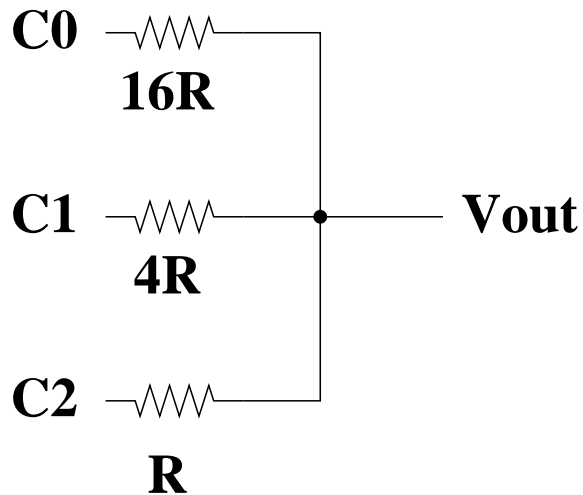# Real-Time Embedded Systems (AME 3623)
Homework 5 Solutions

April 30, 2008

Question 1

Consider the following circuit:

(20pts) Show V_{out} as a function of $C0$, $C1$, and $C2$. Show your derivation.

Assume: positive current flows from left to right.

Ohm's Law gives us:

$$
\begin{aligned}
5C_0 - V_{out} &= 16RI_0 \\
5C_1 - V_{out} &= 4RI_1 \\
5C_2 - V_{out} &= RI_2
\end{aligned}
$$

Kirkoff's Law gives us:
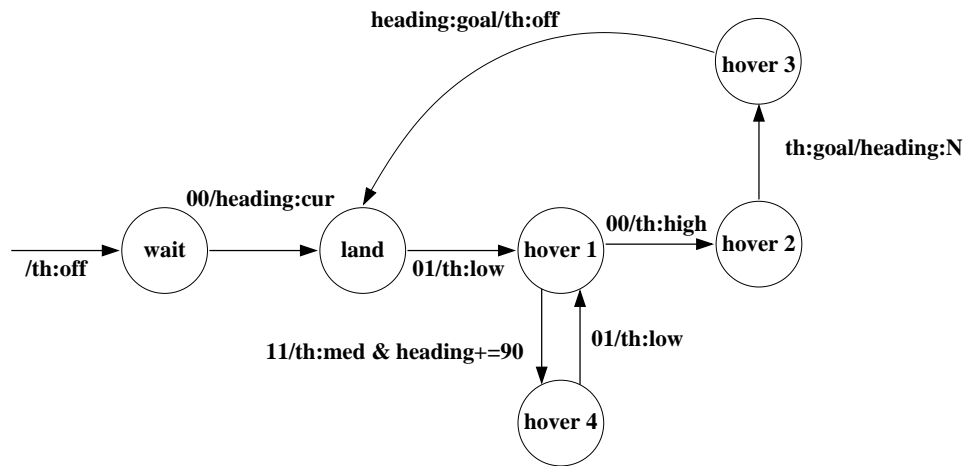
$$I_0 + I_1 + I_2 \;=\; 0$$

Therefore:

$$\frac{5C_0 - V_{out}}{16R} + \frac{5C_1 - V_{out}}{4R} + \frac{5C_2 - V_{out}}{R} \;=\; 0$$

$$5(C_0 + 4C_1 + 16C_2) \;=\; (1 + 4 + 16)V_{out}$$

$$5\frac{C_0 + 4C_1 + 16C_2}{1 + 4 + 16} \;=\; V_{out}$$

Question 2

Consider the FSM from the project:

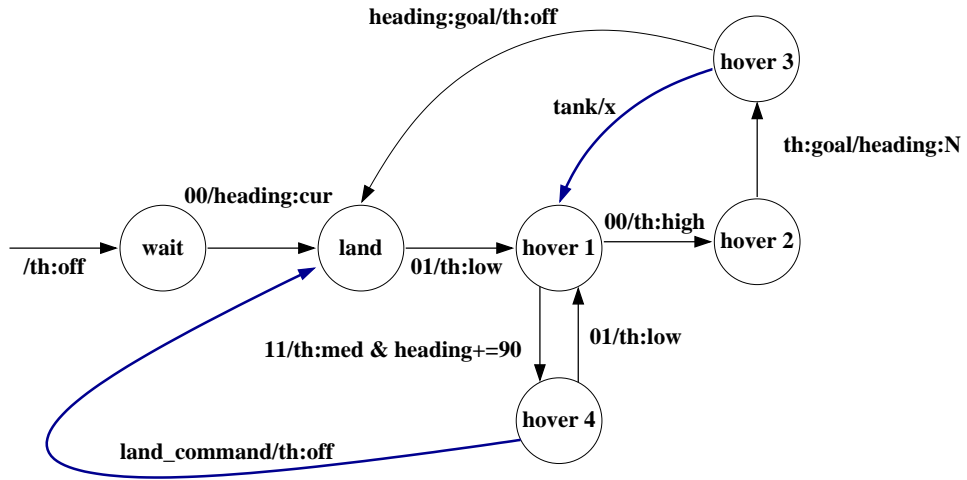Suppose we want our controller to do two additional things:

1. Land on command from *hover 4*.

2. Return to *hover 1* from *hover 3* if an imaging sensor detects a tank.

1. (10pts) What events, states, and actions must you add to this FSM?

   One new event: *tank*.

   Possibly another new event: *land_command*.

2. (10pts) Show the modified FSM.

Question 3

Consider the same FSM from the project (the original FSM, not the one you just modified).

Suppose we want our controller to do two additional things from *hover 3*:

1. Land on command (10)

2. Otherwise, rotate in place indefinitely

1. (10pts) What events, states, and actions must you add to this FSM?
   None.

2. (10pts) Show the modified FSM.