LSU EE 7700-2 **Homework 1** **Due: 25 January 2013**

Problem 1: Read up to, and including, Section II, in the paper "GPU Computing," by Owens *et al*. The paper can be found at `http://www.ece.lsu.edu/gp/srefs/Owens-gpus-2008.pdf`. It is freely accessible within the `lsu.edu` domain, outside you will be prompted for a user name and password. The user name is `ee4720`. The password will be given in class. If you've forgotten the password here's a hint: It's why you shouldn't climb into the cage near Tiger Stadium. The password is all lower case and there are no spaces.

This paper provides a brief history of GPUs and explains how and why they were adopted for scientific computation. The material after Section II is dated and so should not be read.

The following definitions may be helpful in reading the paper: *S*hading:Computing the color of a point on a primitive. The color is computed based on the material properties of the primitive (what one might think of as its color) and also on the location and brightness of light sources, etc. *C*oordinate transformation to screen space: Coordinates refer to the location of the vertices of the primitives (usually triangles). The application programmer specifies these in some convenient coordinate space. The screen coordinate space refers to the x and y location of pixels (unit of screen location), and transformation here refers to the mathematical operation of mapping from user coordinate space to screen space. The operation itself consists of multiplying a transformation matrix, a 4×4 matrix, by the user-space coordinate, written as a four-component column vector (with the fourth component set to 1).

After reading the paper answer the following question^{-1}.

(*a*) The paper might be difficult to read for first-year graduate students without a strong computer architecture background. Find a term or sentence in the paper that you could not understand. Write down the sentence, which page it's on, and your best guess as to what it means.

NOTE: The questions below **are not** *based on the Owens paper from the previous problem. Answer the questions below using material covered in class.*

Problem 2: LISP machines were developed for use in artificial intelligence (AI) research. Many video games have an AI component. Why do you think AI processing units were not (or would not be) successful?

Problem 3: You are in charge of a computing system that computes daily reports. Currently they take 6 hours to compute using eight cores, that is, $t(8) = 6$ hours. The single-core execution time is $t(1) = 32$ hours. The program is written to run on any number of cores.

Your goal is to get the system to compute a result in 4 hours using a budget of $6000. There are two options, buy an additional eight cores for $6000 or hire a programmer at the rate of $20 to $100 per hour (depending on who you hire).

Choose an option and justify your answer. Either answer can be correct. As part of the solution estimate the execution time of the program on a sixteen-core system and the chances that the programmers you hire can improve speedup sufficiently for a 4-hour run.

Note that this is only a fictional assignment, you don't get to keep any left over money.