**BEND:** Deformation of an object using CR (bend, scaling, twist, taper()) Relation of capture region and bend axis  
 Spine object

**Scaling** length  
**Twist -** rotate  
**Taper**- non-uniform scale, with ramp scalar

**IF OBJECT DOESNOT BEND ADD MORE DIVISIONS/POINTS USING RESAMPLE (max length 0.1) NODE**.

**CR** Blue curved\_rectangles are Capture Region bounding box for the object.

**THREE PARAMETERS OF CR**: origin, length, direction

**ABOUT LINE in 3D:**

Line and U different direction circles in the same plane Change up angle for circles in 3DWhite circles are there to increase decrease the length  
Red rectangle are there to increase decrease the CR

**RMB** click in scene view also shows the handle tabs   
to activate/deactivate handles **Go to scene view, LMB click on handles  
You see**

**green bend handle**  
if you do not see the green arrow, manually change the bend angledecrease the length of capture region

**Capture Region**  
Default Capture Axis, z, change to x or y and   
immerse  
Red handles increase decrease length of CR  
Bottom dot move the origin of the CR  
Bottom circle rotate the axis direction CR- up   
vector  
Bottom circle rotate the CR box about direction   
CR- up vector angle

**Twist and scale do effect the capture region.**

**Bend handles:** F (toggle bond visibility) G (Toggle capture) H (Toggle deform) B (cycle capture) N (Fit capture) M (Reverse capture)

**Taper notes:**  
Twist tab, and scale length tab are for the   
objects  
Rectangle at the top scale top  
Rectangle at the bottom scale squish value

Vertical arrow moves the squishpoint  
Merge multiple objects, then it bend all together

**POPNET:** Popnet creates particles and supporting nodes like   
Noise, Scatter ($F functionality is in-built)

**dive into popnet** to add windforce node to get wind direction

**IF constructs used with parameter values (related to switch)**Frame used to  
parameter values control  
if ($F<m, m, n)  
ramp function  
if ($F<m, m, if($F>n, n, $F))

**SCATTER:**

Scatter object creates new points for surface of an   
object. Scatter node replaces the points of an object with random point-locations for the object.  
Scatter creates uniformly distributed points on the surface of object

**ISOOFFSET:** Isooffset is for for band about the surface for fog, smoke,   
cloudnear the surface in and out in the band.

**Iso Surface**

A polygonal mesh will be created along the specified offset of the implicit function.

**Fog Volume**

The volume primitive will be set to 1 inside the object and 0 outside the object. Boundary cells will have an interpolated value between these extremes.

**SDF Volume**

The volume primitive will be a Signed Distance Field. Inside the object will store negative numbers storing the distance to the nearest point on the surface. Outside the object will store positive numbers storing the distance to the nearest point on the primitive. In the GL display, these tend to look inverted as the exterior is what renders as opaque. SDFs are also used by the [RBD Solver](https://www.sidefx.com/docs/houdini/nodes/dop/rbdsolver.html) and the [Fluid Solver](https://www.sidefx.com/docs/houdini/nodes/dop/fluidsolver.html). For additional information, see the [Volume Sample VOP](https://www.sidefx.com/docs/houdini/nodes/vop/volumesample.html) help.

**Tetra Mesh**

The interior of the object is filled with tetrahedrons. The resulting mesh can be used for deformers or for softbody approaches.

**POINT JITTER>:**

This node will randomize point locations by slightly altering their values. (scale parameter)

**MOUNTAIN: to create points displacement**

**(amplitude parameter)**

**LOCK/UNLOCK NODE:** select node in network pane and in top tool bar go for asset there u can see lock or unlock nodes

**PREPARE HDNAC creation in both object and geomnetry level**

**Manipulate parameter table in object level without going to geometry level**

For demo, show how can (geometry can be updated from obj level) be done without going into   
geometry.  
Let us start at object level  
At the HDA level, in order to create user parameters,   
RMB click on boxAsset  
Navigate and Click on Type Properties -🡪 parameter tab (float)

**How to create User defined variables for an HDA?**In the parameter pane of hda , there is no parameter “x-   
scale”.  
We will create a parameter x- scale with textfield to use   
x- scale values to change the box parameter values   
as follows.  
First column: the left column , there are parameter types,   
we want float type, select float.  
Second column: to create parameters, you must be at   
the root level. Second column will load label name   
you type in column 3.  
Third column: Type Name and name in label, confirm   
them in second column, then click apply, accept.

**voronoiFracturePoints** -- where to fracture in object  
**voronoiFracture** – fracture keep glued together with cracks on the object  
**explodedView** – separate the pieces

**RBD Material fracture** for fractures  
**RBD Bullet Solver** for natural animation, special   
effect for falling fracture pieces

**autoDop node** for Rendering the Fractured object  
Detecting collision, and fracturing the non-static   
object, directing the motion path, Ground plane   
can be created at wil

**Deficiencies:**Use of rbdBulletSolver for mutual collision   
detection and shattering  
Only one object shatters unless it is merger of   
several objects

**Connection between Real and Virtual Fracturing   
Shattering**  
you will have immersive experience while fracturing   
and disintegrating object in realtime and virtual   
viewing with animationBar .   
you can reverse fracturing through animationBar

**Static object –** rbd static for collision static will not   
move, will not let any object pass through

**Dynamic-** rbdFractured or rbdObject.   
Both use same gravity, to differentiate the   
timing change the gravity rates.   
Gravity allows you to change direction and force   
of motion.  
This shows static and dynamic (crashing and not   
crashing) objects

Mountain Node :

**Lacunarity measure if inhomogeneity, irregularity in**

**textures, pattern, texture of lake water**

**Roughness - pointedness in peaks**

**Height – hight of peaks**

**Element size- size of block causing unevenness**

**offset – displacement of noise**

These are the QA from the last class. The answers are not mine, no guarantee of correctness. This gives you an idea of questions selected for the

Exam03 SP22CS5407

**HW17**

**In Bend node, What are three things used define a capture region?**

Q: What do you need to define the capture region in bend node?

Q: How do you define the capture region?

A: You define the region with the origin where the start is, the direction the way which it will bend and the length, how far to bend goes.

The uv quick shade node helps to put an image texture on the surface of the node, moon on sphere, your picture on a cylinder, box, sphere?

**Q** What does UV Quick Shade node do?

**A** This node is present on a geometry level. Drag and drop this node in the network pane. To connect this and visualize, drag and drop a sphere node. Connect the output of the sphere to the input of the **uv quick shade** node. Then, in the parameter pane of **uv quick shade**under the “Texture Map” field click the arrow icon to drag and drop your image. Enable the blue flag of the uv quick shade node.

In the Uvquickshade node, change the default location of the texture map in the Network pane to the image location.

Q: If we want to make a thick line to be bent, how can we do so without using sweep?

A: We can create a tube and scale the radius down to make it appear as if it is a thick line, then use the bend node to bend it as we please. This doesn’t require us to use the sweep node to make the line thicker like we learned in past lectures, and it allows us to bend it with only one node connection from the tube to the bend.

Question: What is the node that allows you to set any image as a shader for a polygon

Answer: UV quick shade node

Question : What is a Bend geometry node?

Answer : Bend geometry node applies deformations to captured geometry such as bend, twist, taper and stretch. Bend geometry node lets you define a capture region around an object and apply deformations to the geometry inside the capture region. The capture region is defined by an origin, a capture length and a capture direction which is perpendicular to the planes.

**Question:** How do you apply an image to the face of an object?

**Answer:** To apply an image to the face of an object; enter the geometry layer in Houdini. Next, spawn the object you wish to apply the image to, I will simply use a box. Using the UV Quick Shade node, you can select a texture map and group it to a particular face of an object using the group feature of houdini; however, instead of some kind of outside texture, I will just use a png file. I select my png file through the texture map parameter and then select the face that I can directly see from the box; in this case, its face 4; however my image is nowhere to be seen, what happened? Well if something like that occurs, simply try changing the projection axis; in my case from the Y Axis to the X Axis. And now you have an image as the face of one object.

* Graphical user interface, text, application

  Description automatically generated  
  In Blue: How to select the face of a node (using group feature)  
  In orange: Where to select your image  
  In Green: The projection axis mentioned in the last sentence.
* A close-up of a hand

  Description automatically generated with medium confidence
* Q: What does the bend node do to a shape?
* A: The bend node allows you to take a shape and bend it from a vector. The direction vector defaults to up and the bends come from it. In this node, you can also Twist, length scale, and taper. Also, this node allows you to set up a custom capture parameter and give you control over what you bend.

**HW18**

Q: What does the bend node do to a shape?

A: shape is enclosed in capture region. The capture axis/ capture region is bent away from or towards the upward direction. The object gets deformed accordingly as the Capture regin is bent.

**HW19**

What does RBD stand for?

Answer: Rigid Body Dynamics

Fractal and fracture

What is fractal, fracture, fragmentation?

What is isooffset and scatter?

Q: How to get a shape to fragment into pieces when it hits another object?

A:Using Bullet Solver node and Ground nodes, you turn on ground and then have the object move into the ground and the object should break apart. As long as your fracturing was set up right.

Explodedview and rbdbulletsolver

What is noise in an object? Give an example. isoofffset, scatter, fractal, mountain, jitterpoints, attribute noise?

How can you create a noise indirectly? Shatter, rbdMaterialFracture,

**Q:**How do we create fractures of equal size? What do RBD Material fracture and RBD Bullet solver do?

**A:**  voronoi fractures it creates fractures evenly when we use the same object in both inputs of VornoiFracturepoints or VornoiFracture directly.

I have used a box, sphere , voronoi fracture and an exploded view. Try box vs ( box, sphere)

What node can be used to fracture an object directly without creating any intermediate node explicitly? Shatter, RbdMaterial Fracture?

What do you use to fragment a fractured object? rbdBulletsolver, rbdSolver, explodedview

What do you use to create fine fractured object?rbdFractured, rbdGrains, particlepopnet

What nodes create fragmentation of a shattered/fractured object? explodedview without collision, rbdSolver, rbdBulletSolver on collision

What nodes create animation without using $F explicitly? Autodop, rbdSolverSolver, rbdBulletSolver

What are two inputs for VoronioFracture node?

A: One of the inputs is to indicate which geometry is to be fractured. The second input is to indicate how many pieces and where the geometry is to be shattered into.

What does the RBDBullet Solver Node do? Fragments a fractured object on collision?

A: The RBD Bullet Solver node acts as physics simulation for the geometry that it is attached to. It can be used to simulate gravity and the collisions between different objects in your scene. It can also be used for simulating bullets because of an initial velocity parameter you can set.

**HW20**

Q: How to create the ground without using the ground plane tool located on top of tool bar? And steps to create the sphere and collide it to the grid.

A: Instead of using ground plain tool in collision, create grid node and connect it to fourth input of rbdBulletSolver. Now grid behave likes the ground.

Q: How would you go about simulating a box smashing into a wall from the side and exploding?

What do you do to simulate a groundplane without creating a ground plane from collisions toolbar.

Simulating Groundplane: it can be created with static object, groundplane or grid Grid can be connected to 4th input of rbdBulletSolver to make it a collision object.

Colliding object can be spheres or any object, not necessarily plane grid

**Ground plane is built in rbdBullet solver**

**What is a null object for? Null object is the gateway from the chain of nodes** Question: What does the null node do?

**Null object is the gateway from the chain of nodes** Question: What does the null node do?

Answer: It serves as a placeholder node in a scene, and doesn’t render. In this class it is used as an end effector, saying that the geometry is complete in the node view

**Gravity in force in rbdBulletSolver**

**Gravity in autodop**

**Question:** How to get the solver at the object level?

**Answer:** You can create an object called AutoDop with will help to get the solver at the object level.

Q: If you input an additional velocity into RBD Bullet Solver how does it work?

A: The additional forces that you put into RBD Bullet Solver act as constant forces like gravity and not initial forces that only activate at the start. These forces also speed up by acceleration and act basically in the same way that gravity does.

**Question:**

How do you reverse gravity?

**Answer:** Change the gravity value in RBD bullet solver to a positive number

**Q: How to give custom objects as static Geometry?**

A: In the RBDbulletsolver, we have 4 inputs third input is collision geometry which helps in adding the object to the geometry must hit and break into pieces.

How do you change the gravity of an object to an arbitrary direction in rbdbulletsolver node?

In the rbdbulletsolver node click on the forces tab and change the current gravity from the y direction to the x direction. In autodop it is directly visible.

**HW21**

**Make two objects some distance apart along x-axis, both shattered, rbdfractured for collision**

Q: How can you get to geometries move and fragment? Make gravity opposite direction

Q: How can you get the objects move towards eachother, collide and not fragment? Bypass voronoiFracture on both

Q: How can you get only one object move towards the other, collide and disintegrates the other? Bypass voronoiFracture on one

Q: How can you get to geometries one moves and both fragment? Make gravity opposite direction, make gravity of one zero

**Question**: How does autodop network node work? Give an example.

When you create an rdd object, autodop net work is created automatically.

**Q) Write steps for the sphere to collide with a cube in the air and both fall on the ground.**

**Let them fall at different speeds so that they fracture before hit the ground.**

Q:What does the constraint glue do?A:It keeps the fractured object together. Without it, the geometry would fall apart.

**HW22**

**Question:** What is meant by Houdini Digital Assets(HDA)? Explain using an example.

**Answer:** Houdini Digital Assets are stored in a library file, i.e digital assets.They have .hdanc extension.

Why do we need HDAs? Answer : Houdini lets you turn your work into reusable custom nodes called digital assets.

What are two types of HDAs?

**What is hudini digital asset? At object level**

**What is hudini subnet digital asset? At geometry level**

What is file extention of HDAs?

Question: What is the file extension for a houdini digital asset?

Answer: .hda or in our case .hdanc for non-commercial

Q: What fundamental concept of Object-Oriented Programming is the Houdini Digital Assets like?

A: Houdini Digital Assets are like Classes and Functions in Houdini that allow us to create structures/environments and import them to other Houdini files for use.

**What is the first step to create HDA?**

**What is the first step to create subnet HDA?**

Knowing that HDA can be created at object level, How do we create an HDA at geometry level?

Question: How do we create a subnet?

Answer: Similar to primitive nodes, we can create subnets at the object level simply by pressing the tab key on our keyboard, or by clicking the right mouse button in the network pane. After that, we select the subnetwork node by either typing it in, or scrolling down to the DDList sublist on the dropdown menu.

**How do you upload OBJ HDA, How do you upload subnetLevel HDA?**

**HW23**

How do you save HDAs?

How do you save subnet?

They are saved automatically in your CWD

Question:How can you use the digital asset in the new or existing file?

Answer:

New File:

Right click on the network pane -> export -> file -> select the .hipnc file from the respective directory where digital asset is saved

Existing File:

Right click on the network pane -> digital assets -> select the digital asset created

How do you install multiple HDAs in a new file?

How do you use multiple HDAs in a new file?

A: In the top left click file. Go down to import and select “Import Houdini Digital Asset”. Browse to the library folder that has the HDAs you want to use and select all that you want to use. Clicking open will allow you to use the HDAs that you imported.

What is the use switch and switcher node?

**HW24**

How do you change the direction of motion for an object to avoid collision?make directions orthogonal

Q: How do you change the direction an object moves for a collision?

A: Go into the AutoDop node and edit the gravity node, you can use one node if all objects are going the same direction but you will need more if you want to make objects go in different directions.

How do you make one object Box fragment and other object sphere grains they collide?

Question: What does the node RBD grains do?

Answer: RBD grains node is like RBD shatter node, except that it fills the object selected with spheres and uses the Bullet solver drivers. So if the object were to get into a collision very little spheres(supposed to look like grains) will fly out.

How do you make grid as static object so that a colliding object does not pass through?

Make one fractured and one grains, let the fracture

How do you import HDAs to Install, export HDAs to Save?

How to delete assets from the Houdini library?

A: Go to Asset manger – find the .hipnc file; open the list of address. Select the Asset digital address. Delete. Keep in mind this is temporarily deletion.

What can you do when you run into a problem creating HDAs or uploading a file.?

Use asset manager and find the culprit and delete. Restart.

Q: How do you bring an object from a different project into your current project?

A: One way of bringing in an object is to import it. You can import an object by going to the file drop down menu and then finding Import. From import you can select object and it’ll open a file explorer, then from there you can find whatever you want to import and select it.

**HW25**

**Write steps to create rainfall animation using the “POP network” node.**

**Question:** what does popnet node do?

Question: How do we make animation for a node that has a popnet on it?

Answer: Similar to an RBDFracture node using RBDBulletSolver, a popnet uses it’s own node called PopSolver. It acts mostly the same as RBDBulletSolver does for and RBD node, but has specifications to interact with a popnet node specifically. We can also use a WindForce node if we want the particles made from the popnet node to be blown in our animation like wind.

What is the purpose of the popnet node in Houdini?

Popnet creates particles that can be used in things such as fire, wind, rain, and lava to create a realistic view.

The particle are animated with force in a specied direction

Popnet can be use for anything to create fire, water, etc

What object can be used to create fragments, grains, particles

What is the use of popNet in Houdini?

**Answer:**You can use Popnet which will help in fracturing the object at the geometry level into popnet particles (fine tuned).

PopNet node consist of popSolver which helps in animation. The motion of the fracturing in the popNet is controlled by wind instead of gravity.

What does the windforce node allow you to do?

Answer: It allows you to add a pushing force in a given direction to an object, much like wind.

Windforce can be used like gravity to move nodes in a particular direction.

What does the windforce node do?

The windforce node is a physics based node that’s apply velocity in a manner that wind behaves in.

What does the windforce node allow you to do?

It allows you to add a pushing force in a given direction to an object, much like wind.

Windforce can be used like gravity to move nodes in a particular direction.

What does the popSolver do?

**Create box, sphere, curve**

**Create popnet animate**

**Roll windstorm breaking objects as it collides the object.**

**Brick🡪copy🡪sphere🡪popnet**

**Sphere🡪fog🡪popnet**

**Notes**

Q: A line node can be bend only if?

* In order for a line node to bend it needs to have many points

1. What is set capture region in bend node?
2. Using set capture region we can set the node inside the capture region
3. What is green arrow in bend node?
4. It tells what is the bottom and what is the top and how it bends
5. What part will bend if the capture region is smaller than line?
6. If the capture region is smaller than the line then only the part which is inside the capture region will bend on bending using the green arrow.

Q: How is capture region bounded?

1. Capture region is bounded by two planes which are perpendicular to the direction we have specified
2. When a line is rotated by an angle using the capture region which part is rotated?
3. When a line is rotated the base part remains same only the top part is rotated.
4. How to view the bend angle in scene view?

A:To show the bend angle turn on the enable checkbox in the bend section

1. How to remove the green color in the UpVector angle?
2. Right click on the green field in the Upvector angle attribute and click on delete channels.

Q: How to set the bend angle?

1. You can set the bend angle using the Up Vector angle in the parameters.
2. How to view the twist handle?
3. To show the twist handle turn on enable checkbox
4. How To smooth out the curve after bending?
5. By increasing the points curve will smoothen out

Notes 1

1. What parameters does bend node have?
2. Twist, Length scale, Taper attributes
3. what does Taper attribute do?
4. Taper attribute scales the top of the object
5. What is a bend node?

A:This node lets you define a *capture region*

around (or partially intersecting) a model, and apply deformations to the geometry inside the capture region.

Q: How many ways to twist an object?

1. There are two ways to twist an object, one is to rotate the object in scene view pane and other is manually inserting the values in the twist attribute

Q: What is squish attribute?

1. squish attribute does the scaling about the squish point.
2. How to unlock the locked nodes?
3. To unlock the locked nodes go the assets tab and click on unlock asset then the node will be unlocked and these are supporting nodes and cannot modify them.

Q: What does popnet node do?

1. It creates particles and supporting nodes like noise and scatter and animation is created without using the $F value.

Q: What is windforce in popnet node?

1. Windforce is a node in popnet which is used to blow wind and the attributes in it like velocity determines the direction and scale force determines the force of the wind.

Q: Use of switch node?

1. Switch node is to view the particular object in the scene view and to scale the object click on cursor and select the object and center node will allow us to scale up and down.

Q: When is edit node created in network pane?

1. Whenever we scale it from scene view it creates an edit node.
2. How to create animation using switch?

Notes 2

1. Use $F-1 in the select input attribute and in the animation bar click on next frame to vie different objects in scene view pane

Q: what is scatter node and sdfvolume parameter in isooffset?

1. It creates points, sdfvolume is used to creates volume from band of points around the object surface.

Q: How to define points while creating the scatter node?

1. To create the points in the scatter node enter it manually or use $F or enter the number of points manually in the frame.

Q: Why scattering?

1. It creates a template of points, with options to specify the density, weighted by paramter to control distribution

Q: What is Force total count attribute?

1. Determines the number of points you want to process
2. Isooffset node info?
3. isoffset node contains outputtype parameter
4. What are mountain, attributenoise, pointjitter and differences between them.
5. Popnet node info?
6. Popnet node creates points on the surface and dynamically updates points as the frame number increases and windforce attribute blows the points away.

Q: How to create a digital asset at object level and geometry level?

1. At object level: right click on a node in object level and create the digital asset and uncheck author, specific type then click n desttroy all spare parameters and click on apply then a lock is created which hdanc file is created.

At geomeetry level create a subnet node right clcik on it to see a digital asset and follow same process then digital asset is created at geometry level.

Q: What is cutplane offset parameter?

1. It is a parameter which shows cracks in the object in voronoifracture node
2. What is vrfrac node and vrfracpoints node and explodedview node?

Notes 3

1. VRfrac node shows cracks on the object but it is glued together and vrfracpoints shows the points where the frcaturing happens and explodedview node shows the fractures which are seperated

Q: what is Rbdmaterialfracture?

1. RBD materialfracture also shows cracks on the object but in a different way. Q; What is rbdbulletsolver?
2. All solver nodes are used to create animation and they use $F internally and there

are many tabs in rbdbulletsolver like gravity specifies direction in which an object will be moved, and for collision select the ground plane and set the origin object will break and cretae points

Q: what is shatter node in boolean?

1. Shatter node in boolean is used to combine all the objects together.
2. IN which node scatetr node is used internally?
3. In Rbdmaterialfrac node scatter node is used.
4. Usingg RBDbulletsolver can we set the direction of multiple objects? A:Only one object direction can be set using solver node
5. Do we use two RBDbulletsolvers for different objects?
6. Yes we use two different solvers for different objects
7. what is AutoDopnetwork node?
8. This node is created when rigid bodies tab is selcted in the top bar and when packed object is selected it creates Autodopnetwork node and it gives velocity to the node.

Q: What is collisions tab ?

1. In the top bar there is a ground plane and it will be a colliding object and when the object is collided with the ground, object will break.

Q: What is shatter node?

1. In the model tab there is a shatter option which cracks the object and it creates inbuilt voronoifrcature node as a supporting node.
2. what is a null node?

Notes 4

Q: Different ways of frcaturing the node?

A: Shattering option, rbdmaterialfracture, voronoifracture node.

Notes 5