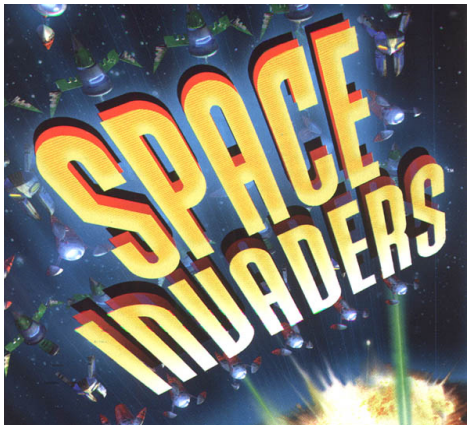
COMPUTATION II - 5EIB0

PROGRAMMING:

FINAL TASK

PART 2 OF 2:

SPACE INVADERS



NOTE: IF YOU CAN THINK OF SOMETHING BETTER YOU COULD CREATE WITH THE KNOWLEDGE YOU LEARNED IN PART 1 OF THIS TASK, THEN IT IS POSSIBLE TO TURN YOUR IDEA INTO YOUR FINAL TASK! IF YOU HAVE A NICE IDEA, CONTACT YOUR INSTRUCTOR AND DISCUSS IT. YOU WILL NEED APPROVAL FIRST.

MARCH, 2016

FINAL TASK, PART 2: SPACE INVADERS

In this part of the task old times relive. You will create your own version of the world famous Space Invaders game! The game is essentially quite simple. The player can move a small cannon on the bottom of the screen from left to right. When the player presses the spacebar the cannon will fire a shell. The player should target the aliens above the cannon. Whenever an alien is hit by a shell it is destroyed. To make things a little bit harder the aliens move from left to right and drop bombs every now and then. When a player is hit by a bomb, one life out of three is lost. A number of stone bridges are present. These protect the player from bombs, but they are slowly destroyed with every impact. The object of the game is to destroy as many aliens as possible and save the world! To sum things up, Space Invaders consists of 6 different elements:

- A cannon on the bottom of the screen
- Aliens moving sideways and slowly fall down.
- Bombs dropped by aliens
- Shells fired by the player
- Stone bridges where the player can find shelter (optional)
- A score monitor which displays the number of lives left and the current score

Check http://www.thepcmanwebsite.com/media/flash_space_invaders/ for an example.

THE CANNON

The cannon can be as easy as a rectangle with a small tip on top of it to simulate the barrel. The hard part is moving the cannon around and making sure fired shells fly away. How you can create moving objects is described below. Another difficult thing is detecting an impact of the shell with an alien. This is also described below.

MOVING OBJECT

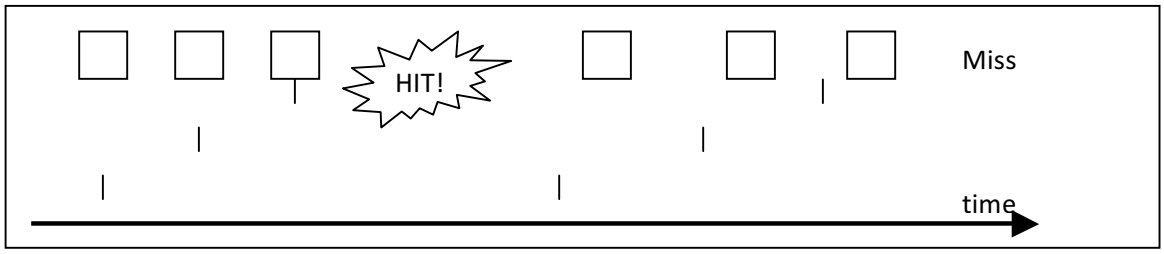
A moving object can be created by drawing the same figure in different places while time passes. Remember the timers demonstrated in the first part of the assignment? You will now have to use them. Each time your timer callback is called, you will have to simulate the time that has passed in between. A simple accelerating object can be created by using the following equations:

```
#define DT 0.001 //Constant defining the overall speed of the game
dvx = ax*DT;     //Change of speed in the x-direction
dvy = ay*DT;     //Change of speed in the y-direction
vx = vx + dvx;   //Speed in the x-direction
vy = vy + dvy;   //Speed in the y-direction
dx = vx*DT;      //Displacement in the x-direction
dy = vy*DT;      //Displacement in the y-direction
x  = x + dx;     //New x position
y  = y + dy;     //New y position
```

Because the amount of time that passes between each frame is very small, you can calculate all data points using the differential equations above. After calculating the new position of the object, you can reset the timer, so it gets called again when a new frame has to be generated. Finally, you should tell Glut that a new frame should be displayed, using the `glutPostRedisplay` function.

OBJECT COLLISIONS

In general it is very hard to detect collisions between objects. In Space Invaders however the problem can be simplified a great deal if rectangular shapes are used to represent the aliens and the cannon shells. Every alien has an x and y coordinate. A fired shell also has an x and y coordinate. To check for a collision you can use the following pseudo code, in which width refers to the width of an alien. You still have to adapt this code a bit, but it gives you an idea of how to solve the problem.




```
if(shell->y == alien->y) {
    if((alien->x – width) < shell->x && shell->x < (alien->x + width)) {
        // Remove the alien
    }
}
```

THE SCOREBOARD

The scoreboard is essentially a small piece of text that gets updated each time an alien is destroyed. The scoreboard also should display the number of lives the player has left.

WHAT WE WOULD LIKE YOU TO BUILD

We would like you to build a version of Space Invaders. The player should be able to move the cannon and shoot at aliens. The aliens have to move from left to right and slowly fall towards the bottom of the screen. The aliens should also drop bombs. The stone bridges are optional. You are encouraged to expand Space Invaders with your own ideas. You could for example load different backgrounds or even moving backgrounds.

Good luck!