# ELEC 4200 Lab#8
# Simulation and Synthesis of a Stored Program Computer Architecture

AUBURN
UNIVERSITY

SAMUEL GINN
COLLEGE OF ENGINEERING

- References you may need:
  - **PicoBlaze_Manual.pdf**
  - **Pico_Blaze_Users_Guide.pdf**

# Overview

- Simulate, synthesize, download and run a tutorial program using PicoBlaze
- Write a PicoBlaze assembly language program to perform hexadecimal to 7-segment display conversion
- Be sure to complete both circuits before you leave.

# Pre-lab Assignment

- Study the *PicoBlaze User Manual*:
  - Pages 6-24: KCPSM6 architecture and project creation
  - Pages 45-46: HDL simulation features
  - Pages 48-100: KCPSM6 assembler and instruction set
- Additional information is available in the *PicoBlaze 8-bit Embedded Controller User Guide*
  - Covers all PicoBlaze versions: Spartan-3/6, Virtex-5/6, **Series 7**
  - **The instruction set simulator is not available for Series 7**
- Write an assembly language program for PicoBlaze to implement a hexadecimal to 7-segment decoder with
  - HEX input IN PORT
  - 7-segment data on OUT PORT

Note: The *User Manual* and *User Guide* are your friends. If you have a question try to look in those documents first.

# Lab Exercise

- Download & extract the PicoBlaze.zip file from the class web page
  - Assemble your assembly language program using KCPSM6.exe.
  - Create a new project, including the KCPSM6.vhd and VHDL ROM file produced by the assembler.
  - Copy or create a top-level VHDL model, instantiating the KCPSM6 CPU and ROM.
  - Simulate the VHDL model with Aldec Active-HDL to verify your program and model.
  - Synthesize and download your model, with input port connected to switches and output port connected to LEDs.
  - Record the number of slices from the synthesis report.
  - Demonstrate synthesized circuitry to the GTA.
- Repeat the above steps for your hex-to-7segment decoder program

# Tips and Tricks

- Note: increasing the number of “output" instructions will increase the brightness of the display
- An alternate approach is to include a latch or register enabled by the PicoBlaze WRITE STROBE to hold the 7-segment values. You can use one of the following:
  - 1 You can include a level-sensitive latch
  - 2 Your parallel load register from Lab 5

# Report Guidelines

- Be sure to include all sections required by the lab manual guidelines. In addition be sure your report includes the following:
  - PicoBlaze assembly code
  - Description of you assembly program and how it works
  - Steps taken to simulate, synthesize, and download your model
  - Synthesis results (LUTs, FFs, slices, etc)
  - What went right and wrong in your design and program
  - Answer to the following question

You have now used three methods to create a 7-segment decoder: PicoBlaze, VHDL (logic equations), and VHDL (behavioral model). Discuss the ease of coding, simulating, debugging and efficiency of these three implementation methods.