COMP4122 Game Design and Development

Assignment 1

Instructions to the students

- There are five questions. Each question carries 20 marks.
- Use a word file to complete your assignment.
- Fill in your student ID. Variables will be used in the questions.

Fill in your Student ID									D
Add 1 if the digit is 0									
Variables in Questions			stA	stB	stC	stD	stE	stF	

- Question 1 -

Demon Slayer: The Hinokami Chronicles is a 3D fighting game on PlayStation that is based on the ACG, Demon Slayer. Suppose you are the game programmer of this game; you will simulate the techniques of the water breathing by using programming.

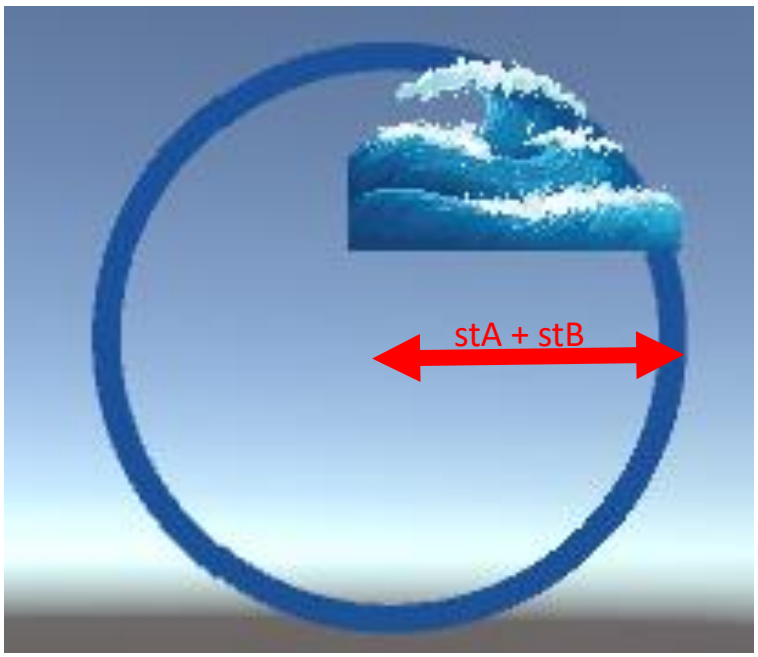
Second Form: Water Wheel of the water breathing in Demon Slayer

- Cartoon presentation. https://www.youtube.com/watch?v=C8_bE7FIDtg
- Game presentation. https://youtu.be/JZRWkKhBnh0?t=31

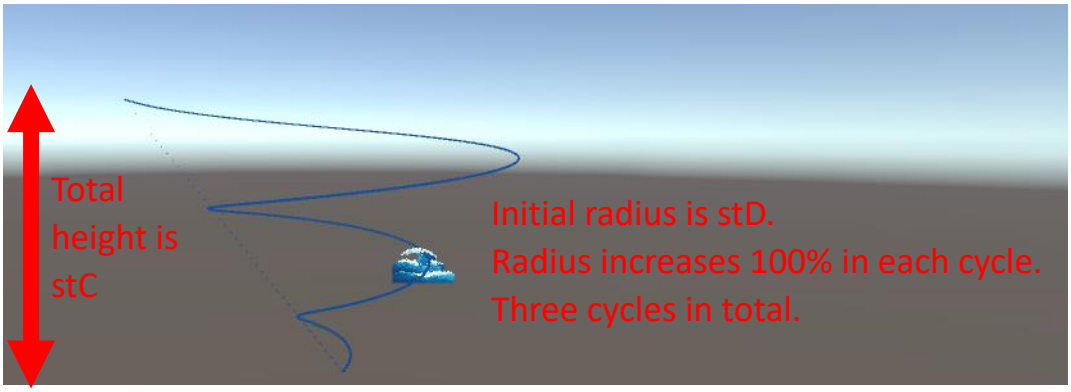
Sixth Form: Whirlpool of the water breathing in Demon Slayer

- Cartoon presentation. https://www.youtube.com/watch?v=npLc0O3X6Yg
- Game presentation. https://youtu.be/i1LsIPdsl8Q?t=23

(a) [5 marks] Simulate the Second Form: Water Wheel of the water breathing. The particle system is simplified. Suppose a PNG file is given to you, animate the PNG file according to the following path on the XY plane. Write down the pseudo-code.



(b) [8 marks] Simulate the Sixth Form: Whirlpool of the water breathing. The particle system is simplified. Suppose a PNG file is given to you, animate the PNG file according to the following path in the XYZ space. Write down the pseudo-code.



(c) [7 marks] The particle system that is designed in part (a) and (b) is not attractive. Explain how we can improve the particle system by using emitter and flocking behavior.

- Question 2 -

Paper Mario™: The Origami King is an ARPG game on Nintendo Switch. Paper Mario presents a different art style to the users in the 3D world. Enemies are made up of crafting materials, origami-style. The paper characters continue to have a white border around them to emphasize their flat appearance.

- Game Trailer. https://youtu.be/FX6DTLcWUdY

(a) [6 marks] Calculate the light intensive of a polygon that product by V1 = (3, 5, 6) and V2 = (stD, stE, stF) and a directional light (4, 5, -8).

(b) [9 marks] Explain why the shading of Character A (Mario) and Character B (Olivia) looks different in the 3D world.

(c) [5 marks] Gradient shadow cannot be generated on Character A (Mario) under the spotlight and point light. Suggest a method to solve this situation.

- Question 3 -

Street Fighter is one of the highest-grossing fighting games in 2D. Player can control one character to perform different attacks or moves. Attacks, moves and critical arts are based on the directional, punch and kick buttons.

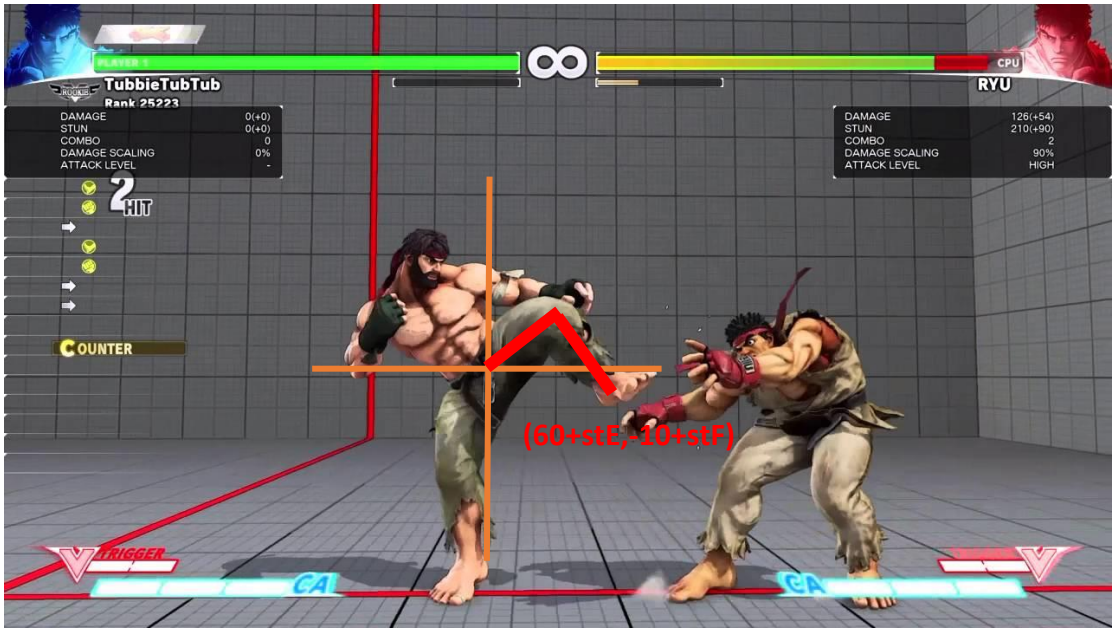


Image source. https://www.polygon.com/street-fighter-5-guide/2017/4/24/14597504/controls

YouTube. https://www.youtube.com/watch?v=ZP4OxNoNC58

(a) [10 marks] RYU is preforming kicking as shown in the figure. The position of his foot is (60 + stE, - 10+stF). His upper and lower leg are 50cm. His leg is moving on the XY plane. Calculate the position of his knee.

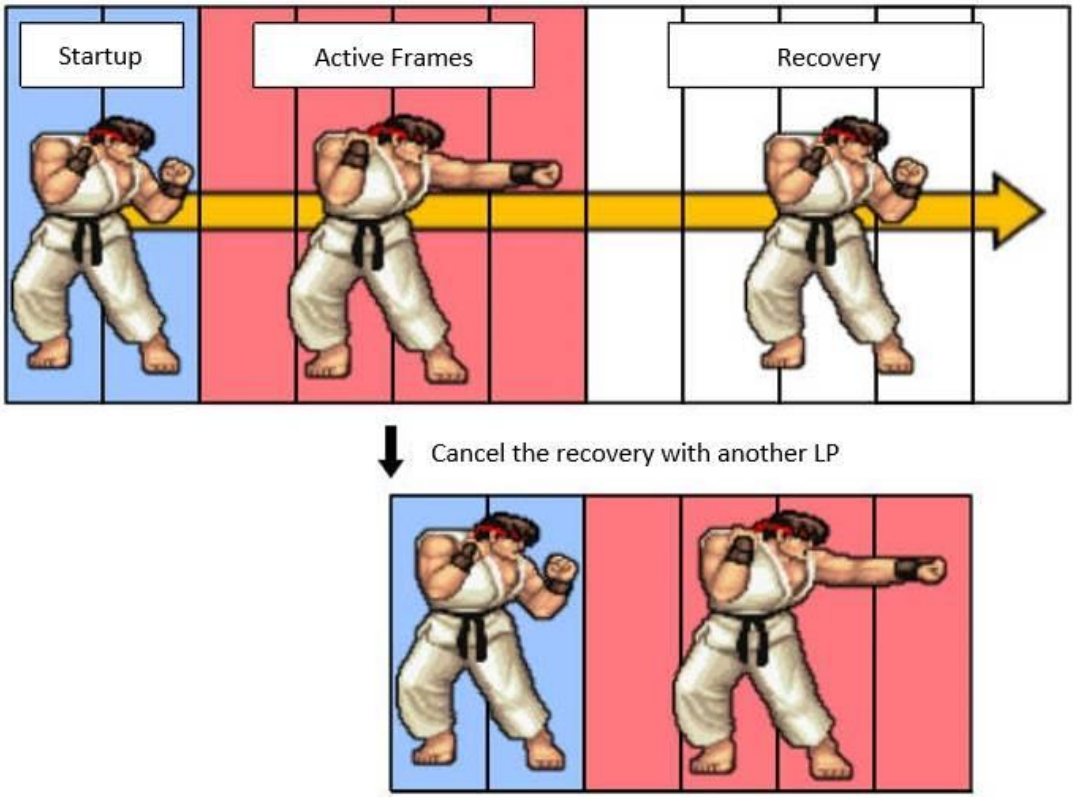


Image source. https://game.capcom.com/cfn/sfv/column/132455?lang=en

YouTube. https://www.youtube.com/watch?v=HyJ__KbHKGk

(b) [10 marks] Each action in street fighter is an animation track. Suppose a player inputs a punch action (TrackA), then cancel the punch action at a certain timeframe ($\triangle$T) and return to idle action (TrackB), then input a kick action (TrackC). Descript the implementation in **3D**.

- Question 4 -

(a) [10 marks] Compute the 3 x 3 rotation matrices that perform a rotation of 30 degrees about the x-, y- and z-axes.

(b) [10 marks] Given three points P1(5,0,0), P2(0,0,5) and P3(10,0,5), calculate the vector normal to the plane containing these three points.

- Question 5 -

a) [10 marks] The order of the transformations sometimes matters. That is, a program that first executes translating (x,y,z) to (x',y',z') and then executes rotating (x',y',z') of 30° may lead to a result different than one that first executes rotating (x,y,z) of 30° and then translates (x',y',z'). Why does the order "sometimes" matter? Give an example when it does not matter.

b) [10 marks] Transformations in computer graphics and animations are represented with 4x4 matrices even though the world is three-dimensional. Why are 4x4 matrices used instead of 3x3 matrices?

- End -