PyQt5 Advanced Mini-Project Exam

Mini-Project: Interactive Ball Game

Create an interactive PyQt5 application where the user controls a paddle to bounce a ball. The ball moves around the screen, and the player must prevent it from falling off the bottom edge. The game ends when the ball hits the bottom edge, and the score is displayed.

Requirements and Questions

Question 1: Create the Game Window (3 Marks)

- Create a `QMainWindow` with a fixed size of 800x600 pixels.
- Use a `QGraphicsView` and `QGraphicsScene` to display the game elements.
- Set the background color of the scene to light gray.

Question 2: Add the Ball (4 Marks)

- Add a ball (a `QGraphicsEllipseItem`) to the scene at a random starting position near the top of the window.
- The ball should have a diameter of 30 pixels and be colored blue.
- Use `QTimer` to animate the ball's movement. The ball should move diagonally at a constant speed.
- If the ball collides with the window's edges (top, left, or right), it should bounce off.

Question 3: Add the Paddle (4 Marks)

- Add a paddle (a `QGraphicsRectItem`) to the scene at the bottom of the window.
- The paddle should be 100 pixels wide and 20 pixels tall, colored green.
- Allow the user to move the paddle left and right using the arrow keys.
- Ensure the paddle cannot move outside the window's boundaries.

Question 4: Handle Collisions (4 Marks)

- Detect collisions between the ball and the paddle.
- When the ball hits the paddle, it should bounce upward.
- If the ball hits the bottom edge of the window, the game should end, and a message box should display "Game Over!".

Question 5: Display the Score (3 Marks)

- Display the player's score in the top-left corner of the window using a `QLabel`.
- Increase the score by 1 every time the ball bounces off the paddle.
- When the game ends, display the final score in the "Game Over!" message box.

Question 6: Restart the Game (2 Marks)

- Add a "Restart" button to the window.
- When clicked, the button should reset the ball's position, reset the score, and restart the game.

Total Marks: 20

- Question 1: 3 Marks
- Question 2: 4 Marks
- Question 3: 4 Marks
- Question 4: 4 Marks
- Question 5: 3 Marks
- Question 6: 2 Marks

Estimated Duration: 3 Hours

This mini-project tests your ability to work with `QGraphicsScene`, `QTimer`, event handling, and custom logic in PyQt5. Good luck!