T-637-GEDE Game Engine Architecture
Problem Set 1 – Due Monday February 8th, 2016

Problem 1 – Engine Design (25%)

Imagine that you are developing a game engine that you want to use with your own game, an open world RPG, but also license to other developers. At some point you have to implement an in-game map and compass system, where the player can bring up a visual representation of the world from a top-down perspective, with various landmarks, fog-of-war, discovered locations, quest goal markers and user defined goal markers. This is automatically generated from how the world is represented within the game engine. There is also a linked compass system that displays on a HUD where the player is facing, as well as where on the horizon the various markers are located. How much of this map and compass system would you implement as part of the game engine you intend to share with others and how much would be specific to your own game? How does this depend on what genre of games your engine should support? What possible platform specific things might you have to consider?

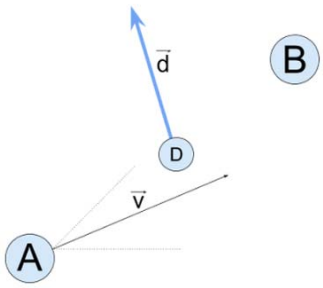
Problem 2 – Space Trouble (25%)

A. Our trusty spaceship captain is hungry, supposedly they at the Restaurant at the End of the Universe sell some mighty fine doughnuts. The ship flies at 240 astronomical units (AU) per hour in the direction **d=<3,1,7>** which leads straight to the restaurant. The flight will take some time and the captain wants to visualize the ship flying in space graphically. He has everything ready except the vector to add to the ship's location per rendered frame. The 3D visualization device refreshes at 30 frames per second. Find the vector that has to be added to the ship's location per update of the 3D environment. Given that one unit of the 3D environment is 1 AU and the location of the ship is updated once per rendered frame.
B. With the 3D visualization ready the captain notices that the current path takes him awfully close to a Vogon toll station. That station is located at **M=(70, 6 , 108.5)** with the current ship's location **S=(30,-4,9)**. Does the captain need to alter his current path to steer away from the station's scanners? The minimum safe distance from the scanners is 3 AU. You can assume that the current path is just a straight line in the same direction as used in part A. Show your calculations.

Problem 3 – Guards! (25%)

A. In a stealth game we have Guard (**A**) and Player (**B**). The Player is trying to sneak past a sleeping guard but bumps into something that makes a noise that wakes the Guard up. Once awake, the Guard looks in the general direction of the noise, but he is slow, so the Player has managed to move a bit further. The Player is now located at **B=(13,10)**, the Guard at **A=(4,4)** looking in the direction **v=<4,1>** with a viewing cone 60° wide. Is the Player inside the viewing cone of the Guard? Show your calculations.

B. Now let's imagine there is a wall in the environment. The wall ends at point **D=(10,8)** and lies on the axis **<u>d</u>=<-1,4>**. You can assume that the player and the guard occupy an infinitely small point in space, and the wall ends in a single point and is infinitely long in the direction **<u>d</u>**. Does the wall provide cover for the player? Show your calculations. You can use the image for reference but not accurate measurements.



Problem 4 – Setting Sun (25%)

We have a polygon (triangle) in 3D space defined by three vertices $\mathbf{P_0=(-2,3,0)}$, $\mathbf{P_1=(2,3,-2)}$ and $\mathbf{P_2=(5,5,3)}$. The „up"-side of the polygon is defined as the side which has the three vertices ordered in counter-clockwise order (from 0 to 2). We have a light source at **L=(-10,20,-10)**. Is the polygon lit up by the light (i.e. does the light shine on top of the polygon) or has it descended into darkness?