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**CS152A Creative lab proposal**

1. **Design Description:**

In this project, we recreate the classic arcade game Pong using the Nexys3 FPGA board. We use the VGA port on the board to output video to a monitor, on which the game will be displayed. The game will allow for two players to play head-to-head, in a first to eleven game. The game will utilize 2 joysticks as controls for player movement, a Pause button, a Reset button, and a Start/End button.

The game begins when the start button is hit. This will be the central button on the FPGA. Each player will use their joystick to control the vertical movement of their paddle (a white rectangle). The ball (a small white square) begins by Player 2’s paddle. When Player 2 moves their joystick, the ball will be launched off the side of their paddle, across the central dotted line, and into play. The ball may hit the top and bottom “walls” of the rectangular field of play, after which it continues its motion, except with the vertical component of its velocity reflected across the ball’s vertical axis. If, for example, the ball gets behind Player 1, it will then hit the wall behind them, giving Player 2 a point. Then, the ball is played in front of Player 1 for the next round to begin. The game continues in this fashion until either player scores 11 points. At that point, the score resets, and the scores are reset back to 0.

**2. Design Milestones and Grading Rubrics**

Static Display ( 25%):

All aspects of the game are correctly displayed before the game begins. One paddle on each side of the screen, a dotted line in the middle, a ball, and two scores, one for each player. There should not be any noticeable flicker on the screen.

Paddle Movement (25%):

Game accurately reads input from joysticks. When joystick is moved up, paddle is moved in +Y direction at constant rate, unless if it runs into top barrier. Movement in -Y direction behaves in same fashion. When joystick is moved in horizontal directions, no movement is displayed on monitor, as if the joystick was pressed in a direction. When the joystick is pointing straight up along the Z axis, no movement is displayed. There is no identifiable delay between movement of physical joystick and movement of paddle on screen. Paddles do not move until game begins.

Ball Movement (30%):

Ball begins next to paddle of appropriate Player. Once paddle moves, the ball moves away from the paddle, normal to the paddle’s surface and its velocity. Ball’s movement is bounded by the game’s walls. For top and bottom walls, the ball bounces off, continuing with same constant horizontal velocity, however the vertical component’s direction is derived from the product of the ball’s initial velocity and the normal vector of the wall. When ball makes contact with a paddle, it’s horizontal velocity is inverted, and the vertical component is normal to the ball’s motion and the motion of the paddle. If the ball make contact with a back wall, it disappears for 2 seconds before reappearing by the other player’s paddle.

Scorekeeping & Game Management (20%):

Score for each player is displayed at top of screen and is a counter, counting up from 0. Each time a player scores, their score is incremented. When one player’s score reaches 11, the game is over and scores reset. If the Pause button is hit, then the game pauses, ball is held in place and paddles do not respond to joystick. Scores are kept as is. If the Start/End button is hit while in the game, the game will end, turning off the display. On next play, the scores will start back at 0. If the Reset button is hit, ball and paddle placements return to their original position, and scores go back to 0.