ECE 278 HW4 - Interrupt-Driven Reaction Game

Objective

Design and implement an interrupt-driven reaction game on the Altera DE1-SoC FPGA board using your designed Nios II system. The goal is to use push button switches (KEY[0]–KEY[3]), LEDs (LED[0]–LED[9]), seven-segment displays (HEX[0]–HEX[5]), and optionally a slider switch (SW[0]) to create a timed reaction game to test a players' reflex. The game lasts exactly 1 minutes per session and uses the following components by applying the Nios II HAL API to handle interrupts, **process logic**, and demonstrate the system's functionality.

- **Push Buttons (KEY[0]–KEY[3])**: KEY[0] starts or restarts the game, KEY[1]–KEY[3] are used to match displayed LED patterns, and KEY[3] can also stop the game early.
- **LEDs (LED[0]–LED[3])**: Display random patterns (values 1–15 in decimal, corresponding to binary patterns on LED[0]–LED[3]) at a fixed frequency (e.g., every 1 second, 0.5 seconds, or 0.25 seconds) within each game.
- **Seven-Segment Displays**: Show the player's score (0–99).
- **Slider Switch (SW[0], optional)**: Toggles between normal and hard difficulty modes, affecting the pattern frequency.
- **Interval Timer**: Generates interrupts every 100ms to control game timing and pattern changes.

Scoring and Feedback

If a button presses match the pattern's will receive a score of 10 (capped at 99). Incorrect presses (e.g., KEY[1] instead of KEY[2]) or no response within the frequency period deducts 5 points.

Pattern Frequency:

Must be chosen randomly at game start from 1s, 0.5s, 0.25s 0r (10, 5, 3 ticks at 100ms per tick). Example: If pattern_frequency = 5 (0.5s), a new pattern appears every 0.5 seconds, requiring quick responses.

Optional: In hard mode (difficulty = 1), frequencies are halved (e.g., 0.5s, 0.25s, 0.125s).