# **CS 638**

## **Homework 5: Curves**

Due: Tuesday, November 2, 1999 9:30AM (the beginning of class)

#### **Question 1:**

• We want to define a new type of cubic curve segment where the parameters are:

P0 = the value at the beginning

P1 = the value at the middle (u=.5)

P2 = the derivative of the curve at the middle (u=.5)

P3 = the value at the end (u=1)

Derive the matrix that creates this cubic type (e.g. the matrix that transforms these parameters into "canonical" parameters.

## **Question 2:**

• Define a "double" cubic segment (e.g. two cubic segments that are attached) that allow us to specify the position, first and second derivatives at the beginning, the "center point" (the place where the two segments connect) and the end (the end of the second cubic). The curve must be C2 continuous at the connection.

Derive the two matrices that map from the 5 points to the 8 canonical parameters (2 for each cubic segment).

## **Question 3:**

• Consider a Quintic curve (e.g. including the fifth power). It allows 6 different parameters to be defines (just as a cubic allows 4).

Find the matrix that maps from the following controls to the canonical parameters (hint: it will be 6x6):

P0 = value at u=0

P1 = derivative at u=0

- P2 = value at u=.5
- P3 = derivative at u=.5
- P4 = value at u=1

P5 = derivative at u=1

#### **Question 4:**

• Notice that the curve in the last section has the same controls as two hermit cubic segments that are attached so that the controls at the end of one are shared with the beginning of the next.

Compare the two. Explain why they are different, and provide an example (values for the parameters and a sketch) that illustrates the differences.