Houdini Workshop

Doughnut

Basic Geo

- [ ] In node graph, TAB to create a new node
- [ ] Search for Geo
- [ ] Call it 01_Body
- [ ] Double-click to open it
- [ ] Create a Torus object
- [ ] Change Rows and Columns to get the correct shape
- [ ] CTRL+LMB click and drag the small circle under the Torus node and search for Mountain
- [ ] You may need to enable the visuble and render options on the node (roll over Mountain node, look for the Eye icon)
- [ ] Alter node properties to suit
- [ ] Add a Transform node to the chain
- [ ] Set Translate Y to -$YMIN - this is a function that sets the object to the "floor" of the scene (i.e. origin - object height)
- [ ] To be able to refer to this later on, we can add a NULL to the end of the node chain
- [ ] Call it OUT
- [ ] Press L to arrange the node items
- [ ] Press Spacebar+H to arrange the node items so you can see them all centered
- [ ] Press U to go "up"/"out" of that item in the node graph - you should see the 01_Body item now

Chocolate

- [ ] Create a new geo node
- [ ] Call it 02_Chocolate
- [ ] Double click into the new node
- [ ] Inside this, we want to refer to the geo we just made, so search for Object Merge
- [ ] In the Properties of this node, look for Object1 and click the icon to the right of this that looks like a bar with a black arrow under it
- [ ] From this Choose Operator menu, go into the 01_Body and choose the OUT operator
- [ ] We now need to "mask" our doughnut geo, so we can select the top part to become the chocolate. To do this, we need to drag out from the small circle under Object_Merge and search for PointVOP (see https://www.sidefx.com/tutorials/introduction-to-vops/ for more info on VOPs)
- [ ] Call the new PointVOP Mask
- [ ] Double click it to open it
- [ ] Zoom into the VOP left hand node and find the N pin (stands for Normals)
- [ ] CTRL+LMB drag from the N pin and search for Dot Product
- [ ] On the Output pin of the Dot Product CTRL+LMB drag and search for Clamp
- [ ] On the Output pin of the Clamp CTRL+LMB and search for Bind Export

- [ ] Change the Name of the Bind Export object to density
- [ ] Press U to go up in the node graph
- [ ] CTRL+LMB drag from the bottom pin on the Mask node and search for Scatter
- [ ] The Scatter node distributes items across our object - but we dont want it to be across all the surface, we want it to be driven by the mask density we set earlier
- [ ] Change the Density Attribute to TRUE and ensure it points to density and should be param
- [ ] Next turn off Force Total Count
- [ ] Then change the Density Scale until you get the look you want (if you are finding this confusing to see, turn off the Display flag on the object_merge node
- [ ] Next, CTRL+LMB drag from the Scatter bottom pin and search for VDB from Particles
- [ ] Change the Voxel Size to 0.02
- [ ] Change Point Radius Scale to 0.06
- [ ] It will look a bit blobby, if you want to smooth this out you need to CTRL+LMB drag from the pin on the bottom of the VDB from Particles node and search for VDB Smooth
- [ ] Change the properties to get the result you want
- [ ] CTRL+LMB drag from pin under VDB Smooth and create a NULL
- [ ] Call the NULL OUT_VOLUME
- [ ] Do the same thing and call the other NULL OUT_MESH
- [ ] However, we need to convert the VDB to polygons so insert a Convert VDB node between the VDB Smooth and the OUT_MESH NULL
- [ ] Set the Convert To format on the new node to Polygons
- [ ] Press U to go to the root node view

Sprinkles

- [ ] Create a new geo node called 03_Sprinkles
- [ ] Go into the 02_Chocolate node and copy the Mask node, we're going to use that in the new Sprinkles node
- [ ] Go back up and then into the Sprinkles node
- [ ] Create an Object Merge node and set the Object to the OUT_MESH on the Chocolate object we just made
- [ ] Then paste the Mask under this new object merge
- [ ] CTRL+LMB click and drag from the pin under Mask and search for Scatter
- [ ] As before, we dont want to use the Force Total Count on the Scatter, so turn this off
- [ ] Make sure you turn on the Density Attribute
- [ ] Change the Density Scale to suit
- [ ] In the node graph, create a new node - search for Normal
- [ ] Insert the Normal node between the object_merge and the mask nodes
- [ ] In the Normal properties, change Add Normals To... to read Points
- [ ] In a blank area of the node graph, create a new node - search for Line
- [ ] CTRL+LMB click and drag from the pin under the Line node and search for Copy To Points
- [ ] Drag from the pin under Scatter to the right side pin on the top of the Copy to Points node

- [ ] You will probably now have a hairy doughnut - not what we wanted!
- [ ] We need to change the information that the Lines are getting to put them in the right place and align them with the surface properly
- [ ] Let's start by creating a new node - search for Attribute Randomize - and add this between the Scatter and Copy to Points nodes
- [ ] You should see the lines change to many different colours - that's because currently the Attribute Name that the node is changing is set to Cd (colour)
- [ ] Change this Attribute Name to pscale
- [ ] Scale only has one "dimension" so change the Dimensions to 1
- [ ] Change the first Min Value to 0.5
- [ ] Then change Global Scale to something small like 0.06
- [ ] CTRL+LMB click and drag from the Copy to Points pin and search for Resample
- [ ] If you turn on Points mode (the icon on the right side of the viewport that looks like a point) you can see that the sprinkles currently have two points, we want to add to this
- [ ] Change the Length properties to something like 0.05 - you should see some of these lines split into more points
- [ ] CTRL+LMB click and drag from the bottom point of the Resample node and search for Point Jitter
- [ ] Change the scale to something small such as 0.04 - you should see the sprinkles randomise
- [ ] Add another Resample underneath the point jitter and change the Treat Polygons As option to Subdivison Curves
- [ ] If we want to add random colours to the objects, we need to add another Point VOP between the Attribute Random and Copy to Points
- [ ] Go into the Point VOP and create a new node off of the ptnum pin - search for Random
- [ ] Then, from the output of the Random node, create a new node - search for Ramp Parameter
- [ ] Connect the output pin of the Ramp to the Cd Output node on the right
- [ ] Go up one level in the node graph, you should now see a colour ramp in the properties area
- [ ] Click the small upwards pointing triangles under the ramp and change their Interpolation to Constant
- [ ] Now, change the Point numbers and colours to suit
- [ ] To make the lines into geometry, CTRL+LMB click and drag from the Resample pin and search for Polywire
- [ ] Change the Wire Radius to something small (e.g. 0.01)
- [ ] Change the Divisions to 8
- [ ] CTRL+LMB drag from the Polywire bottom pin and search for Subdivide
- [ ] Finally, CTRL+LMB drag from the bottom pin on the Subdivide node and add a NULL called OUT

"Dents"

- [ ] The sprinkles will have some interaction with the chocolate material, so we need to make this happen. To do so, go up to the object level of the node graph and create another geo object, this time called 04_Dents
- [ ] Open the 04_Dents and add an Object Merge
- [ ] Target the Object property to the OUT_VOLUME of the Chocolate we made earlier
- [ ] Create another Object Merge, this time targeting the OUT node we made on the Sprinkles object

- [ ] From the out pin on the new merge node (the sprinkles one), search for VDB From Polygons
- [ ] Change the Voxel size on this node to 0.01
- [ ] On the other Object Merge (the Chocolate OUT_VOLUME), CTRL+LMB drag and click from the out pin and search for VDB Resample
- [ ] Connect the Out pin from the VDB From Polygons node to the right pin on the VDB Resample node we just made
- [ ] CTRL+LMB drag from the VDB Resample out pin on bottom and search for VDB Combine
- [ ] Connect the out pin on bottom of VDB From Polygons to the right top pin of VDB Combine
- [ ] Change the Combine Operation to SDF Difference
- [ ] CTRL+LMB drag from the VDB Combine out pin and search for Convert VDB
- [ ] Change the Convert to... option to Polygons
- [ ] CTRL+LMB drag from the bottom pin of the Convert node and add a NULL
- [ ] Change the NULL name to OUT

Test Rendering

- [ ] To render, we first need to add an environment light, so right click/Tab in the node area and search for Environment Light
- [ ] Choose an Environment Map from the Environment Map property (download one from https://hdri-haven.com/ or similar if you haven't got any to hand)
- [ ] In the Menu bar, choose Render>Create Render Node>Mantra PBR
- [ ] In the main viewport, choose where it says No Cam and create a new camera
- [ ] Press the padlock icon in the right side of the viewport to lock the camera
- [ ] In the camera properties, choose the View tab and change the focal length to 80