COMP417
Quiz on (Extended) Kalman Filter
First Name:
Last Name:
McGill ID:

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Each of these questions is worth 0.5 points

1. Applying Bayes' rule with a Gaussian prior and a Gaussian measurement likelihood always results in a Gaussian posterior. True or False?

2. The propagation step of the Kalman Filter reduces the uncertainty of the state estimate. True or False?

3. The update step of the Kalman Filter increases the variance/covariance of the Gaussian state estimate. True or False?

4. Suppose your prior distribution for a 1D random variable is $x \sim \mathcal{N}(0, 10^2)$. Your measurement likelihood is $z|x \sim \mathcal{N}(10, 1^2)$, where $z = x + w, \quad w \sim \mathcal{N}(0, 1^2)$. In other words, initially you thought x was around 0 with variance 10^2, but then you got a noisy measurement around 10 with variance 1^2. Which of the following statements are true about the posterior distribution $x|z \sim \mathcal{N}(\mu, \sigma^2)$, i.e your updated belief?

(a) μ is closer to 10 than to 1.
(b) $\mu = 0.5$
(c) $\sigma < \min(10, 1)$
(d) $\sigma > \max(10, 1)$
(e) $\sigma = 4.5$

5. Suppose the measurement model of a system is a linear function of the state plus noise: $\mathbf{z} = \mathbf{H}\mathbf{x} + \mathbf{n}$. If the difference between the expected measurement $\mathbf{H}\boldsymbol{\mu}_x$ and the actual measurement $\bar{\mathbf{z}}$ is zero, then the update step of the Kalman Filter will:
(a) Change the mean but not the variance
(b) Change the variance but not the mean
(c) Change neither the variance nor the mean
(d) Change both

6. The Kalman Filter is a good choice for problems where the distribution of your state estimate can be multimodal, i.e. in cases where there are multiple hypotheses that are equally likely, or more generally, multiple local maxima in the posterior distribution. True or False?

7. The Extended Kalman Filter approximates nonlinear dynamics or observation models using Monte Carlo sampling. True or False?

8. The Extended Kalman Filter is an optimal estimator. True or False?

9. The Extended Kalman Filter is a good choice for problems where the distribution of your state estimate can be multimodal, i.e. in cases where there are multiple hypotheses that are equally likely, or more generally, multiple local maxima in the posterior distribution. True or False?

10. When the dynamics model and the measurement model are linear functions, the Extended Kalman Filter and the Kalman Filter are identical. True or False?