CSC477: Introduction to Mobile Robotics
Quiz 0

September 5, 2019

1   Instructions

This quiz will not affect your marks. It will help me get to know you and understand your skills, preferences, and background knowledge. Its purpose is for me to see how to best enable you to succeed in this course.

2   Personal details

- Name:

- Program and year (e.g. CS Major, year 3):

- Which other courses are you taking this semester? (titles, not course numbers):

- Do you plan to make use of the CS lab machines?

- If so, in person or remotely?

- Do you have access to a GPU?

- If not, what is roughly the CPU model of your laptop/desktop (e.g. i3, i5, i7)?

- Are you comfortable using a Linux distribution (e.g. Ubuntu) on your machine?

3   Your goals for this course

- Are you taking this course for credit, or auditing?

- Why are you interested in this course? What do you hope to learn from it?

4   Background knowledge

For each of the following subjects and skills, rate your level of knowledge and comfort in the range 0 to 5 where: 0 means you have never had any prior exposure to this subject, 5 means that you have mastered it.

Programming Experience

- How comfortable do you feel programming in: Python, C++?

- How much experience do you have with scientific computing libraries (e.g. numpy, scipy, eigen etc.)?

- Have you ever programmed real robot hardware before? If so, give one example.

- Loops, conditionals, classes, modularity

- Threads, callbacks, remote procedure calls, serialization

- Breadth-first and depth-first search

Linear Algebra

- Dot product

- Matrix multiplication

- Matrix inversion

- Determinant

Probability

- In the multivariate normal distribution $\mathbb{N}(x; \mu, \Sigma)$

  – What are the restrictions on the covariance matrix Σ?
  – Is it possible that $p(x) > 1$ for some x?

- If θ denotes the parameters of a model/a hypothesis and x denotes the evidence/the observed data:

  – Write down Bayes' rule:
  – Which of the terms is the posterior?
  – Which of the terms is the likelihood?

- What is the definition of the maximum likelihood estimate?

- What is the definition of the maximum a posteriori estimate?

- Expectation, variance, correlation

- Conditional probability

Optimization

- If $x \in \mathbb{R}^d$ and $A \in \mathbb{R}^{d \times d}$, what is $\frac{\partial (Ax)}{\partial x}$? What about $\frac{\partial (x^\top Ax)}{\partial x}$?

- Do you know how to solve linear least squares problems?

- Do you know how to solve nonlinear least squares problems?

- Do you know how to solve nonlinear least squares problems with equality constraints?

Control Theory

- Do you know what PID control is?

- Do you know what the Linear Quadratic Regulator is?

- Have you taken a course on ordinary differential equations?