CSS450: Assignment 5 Question Sheet [This assignment carries twice the weight]

The following questions are based on the system we have developed thus far. This is my attempt at drawing my face:
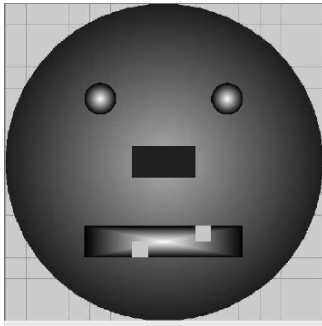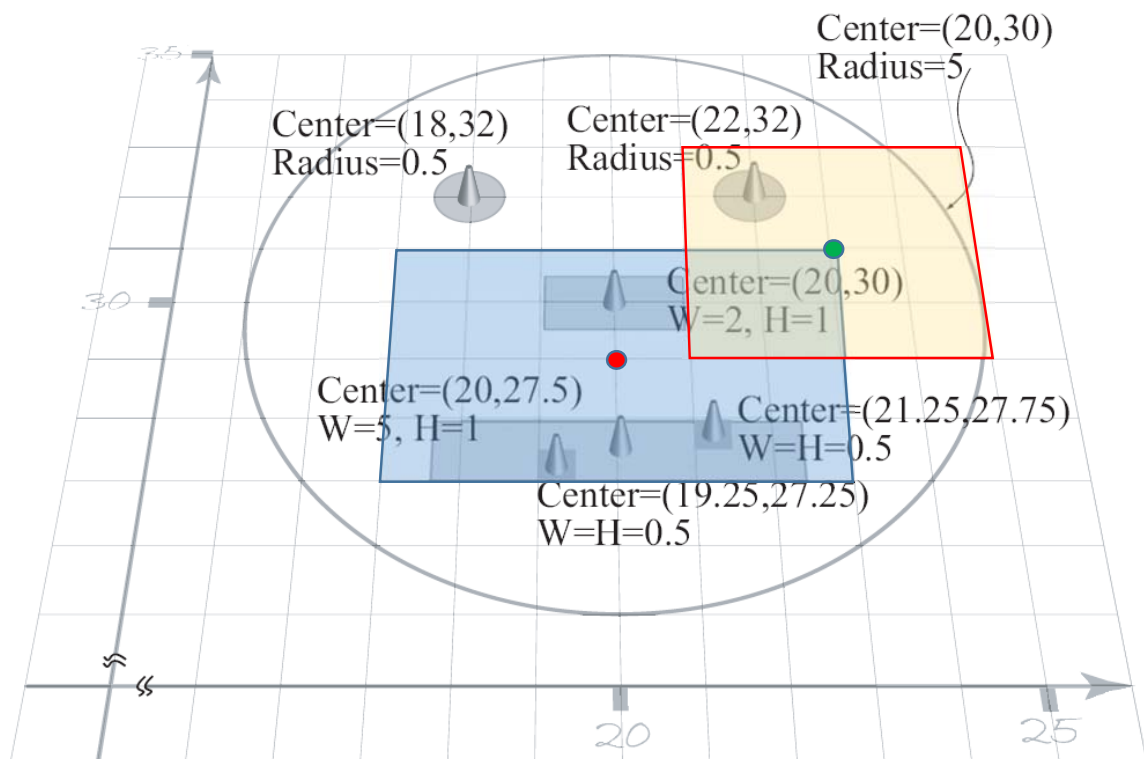

Notice that, my face is made of three circles (one for face outline and two for my eyes), and four squares (one for my nose, one for my mouth, and two for the two teeth left). Here is my design (the "cones" in the drawing are meant to identify the center position of the corresponding shapes):
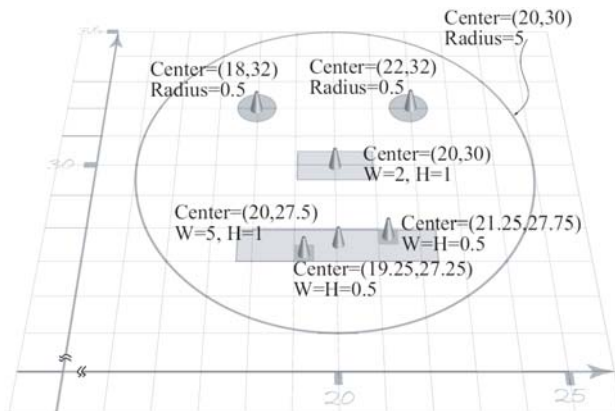
To admire myself, I define two cameras:

- Main:
  - WC Center: (20, 29)   Width=6
  - Viewport: (20, 40, 600, 400)
- Hero:
  - WC Center: (23, 31)   Width= 4
  - Viewport: (0, 0, 40, 40)

Center=(20,30) Radius=5

Center=(18,32) Radius=0.5

Center=(22,32) Radius=0.5

Center=(20,30) W=2, H=1

Center=(20,27.5) W=5, H=1

Center=(21.25,27.75) W=H=0.5

Center=(19.25,27.25) W=H=0.5

1. For the Main Camera

   a. What is the height of the WC Window?

Aspect ratio of viewport: 600/400

WC Height = WC Width * 400/600 = 4

b. For all the pixels you can see in the Viewport, how many of them belong to the circle that represents the outline of my face? NOTE: another way of asking this question is, how many of the pixels are **NOT** covered by one or multiple rectangles.

Total WC Area = 24   Total pixels = 600x400 = 240000

Area occupied by Rectangle = 7   Pixels occupied by rectangle=70000

Area occupied by Circle = 17   Pixels occupied by circle=170000

c. What is the WC position that corresponds to Viewport Coordinate of (120, 240)?

This is 120 units in X (out of 600) and 240 units in Y (out of 400)

Formula from class:

$Xwc = Xwc1 + Vx/Wvp * Wwc$

$Xwc1 = 17$ $Ywc1=27$

$Wwc = 6$ $Hwc = 4$

$Wvp = 600$ $Hvp = 400$

$Vx=120$ $Vy=240$

$Xwc = 17 + 120/600 * 6 = 18.2$

$Ywc = 27 + 240/400 * 4 = 29.4$

d. What is the Viewport Coordinate of WC position (22, 30)?

Invert the equation …

$Vx = (Xwc-Xwc1) * Wvp/Wwc$

Now, Xwc=22,

$Vx = (22-17) * 600/6 = 500$

$Vy = (30-27) * 400/4 = 300$

2. For the Hero Camera

a. What is the WC position that corresponds to Viewport Coordinate of (30, 20)

$Xwc1 = 21$ $Ywc1=29$

$Wwc = 4$ $Hwc = 4$

$Wvp = 40$ $Hvp = 40$

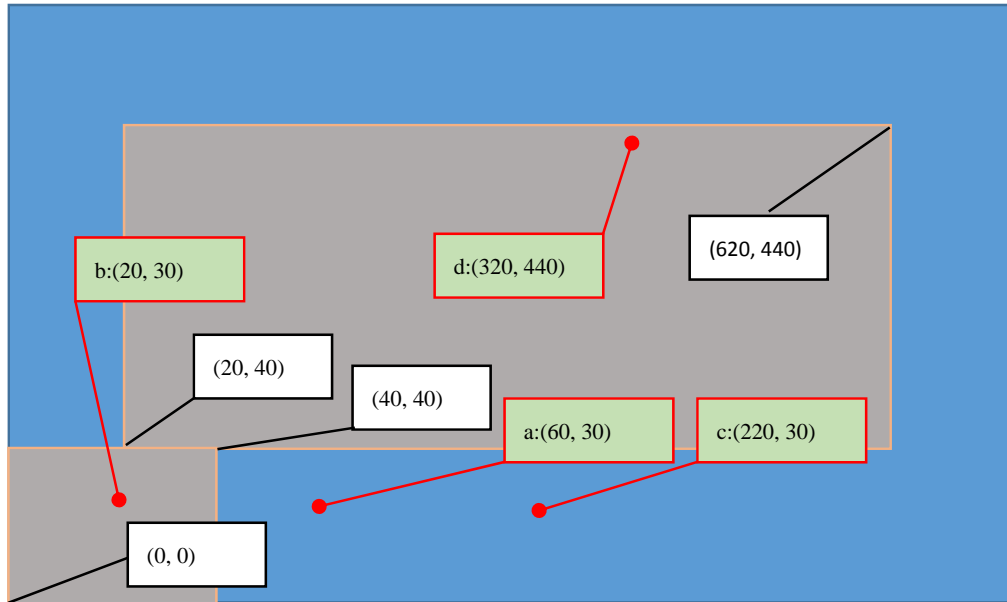$Vx=30$ $Vy=20$

$Xwc = Xwc1 + Vx * Wwc / Wvp = 21 + 30 * (4 /40) = 24$

Ywc = Ywc1 + Vy * Hwc/Hvp = 29 + 20 * (4/40) = 31

      b.   What is the Viewport Coordinate of WC position (22, 30)?

Vx = (Xwc-Xwc1) * Wvp/Wwc = (22-21) * 40/4 = 10

Vy=(Ywc-Ywc1) * Hvp/Hwc = (30-29)*40/4 = 10

This is what the canvas looks like:

3.   What are the WC positions when I click my mouse at:
      a.   Canvas Coordinate position (60, 30)?

Position outside of all Viewport, no corresponding WC   (or say undefined)

      b.   Canvas Coordinate position (20, 30)?

In small viewport,
      Xwc1 = 21   Ywc1=29
      Wwc = 4   Hwc = 4
      Wvp = 40   Hvp = 40

Canvas (20, 30) ➔ Small Viewport: (20, 30)
      Vx=20   Vy=30
   Xwc = Xwc1 + Vx * Wwc / Wvp = 21 + 20 * (4 /40) = 23
   Ywc = Ywc1 + Vy * Hwc/Hvp = 29 + 30 * (4/40) = 32

c. Canvas Coordinate position (220, 30)?

Position outside of all Viewport, no corresponding WC (or say undefined)

d. Canvas Coordinate position (320, 440)?

In large viewport,

X_{wc1} = 17 Y_{wc1}=27

W_{wc} = 6 H_{wc} = 4

W_{vp} = 600 H_{vp} = 400

Canvas (320, 440) ➔ Large Viewport (320 – 20, 440 – 40) = (300, 400)

V_x=300 V_y=400

X_{wc} = X_{wc1} + V_x * W_{wc} / W_{vp} = 17 + 300 * (6 /600) = 17 + 3 = 20

Y_{wc} = Y_{wc1} + V_y * H_{wc}/H_{vp} = 27 + 400 * (4/400) = 27 + 4 = 31