



# E11: Autonomous Vehicles

Fall 2011

Harris & Harris

## PS 3: Creating Gold Codes

### Gold Code Generation

For this assignment, write a single Mudduino file named `goldcode.pde`. **Important:** place the following comment on the first line of `goldcode.pde` (where `xx` is the number of hours that it took you):

```
// Time to complete program = xx hours
```

Your program has two purposes:

(1) To create and print the following eight Gold Codes using the methods discussed in class:

- Gold Code 1:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00001)$
- Gold Code 2:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00010)$
- Gold Code 3:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00011)$
- Gold Code 4:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00100)$
- Gold Code 5:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00101)$
- Gold Code 6:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00110)$
- Gold Code 7:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 00111)$
- Gold Code 8:  $GC(1 + x^2 + x^3 + x^4 + x^5, 1 + x^3 + x^5, 01000)$

(2) To correlate each Gold Code with itself and each of the others and print the result. For each set of two Gold Codes, the correlation needs to give results for all possible shifted versions of the second Gold Code (31 possibilities per pair). For consistency, right-shift the second Gold Code.

Print your resulting Gold Codes in this format:

Gold Code <number>: <31-bit sequence>

Print the correlations in this format:

Correlation GC <number1>, GC <number2>:  
<0 shift val> <1 shift val> <2 shift val> .... <30 shift val>  
MAX: <maximum correlation across all shifts>

### Hints

Remember, before writing any code, first write out the steps to complete the program. We've given you the high-level steps; now break those down into a number of sub-steps. Then

implement one step at a time, likely as a separate function; test and debug that function – verify that it matches your expectations (make sure you have expectations! Likely from hand calculations and/or the lecture notes); then move on to the next step.

In particular, you are likely to store your seed in a 5-element array and it is easy to botch the order or index of the elements in the array.

## **Deliverables**

You are responsible for turning in one Arduino file:

- `goldcode.pde`

## **Grading**

Your score is based on a 5 point scale for each problem, with 5 being the highest score:

- 5: Your program runs as expected; the code is clear and well commented.
- 4: Your program runs as expected; the code is mostly clear and well commented.
- 3: Your program runs as expected; more clarity and/or comments are needed.
- 2: Your program mostly runs as expected; clarity and comments are missing.
- 1: Your program does not run as expected; but the code is mostly clear and commented.
- 0: Your program does not run as expected; clarity and comments are lacking.