CS-AD-216: Foundations of Computer Graphics

Assignment 3, Due: September 29

Instructions:

- Assignments can be submitted in groups of at most three. The purpose of groups is to learn from each other, not to divide work. Each member should participate in solving the problems and have a complete understanding of the solutions submitted.
- Submit your assignments as a zip file (one per group).

Problem 1 (10 points: 2 points each)**.**
In all questions below, the coordinates of the points and vectors are in the standard orthonormal basis: unit vectors along the positive x, y and z directions.

1. Compute all vectors of length 1 perpendicular to the vectors $(1, 2, 3)$ and $(2, 3, 4)$.
2. Compute the angle between the vectors $(2, 3, -1)$ and $(-1, 2, 3)$. You can express your answer using inverse trigonometric functions.
3. Let $\vec{u} = (7, 4, -22)$ and $\vec{v} = (-7, \sqrt{3}, 9.9)$. Compute $(\vec{u} + \vec{v}) \cdot (\vec{u} \times \vec{v})$.
4. Consider a plane in three dimensions passing through the point $(2, 0, -1)$ and having normal $(1, 1, 2)$. What is the implicit equation of the plane?
5. Is the point $(2, 5)$ an affine combination of the points $(6, 3)$ and $(-9, 11)$? Explain your answer.

Problem 2 (10 points)**.**
Write a program that allows the user to draw a bunch of axis parallel rectangles (i.e., the sides of the rectangles are parallel to the coordinate axes). The user draws a rectangles by clicking at two points p and q. These clicks should generate the (unique) axis parallel rectangle who opposite corners are p and q. The next pair of clicks generate another rectangle and so on.

All the rectangles drawn by the user should be displayed at all times, i.e., they shouldn't disappear when the next rectangle is drawn. The rectangles should be monochromatic and the colors should be chosen randomly. You can use `Math.random()` in Javascript for random numbers.

As the rectangles are being added, you don't really need to send the data for all previous rectangles every time you draw a new rectangle. Instead, you want to append data by using the function `gl.bufferSubData(···)`.