EMB3, spring 2014:
Pong Power Player Project

Minimum project requirements:

- Receive and interpret the VGA signal
  - Remove the noise in the image
    for instance using the optimized sliding average filter from the exercise (lecture 3).
  - Locate ball and bat
  - Calculate the “speed” of the ball

- Transmit the filtered VGA signal to a monitor for verification
  - Change the color of the ball according to the speed

- Make an AI to control the left bat
  - Use MicroBlaze:
    - To send the control commands via UART to the computer

- Use HW Dip-Switches to:
  - Enable/Disable the AI

- Use HW pushbuttons to:
  - Control the left bat manually (when AI is disabled)

- Use ChipScope to (when AI is disabled):
  - Disable pushbutton control of the left bat and enable chipscope control of it.
  - Control the left bat manually using ChipScope.

- Use PlanAhead to floorplan your design
  - Minimum requirement is pblocks for each of your own second-level (blockdiagram) design blocks (except ChipScope blocks).

- Hand in:
  - Individual report
  - Working bit file
  - ReadMe.txt file with a short user guide for your design
  - A zip file with all source + project files

If you have time:

- Use HW Dip-Switches to:
  - Activate/De-activate the individual parts of the design which alters the VGA signal (noise filtering, ball recoloring, etc.)
    THIS IS STRONGLY ENCOURAGED AS IT WILL EASE DEBUGGING AS WELL AS SHOW YOU HAVE PARTITIONED OUT DESIGN IN AN APPRIPIATE MANOR!

- Connect a real keyboard (PS2) to the FPGA and use it for control.
- Make an evil AI that can beat the computer!
- Make an advanced filtering algorithm to remove the noise instead of using the simple sliding average filter.
- Make a whole new graphics engine to completely redraw the picture (using the extracted coordinates of ball and bat's). (You must still be able to output the original filtered + recolored signal)
- Your own ideas!

Important data:

- Ball size: 20x20 pixels
- Bat size: 20x100 pixels
- X-position of the upper-left corner of the left bat: 20
- X-position of the upper-left corner of the right bat: <horizontal resolution> - 40 (at 640x480: 600)
- UART parameters: 115200 kbps, 8 data bits, 1 stop bit, no parity, no flow-control
- UART Control protocol:
  - Send: 'U' to move bat up, 'D' to move bat down, 'S' to stop bat
  - Bat will continue to move, until a new command is received