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## CS485 AUTONOMOUS ROBOTICS

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### Homework 3 Probabilistic Robotics

**Due:** April 7 before class

**Name:**

**G Number:**

**Email:**

## 1 Robot State Estimation

What is the total joint probability the **original** robot state estimation problem aims to solve? Please explain every notation in your equation. (10 points)

What are the three assumptions we make to simplify the original robot state estimation problem? (10 points)

What is the simplified joint probability distribution after we incorporate our three assumptions? Please explain each term in your equation. (10 points)

## 2 Sleepy Driver HMM

Derive the entire state distribution of the Sleepy Driver HMM problem discussed in class, in which the driver sees yellow, yellow, and white in the first three time steps. Use the same prior, motion/state transition model, and observation model in the slides. Provide as many details as you can. (50 points)

### 3 Filter Algorithms

What two assumptions does KF make during robot state estimation? (5 points)

What two quantities does KF keep track of to represent robot state? (5 points)

What is the difference between KF and EKF? What extra procedure you need to perform for EKF compared to for KF? (10 points)