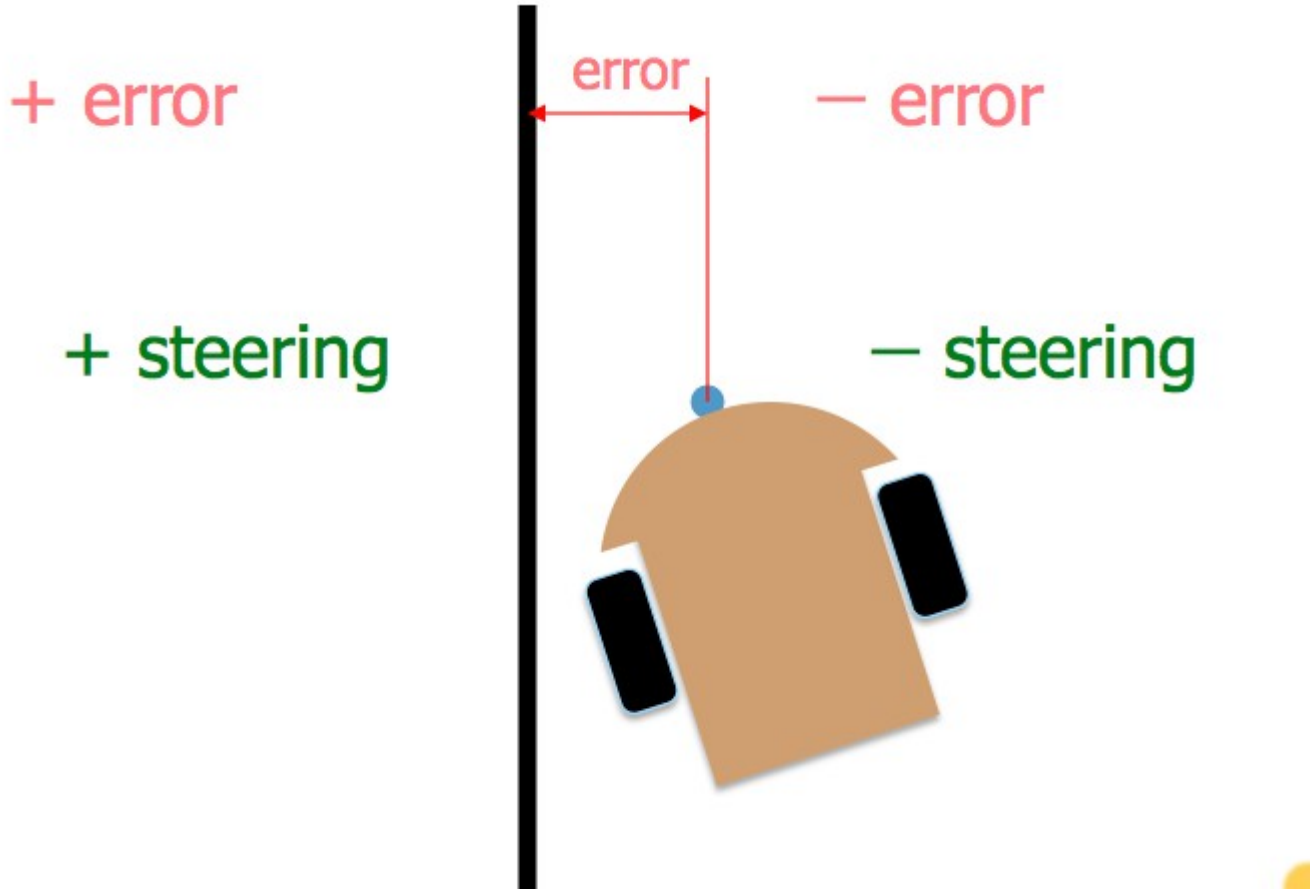
ECE3 Spring 2019
Practice Problems 8

1. In the PID Concepts slides, Slide 22, (labeled "Quiz Time!") shows a vehicle-to-path setup and asks about the signs of K_P and K_D. In the figure below, the signs of the error and steering have changed. Given that, what are the signs of K_P and K_D?



$K_p<0$

$K_d<0$

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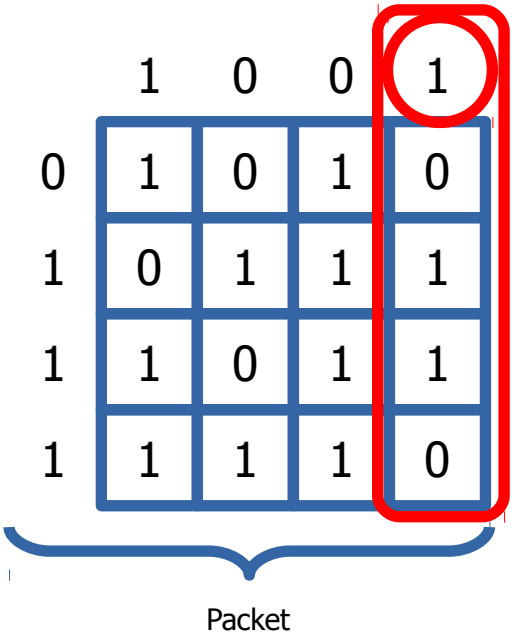
2. The Royal Game of Ur was played in ancient times with a regular tetrahedral die (a four-sided die with equilateral triangular faces). The probability of the die landing on a given face is the same for all faces; i.e., the faces are equiprobable. How many bits are required to represent the outcome of one throw of a tetrahedral die?

$\mathcal{H} = \log_2 N$ bits/event$=\log_2 4$ bits/event$=2$ bits/event

3. Find the error in this packet, if there is an error.



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LEFT END							RIGHT END
8	4	2	1	-1	-2	-4	-8
70	900	800	90	60	55	60	65

This is the current set of path sensor readings that you code is to turn into an error value and subsequently into a steering command. The left side sensors see the path, meaning that the car is to the right of the path. This is a positive error. Steering commands to the right are positive; to the left are negative. The past error value is 5500. Your $K_p = -0.002$, and your $K_d = -0.02$.

a. What is the current error?
b. What is the K_p steering command?
c. What is the K_d steering command?
d. What is the composite steering command?

Current error = sumproduct(weights,readings) = 4920
Δ error =4920-5500 = −580
K_p Command = -0.002*4920 = -9.84
K_d Command = -0.02*Δ error =11.6
Composite command = 1.76