Robotics Engineering Graduate Program

Problem Set for Preparation

Dear students,

Welcome to the WPI Robotics Engineering Graduate Program! Robotics engineering is a multi-disciplinary field that builds on the fundamental knowledge of many domains including computer science, electrical engineering, and mechanical engineering. This might sound overwhelming, but no need to worry. This program is designed to equip you with all the skills and knowledge you need. Nevertheless, we would like to encourage you to brush up your linear algebra, differential equations, and basic programming skills before beginning your study at WPI. Therefore, we have prepared this problem set for you. You do not need to submit the solutions to these problems to us; please consider them as guidelines for warming up on these topics.

Basic Programming

1. Using either C++ or Python 3, write a program that gets a positive integer number from the command line, calculates the factorial of the number, and prints it on the screen.
2. Using either C++ or Python 3, write a program that gets a string from the command line, and prints “yes” if the string has the letter “x” in it, and prints “no” otherwise.
3. Using either C++ or Python 3, write a simple calculator program that parses arithmetic expressions such as “(3+2)\*6” and returns the result. The expression to calculate should be passed as a command line argument in quotes.

Basic Linear Algebra

1. For a given matrix, how do you understand that it is orthogonal or not?
2. How do you understand if a matrix is singular or not? What does it mean to be singular?
3. Explain what eigenvectors and eigenvalues of a matrix are. What is a geometric interpretation of a Eigen vector?

Basic Differential Equations

1. Solve for

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1. Solve the integral expressions below:

There are many resources you can find on the internet that can help study these topics. We would like to point you to a couple of them:

<http://www.deeplearningbook.org/contents/linear_algebra.html>

<https://www.tutorialspoint.com/cplusplus/index.htm>

<https://math.libretexts.org/Courses/Monroe_Community_College/MTH_211_Calculus_II/Chapter_8%3A_Introduction_to_Differential_Equations/8.1%3A_Basics_of_Differential_Equations>

We are excited to meet you soon! Please email Professor Berk Calli if you have any questions: [bcalli@wpi.edu](mailto:bcalli@wpi.edu)