The challenge is to express them using the functions provided in the new made-up programming language.

Remember, there will often be multiple algorithms that can all solve the same puzzle. As an extra challenge, try to find the most efficient one with the fewest steps.

- [2 marks] Write a program to solve game board: exercise_a

NAME your sketch “A1-part2-a”

- [2 marks] Write a program to solve game board: exercise_b

NAME your sketch “A1-part2-b”
• [2 marks] Write a program to solve game board: exercise_c

NOTE: this is a static game board, so “run the program in your head” to make sure it works.

NAME your sketch “A1-part2-c”

• [2 marks] Write a program to solve game board: exercise_d

NAME your sketch “A1-part2-d”

For all four programs:

• [2 marks] Use the correct syntax of the Rush Hour language specified in this question (e.g. correct function calls, correct colour names).

• [2 marks] Use good coding style (e.g. semicolons, whitespace), see Style Guide on LEARN.
Submitting

Submit all the downloaded sketch ZIP files, all contained in a single ZIP file called “A1.zip”, to the “Assignment 1” LEARN dropbox.

For step-by-step instructions to create a ZIP to submit, see “How to Save and Submit” (on the CS 105 LEARN Site).

It is your responsibility to submit to the correct files to the correct dropbox before the deadline. Otherwise, you will receive a mark of 0.