



CZ3003

COMPUTER GRAPHICS and VISUALIZATION

LAB 1 REPORT

VISUALIZATION USING POLYGONS

LAB GROUP : SSP6

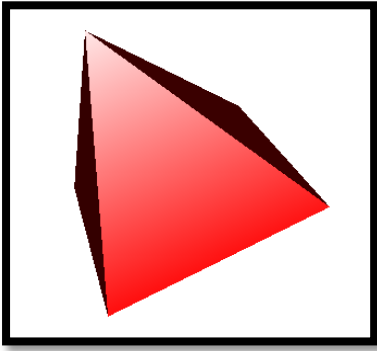
Sam Jian Shen (U1821296L)

School of Computer Science and Engineering
Nanyang Technological University

Contents

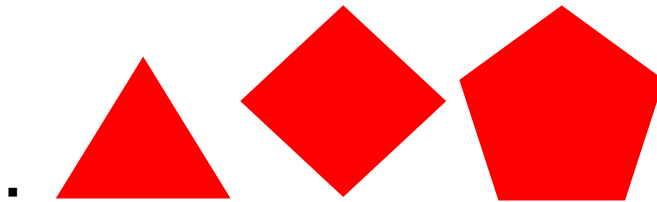
Analysis of polygon mesh.....	3
Graphics Modes	4
Shape Color	6
Changes to polygon mesh	9

Analysis of polygon mesh



Source : polygons.wrl

- Observation
 - o Consist of 5 vertices
 - 1 at the top of the pyramid
 - 4 at the base of the pyramid
 - o Total of 5 surfaces
 - 1 Base of the pyramid
 - 4 Side of the pyramid
- Definition :
 - o A plane shape (2D) with at least 3 straight sides and angles (Triangle).
 - o For example : Triangles, Rectangles , Pentagons etc

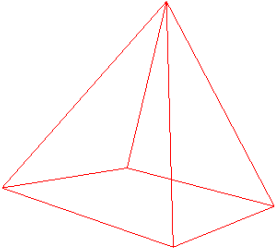

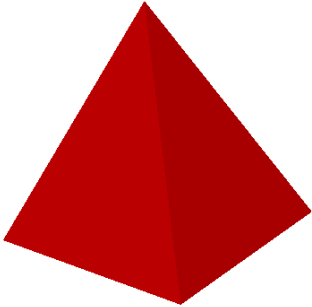
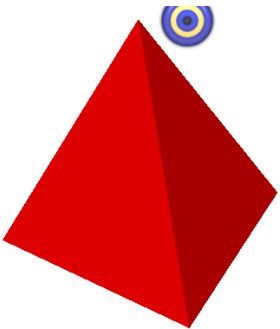


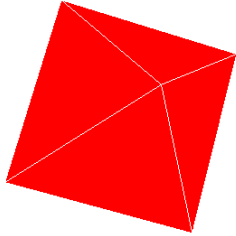
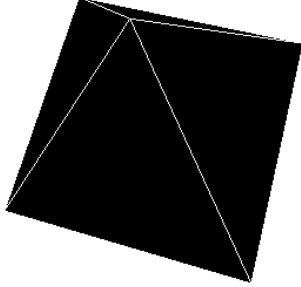
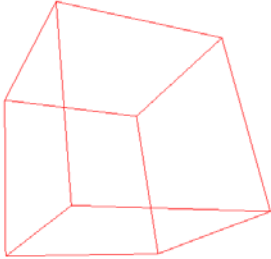
- Base on definition
 - o The polygon shown above has
 - 4 triangular plane
 - 1 square plane
 - Joined with 5 vertices which result in a form of pyramid

Graphics Modes

Steps Approach:

1. Open 'polygons.wrl' with IE
2. Right-click at any space within the window
3. Select 'Graphics'
4. Choose the respective graphic modes

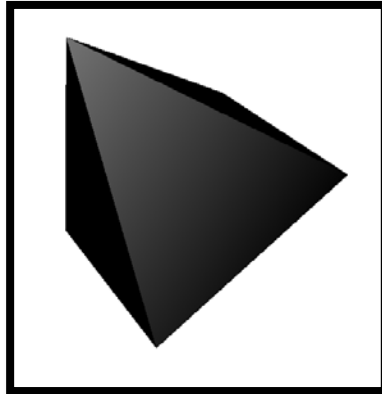
Modes	Result	Remarks :
Wireframes		It display the layout of the figure.
Vertices		It display the vertices of the figure. Note : It is barely visible
Flat		It display the flat surface of the figure.
Smooth		It display the smooth surface of the figure.

Solid		It display white frame at the edge of the polygon which result in white between joint any 2 polygons. This helps to outline a 3D solid object should the lighting effect is absent.
Hidden Line		It display similar to 'Solid' mode. The differences is that it helps in display the joint between polygon more contrast as the polygon surface are render black colour. This also helps identify the line when surface are white colour.
Bounding Boxes		It display the box outline of the figure.

*Note: The remarks are solely base on observation analysis from source: 'polygons.wrl'. The interpretation may differ with other files.

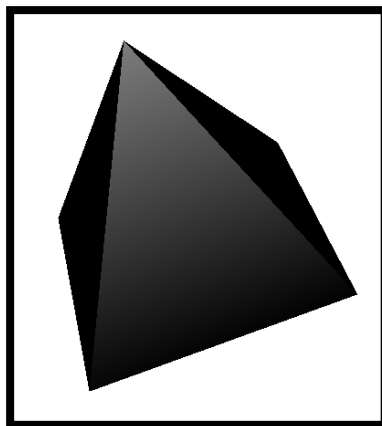
Shape Color

- If value of Red is less than 0
 - o Modify RGB(Red, Green, Blue) (1 0 0 -> -1 0 0) in diffuseColor function from 'polygons.wrl'
 - o Result :



Source : polygons_below_zero.wrl

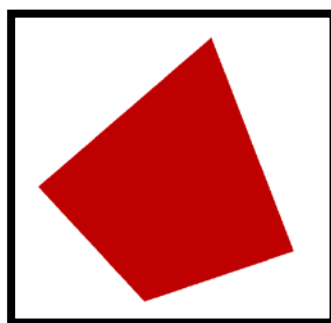
- o Observation
 - This is the same result as RGB 0 0 0 as shown below



Source : polygons_pure_black.wrl

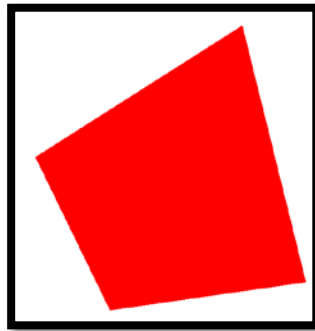
- Therefore any value lower than zero is treated as a value zero
- The reason why it was black because no RGB colour is used (RGB = 0 0 0)

- If value of Red is more than 1
 - o Modify RGB(Red, Green, Blue) (1 0 0 -> 100 0 0) in diffuseColor function from 'polygons.wrl'
 - o Result
 - Before



Source : polygons.wrl

- After



Source : polygons_above_one.wrl

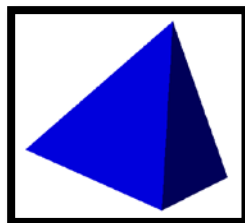
- Observation

- Increase beyond value of 1 result in increased of brightness of the specific colour. In this case, the redness is brighter when value set at 100 as compare to value set at 1.
- This contradicts the statement in the lab experiment 1 statement point 3. It stated that "color values must be real number between 0 and 1." This has proven false as value below 0 or above 1 is consider a valid value by the VRML program. Perhaps, it is an implementation error when designing the limitation of the 'diffuseColor' parameter value limitation.

- Color Analysis

- Blue

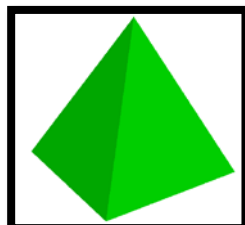
- Changes 1 0 0 -> 0 0 1
- Result :



Source : polygons_blue.wrl

- Green

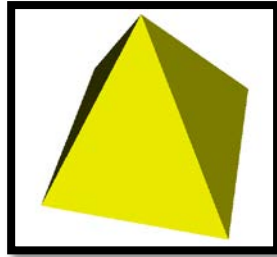
- Changes 1 0 0 -> 0 1 0
- Result :



Source : polygons_green.wrl

- Yellow

- Change 1 0 0 -> 1 1 0
- Result :

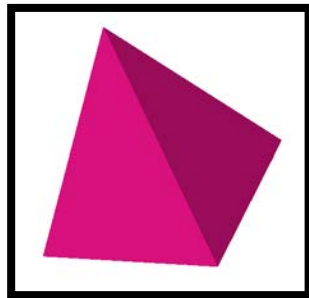


Source : polygons_yellow.wrl

○ Other

■	deeppink	#FF1493	rgb(255,20,147)
---	----------	---------	-----------------

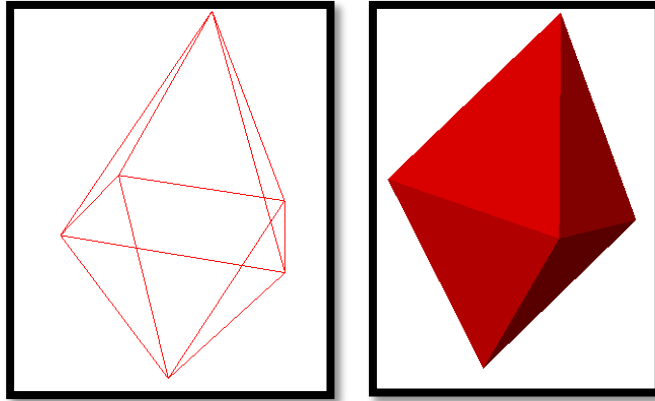
- Source : <https://www.rapidtables.com/web/color/pink-color.html>
- Since value of RGB 8 bits hex value is $2^8 - 1 = 255$
- Colour Range is from 0 ~ 255
- In VRML case Colour Range is from 0 ~ 1
- Scale :
 - 255/255 20/255 147/255 which is equivalent to
 - 1 0.08 0.58
- Result :



Source : deeppink.wrl

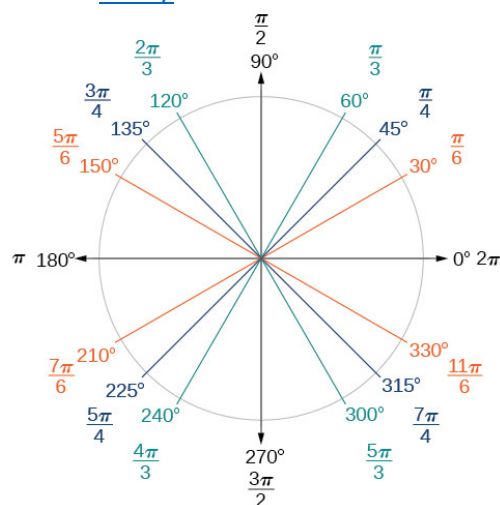
Changes to polygon mesh

- A new polygon mesh develop when adding new vertices and polygons
 - 1 easy way is to add a vertices at the bottom with coordinate (0,-3,0)
 - The reason -3 to create an flip pyramid
 - Result



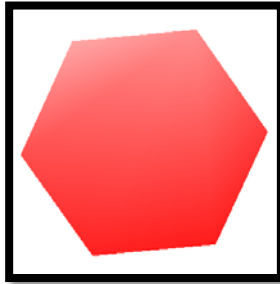
Source : polygons_new.wrl

- 2D regular hexagon
 - A way to form a hexagon shape is using circle with sampling point of 6 since a hexagon consist of 6 vertices.
 - Steps to derived the coordinates of sampling points
 - Assumption :
 - Centre of Circle is at origin (0,0,0)
 - It's radius is 4
 - Given parametric equation of 2D circle is
 - $x = 4\cos\theta$
 - $y = 4\sin\theta$
 - The range of θ in radian form is
 - Unit Circle



- Point of interest is green line which is 60 degree apart

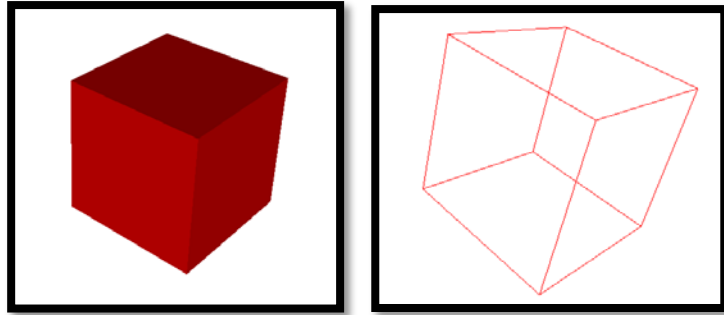
- So the θ is ($\pi/3$, $2\pi/3$, π , $4\pi/3$, $5\pi/3$, 2π)
- Using parametric equation and θ , the 6 coordinate (x,y,z) can be derived
- Evaluation Coordination :
 1. (2, 2sqrt(3),0)
 2. (-2,2sqrt(3),0)
 3. (-4,0,0)
 4. (-2,-2sqrt(3),0)
 5. (2,-2sqrt(3),0)
 6. (4,0,0)
- Evaluation Polygons
 - Basically link all vertices 1,2,3,4,5,6
- Result :



Source : polygons_hex.wrl

- 3D cube

- A cube consist of equal length, breadth and height.
- Steps
 - Assumption:
 - Length, Breadth and Height = 4 units
 - Number of vertices is $4 \times 2 = 8$
 - Therefore individual coordinate is (Note : from vertex 0 ~ 7)
 1. (-2,-2,2)
 2. (2,-2,2)
 3. (2,-2,-2)
 4. (-2,-2,-2)
 5. (-2,2,-2)
 6. (-2,2,2)
 7. (2,2,2)
 8. (2,2,-2)
 - Individual polygon (In order)
 1. 0,3,2,1
 2. 0,1,6,5
 3. 1,2,7,6
 4. 2,3,4,7
 5. 3,0,5,4
 6. 5,6,7,4
 - Result :



Source : polygon_cube.wrl

- Order of vertices changes
 - o There is a pattern that prevents the polygon from display appropriately
 - All vertices must be declared in anti-clockwise order
 - Clock-wise direction results in polygon not able to display correctly as shown below.



- Source : polygons_new_vorder.wrl
- This figure is a reference from 'polygons_new.wrl' file which should show 2 combinations of a pyramid in the opposite direction.
- 2 polygons are in the clockwise direction. This results in the bottom pyramid; an invisible polygon at the front and an inner polygon can be seen beside.
- o One theory that could describe such a phenomenon, is a VRML program is designed to render the visible polygon. There is no reason to render inner polygon which is the opposite order of vertices. Thus, allow better rendering performance.
- o As explained in the lecture, VRML follows Right-Hand-Rule. Where thumb is the only visible side. This means that 1 surface is visible while the other surface not visible.

