Answers to Written Assignment 4

1. If the dot product between the view vector and the face vector is negative, then the face is back facing. Otherwise, the face is front facing. (We ignore the case when it is zero, as it is a degenerate case).
2. For every edge, there are two faces incident on it, as it is a manifold. If one of the faces is front facing, and the other is back facing (as computed using Answer 1), then that edge is a silhoutte edge.
3. Either you will see nothing (if the pixel is drawn **only** if the incoming pixel's depth value is less than the depth value already existing in the buffer), or you will see a thin silhoutte (if the pixel is drawn if the incoming pixel's depth value is **less than or equal to** the already existing depth value).
4. If the pixels are thickened, then I would **surely** see all the silhoutte edges irrespective of the depth comparison function (whether it is **less than**, or **less than or equal to**).
5. There are more than million colors. There are million polygons. Draw each polygon with a unique color. After drawing all the polygons, read the frame buffer (colors). Since each color belongs to a unique polygon, those are the polygons visible from the viewpoint. Further, this way of finding the visible polygon is up to a pixel accuracy.
6. The depth value at any point is its distance to the cone. This can be computed to be that point's distance from P. Hence, if you draw a cone hinged at P, the depth buffer value at pixel x will be the distance of x from P.
7. If a point x gets a red color, rather than a green color, it means that the cone rested on P is front of the cone rested on Q at x. This means that, at pixel x, the depth value of P's cone is less than the depth value of Q's cone. From Answer 6, since depth and distance from apex are same, we can conclude that the distance of x from P is less than the distance of x from Q. From this argument, we can conclude that, if x gets a red color, then it is closer to P than Q, and if it gets a green color, then it is closer to Q than P.
8. The boundary of the regions of P and Q, from our argument in question 7, should be equidistant from P and Q. Perpendicular bisector is the line that is equidistant from two points. Hence the boundary will be a straight line. There will be no explicit boundary drawn (since no unique color can be given), but the boundary will be *perceived as change in color* from one region to another.
9. From our answer 7, all points closer to P will be red color, and all points closer to Q will have green color. This is exactly the definition of Voronoi region. So R1 will have red color, and R2 will have green color.
10. Consider points on the plane. Draw 45 degree cones hinged at those points and that extends beyond the far plane. Each cone gets a different color. Use orthographic projection to look at the cones from the other side of the plane (as shown in the diagram for Question 7). We will be seeing all regions of the Voronoi diagram in different colors.