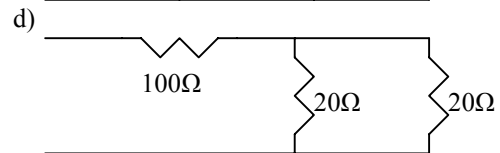
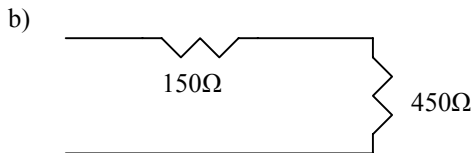
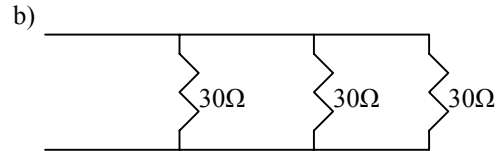
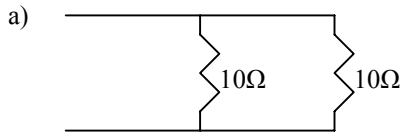


Exploration in Robotics

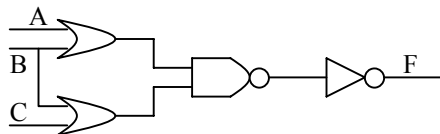
Final

Instructions: Please answer each question in as much detail as possible. Include diagrams, pictures, and flow charts when necessary. You may use your journals for this test. You must work alone on all of the questions except for the last one. You may work on the last question in your group.

- 1) What are the differences between a microcontroller, like the HC12 you used on your robot, and a microprocessor, like you have in your computer at home?
- 2) Which sensors on your robot are analog and which are digital?
- 3) Draw the circuit symbol for each of the following:
 - a) resistor
 - b) capacitor
 - c) SPST (Single Pole Single Throw) Switch
 - d) battery (or power source)
 - e) motor
 - f) SPDT (Single Pole Double Throw) Switch
- 4) Why did we put a fuse on our robots?
- 5) What are the differences between AC and DC voltages?
- 6) What units do we use for power?
- 7) Calculate the equivalent resistance, or capacitance for each circuit:



- 8) Suppose you have a resistor that has the following color codes on it: Black, Brown, Orange, and Gold. What value does the resistor have, and what is its tolerance?
- 9) Draw the circuit symbol for each of the following:
 - a) AND gate
 - b) OR gate
 - c) INVERTER
 - d) NAND gate
 - e) NOR gate
 - f) XOR (exclusive OR) gate
- 10) Draw a digital (with AND, OR, etc) gates for the Boolean equation: $F = AB + AC + BC + ABC$
- 11) Build a truth table for the following circuit:



A	B	C		F

12) How does a motor work?

13) Imagine you have a motor, and would like to select between having the motor go at two different speeds. Draw a circuit diagram to do this (HINT: all you need is two batteries with two different voltages, a motor, and a SPDT switch).

14) What does a compiler do?

15) Is the following program a good program? (Note, it should compile and run without any errors). What is the program supposed to do?

```
#include "DBug12.h"
#include "hc12.h"
#include "robot.h"
void main(void) {
  unsigned int i = 0;
  while (i <= 100) {
    move_motor(i, i);
    i++;}
  move_motor(0,0);
}
```

16) Imagine two surfaces side by side - a black surface, and a white surface. There are no walls around. Your robot must attempt to move in as straight a line as possible. The easiest way to do this would be to follow the edge where both the black and white surfaces meet.

- Write specifications for this program
- Come up with an algorithm and/or flow chart for your program
- Write a program to implement it for your robot.
- Time permitting, compile, run, and debug your program on your robot