

City Project

General Description

Let's build a three-dimensional city as a class. Each person is responsible for one structure (and one detail?). Parts may be distributed randomly or students may select. Each part needs to fill out a three-dimensional region of $-10 \leq x \leq 10$, $-10 \leq y \leq 10$, $0 \leq z \leq 10$ with the center of the ground at $(0, 0, 0)$. Parts can be rescaled as needed when it is all put together. Your structure should be one Graphics3D function. Avoid using Opacity since this will slow down image rendering. Do not Manipulate objects.

Structures

Develop list of structures with the class. Suggestions are below:

School, City Hall, Library, Police Station, Fire Station, Post Office, Park, Office Building(s), Grocery Store, Stadium, House(s), Apartment Building(s), Shopping Center, Movie Theater, Gym/Fitness, Center, Museum, Bank, Train/Bus Station, Restaurant(s), Airport

Details

Some details will be needed when it is all put together to really make it look great. Examples are below:

Cars, Buses, Streets, Trees, Mailboxes, Fire hydrants, Lamp posts

Building the City

One or two students should be responsible for the layout of the city. They can determine the scale for each piece as it will fit into the city plan. These students should also be able to put all the pieces together using scaling and transformations if everyone else structures it according to the directions. Elements can be repeated simply by using their names again.

Example of Putting Parts Together

Note: Part labels are for the list of primitives inside the Graphics3D command. Also, the size of text will not scale, so font sizes will have to be adjusted individually.

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In[21]:= Graphics3D [PartOne = {
  { Blue, Thick , Dashing[Large], Line[{ { 0, 0, 0} , { 5, 5, 5} , { 2, 5, 2} } ]} ,
  { Red, Sphere[{ 2, 2, 2} , 1]} ,
  { Green, Opacity[0.5], Cuboid[{ 1, 2, 0} , { 4 , 3 , 5} ]} ,
  { Orange, Cylinder[{ { 0, 0, 0} , { 3 , 1, 5} } , 1/2]}
} , Boxed → False, Axes → True, AxesEdge → { { - 1, - 1} , { - 1, - 1} , { - 1, - 1} } ]

In[22]:= Graphics3D [PartTwo = {
  { EdgeForm[Thickness[0.01]] , Purple, Polygon[
    { { 0, 0, 0} , { 1, - 4 , - 2} , { 1, 1, 1} , { - 3 , 4 , - 5} , { - 5, - 5, - 5} , { 3 , 4 , 5} } ]} ,
  { Brown, PointSize[0.03 ] , Point[{ 0, - 1, 0} ]} ,
  { Text[Style[" Sample" , 25, Bold] , { 4 , - 1, 1} ]}
} ,
PlotRange → 5, AxesLabel → { " x" , " y" , " z " } ,
Boxed → False, Axes → True, AxesEdge → { { - 1, - 1} , { - 1, - 1} , { - 1, - 1} } ]

In[23]:= Graphics3D [ { PartOne,
  GeometricTransformation[PartTwo,
    ScalingTransform[{ 1 / 4 , 1 / 4 , 1 / 4 } ] . TranslationTransform[{ 5, 0, 0} ] ]
} , PlotRange → 5, AxesLabel → { " x" , " y" , " z " } ,
Boxed → False, Axes → True, AxesEdge → { { - 1, - 1} , { - 1, - 1} , { - 1, - 1} } ]

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