Game Engine Architecture – Lab #4

The objective of this exercise is to code the game *space invaders* using the avancez library. The game shall use components and events and will optimize performance using a data-oriented approach.

Description:

Space Invaders consists of four different objects: the player ship, the aliens, the aliens' bombs and the player's rockets. The goal of the game is to shoot as many aliens as possible without being hit by them or their bombs.

The player ship
The player ship is placed at the bottom of the screen. It can only move horizontally. It can fire rockets at the aliens. The ship can take three hits from aliens or their bombs before it is destroyed and the game is over.

The rockets
The rockets travel straight up. If they hit an alien, the alien and the rocket are destroyed, and the player's score is increased. Rockets cannot destroy bombs. When the rocket reaches the top of the screen, it disappears.

The aliens
The aliens start out at the top left corner of the screen, organized in rows and columns. They move slowly to the right, until the rightmost alien reaches the border of the screen. Then, they all take one step down, and start travel to the left instead. If the alien collides with the player, the alien is destroyed and the player's health is decreased. The aliens drop bombs randomly.

The bombs
The bombs travel straight down. If they hit the player, the player's health is decreased and the bomb is destroyed. When a bomb reaches the bottom of the screen, it disappears. Bombs don't hurt other aliens.

The end of the game
If the player is hit three times by aliens or their bombs, or an alien reaches the bottom of the screen, the player loses and the game is over. If the player kills all aliens, a new alien army should be created at the top of the screen.

Codebase:

You will find an extended version of the engine, compared with Lab3. In particular, you will find additional classes defining game objects, components, object pools and the implementation of a message passing mechanism. Also, there is a class "game", where the game loop is implemented.

Your task is to extend the codebase and complete the game implementation. See the executable invaders.exe as an example of the expected result.

The sample implements the player ship and can shoot bullets which are retrieved from an object pool.

Subtasks:

1) Check the functionalities in the game_object and component classes. How are messages sent and received?
2) Define the component and the game object for a single alien, which moves from one side to the screen to the opposite side, steps down and back.
3) Make the alien shoot a single rocket at random intervals.
4) Implement the collision between
    a. the rockets and the player ship
    b. the bullets and the alien

    hint: have a look at the component subclasses in component.h.

    note: don't worry about spatial data structures for this assignment.
5) add a grid of aliens.
6) add winning and losing conditions:
    a. the player loses when either it is hit three times, or the aliens reach the bottom of the screen;
    b. the player wins if kills all the aliens; in this case another grid of aliens is generated and the time of the game is accelerated by 1.2x. The score is multiplied by the same factor.
7) Add a user interface showing
    a. The number of lives
    b. The current score
    c. The current time multiplication factor