# CSC2626: Imitation Learning for Robotics
# Quiz 0

September 14, 2022

## 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:

- Research program and year (e.g. PhD 1st year):

- Department:

- Research area(s):

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

- Do you have access to a GPU?

## 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?

- Do you already have a topic in mind for your final project, or will you be deciding later on?

## 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++, Matlab?

- How much experience do you have with automatic differentiation frameworks for deep learning (e.g. pytorch, jax, tensorflow, theano, mxnet etc.)?

- 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.

**Probability and Inference**

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

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

- If $\theta$ 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?

- Which distances between probability distributions do you know?

- Do you know what variational inference is?

## 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 what stochastic gradient descent is?

- 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?

## Neural Networks

- Do you know what a convolutional neural network (CNN) is?

- Which losses do you know for: (a) classification (b) regression?

- Do you know what a fully connected layer is?

- Do you know what a residual layer is?

- Do you know what Dropout is?

- Do you know what softmax is?

## Control Theory

- Do you know what PID control is?

- Do you know what the Linear Quadratic Regulator is?

- Do you know what Model Predictive Control is?

- Have you taken a course on feedback control?

- Have you taken a course on ordinary differential equations?

**Reinforcement Learning**

- Have you taken a course on reinforcement learning? If so, which one? (online included)

- Which RL algorithms have you implemented or used?

- If $s$ is a state and $a$ is an action, applied to a system with deterministic dynamics $s_{t+1} = f(s_t, a_t)$, stochastic policy $\pi(a_t|s_t)$, and deterministic reward function $r(s, a)$, can you define $Q(s, a)$ and $V(s)$?