11/13/2017

Course Work 1

Data Visualization
F21DV

AlMazloum, Amer Eddin
HERIOT WATT
Professor: Dr. Salih Ismail

Table of Contents

1. Introduction

1. D3.js:

D3.js is a JavaScript library for manipulating documents based on data. **D3** helps you bring data to life using HTML, SVG, and CSS. D3's emphasis on web standards gives you the full capabilities of modern browsers without tying yourself to a proprietary framework, combining powerful visualization components and a data-driven approach to DOM manipulation.
Download the latest version (4.11.0) here:
D3.zip
The full source and tests are also available for download on GitHub. Show your support for D3's ongoing development by buying official stickers!

D3 allows you to bind arbitrary data to a Document Object Model (DOM), and then apply data-driven transformations to the document. For example, you can use D3 to generate an HTML table from an array of numbers. Or, use the same data to create an interactive SVG bar chart with smooth transitions and interaction.

2. Project goals:

The goal of this project is to produce an interactive internet application for analysis & visualization of REF 2014 data to show at least three different layouts with three different profiles. The application is client side written in D3.js v4 library. The data provided in CSV format it's about research excellence framework is quality assessment of UK universities' research comprising:

- 154 UK institutions
- 36 subject-based Unit of assessment (UOAs)
- 4 profiles (outputs, impact, Environments, overall)
- 4 starred quality levels

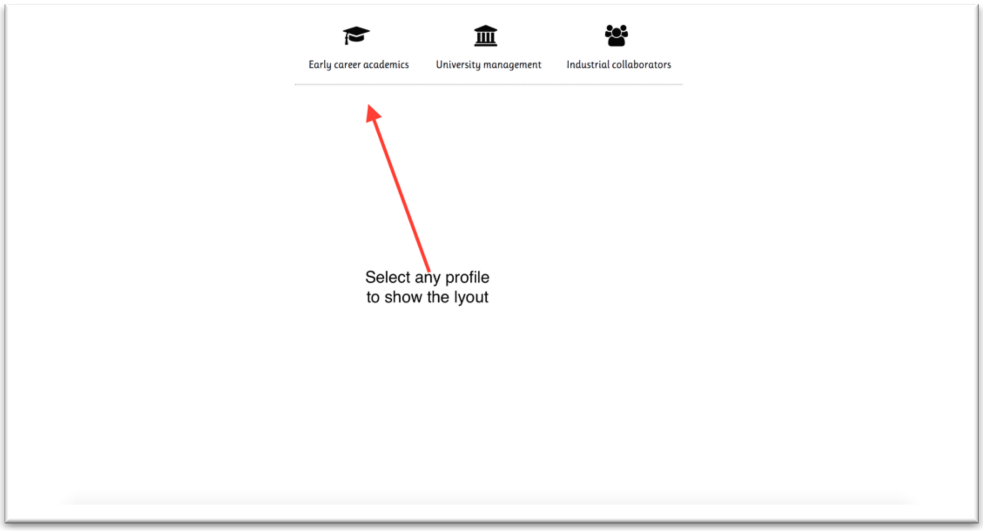
For more information about this data see this link: http://www.ref.ac.uk/results/intro/

3. Project Motivation:

1. Graphical User Manual

1. General:

From this page, you can navigate between all the three profiles by clicking on the image.



- **Early career academics**: will showing the Early career academics layouts and you can navigate between this layout.

- **University management:** will showing the University management layouts and you can navigate between this layout.

- **Industrial collaborators**: will showing the University management layouts and you can navigate between this layout.

2. Early career academics:

First thing appears once click on Early career is the Figure 1, that showing all the UOA in bar chart and all the Universities in map chart. From this point, you can move the mouse over any bar to show the information of this UOA as shooing in figure 2, by click on the bar you will selected the UOA and you will able to filter and see all the university that teaching this as a green point on the map chart like figure 3. The selected UOA name will appears on the tope of chart as showing in figure 3.

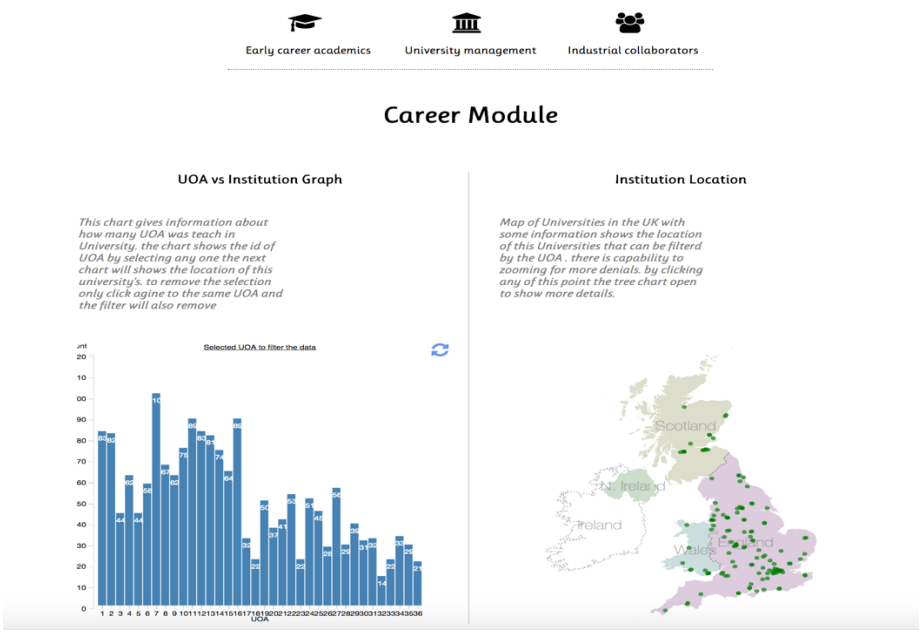


Figure 1

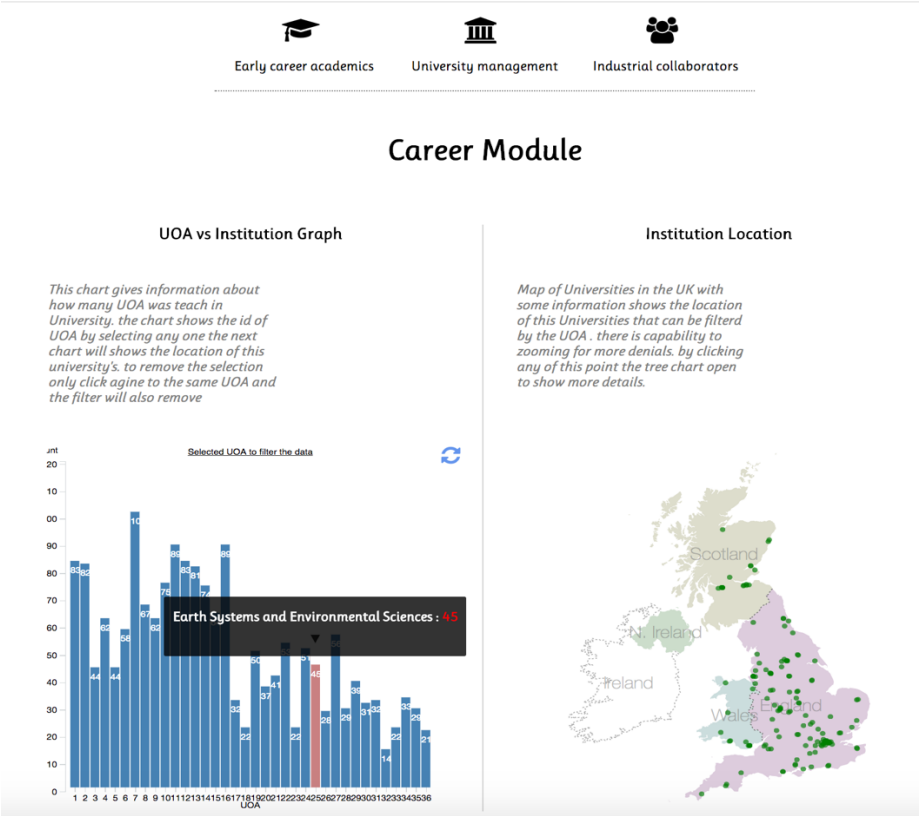


Figure 2

The Selected name of UOA and the filtered universities will be showing like this chart

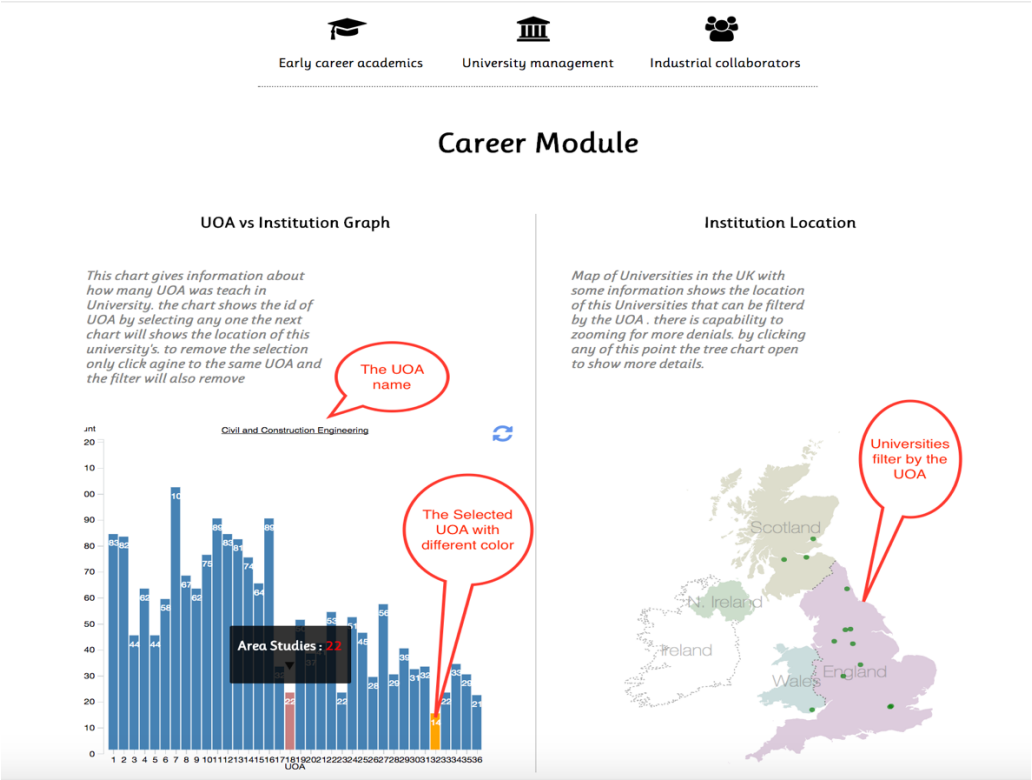


Figure 3

To show information about any point in the map (here university) just go to this point, when mouse will be over the point the information about this University will showing as tooltips as Figure 4. By click on any point on the map another chart will appear as tree to allow you to see the performance's UOAs for selected university as Figure 5 or update the old chart to hold new data. There is also capability on the map chart for zooming and drag for more details (will enhance in new virgin) .

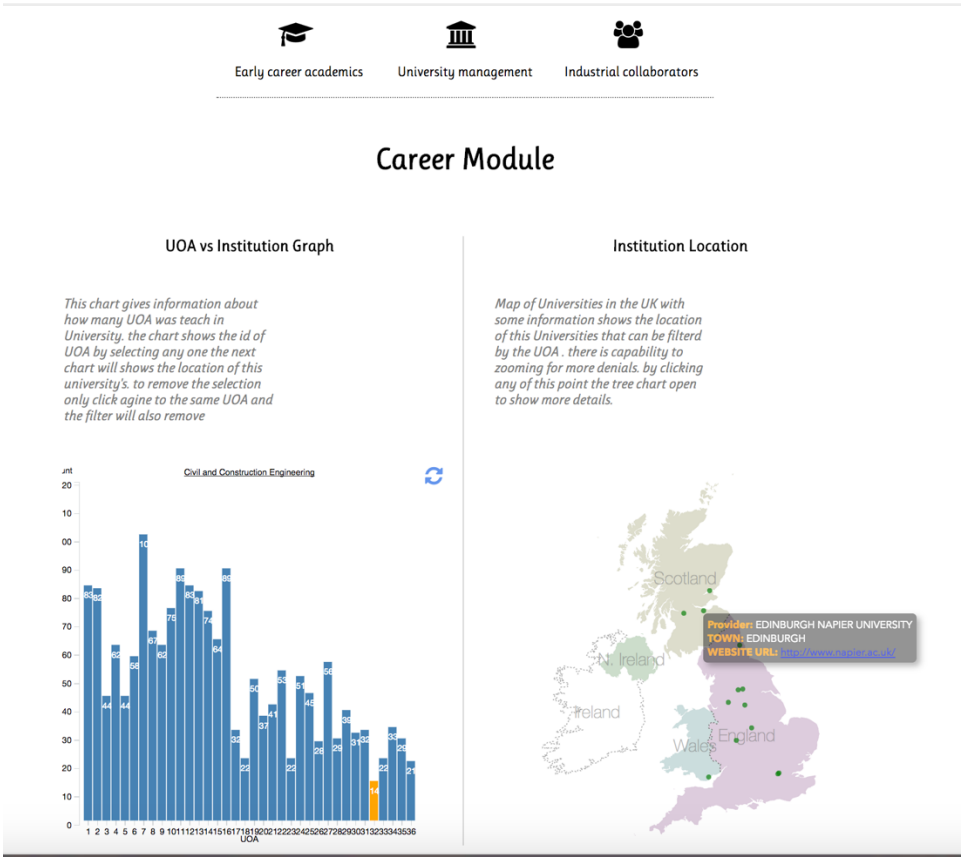


Figure 4

The tree map chart to show information about selected university.

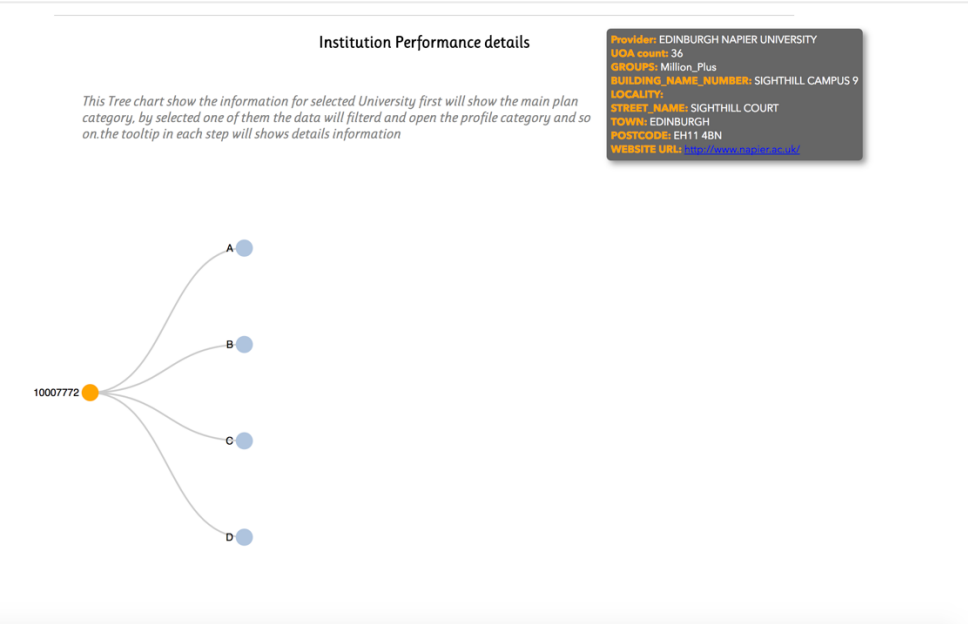


Figure 5

The last layout chart showing information about the institution performance details for each node for example the Main Panel B. as Figure 6 showing there is tooltips has information about the number of UOA under this category and sum of the level start 1* ,2* etc. by mouse over on any node the information will showing as tooltips and by click this node if gas any child the tree will grows till there is no more children node.

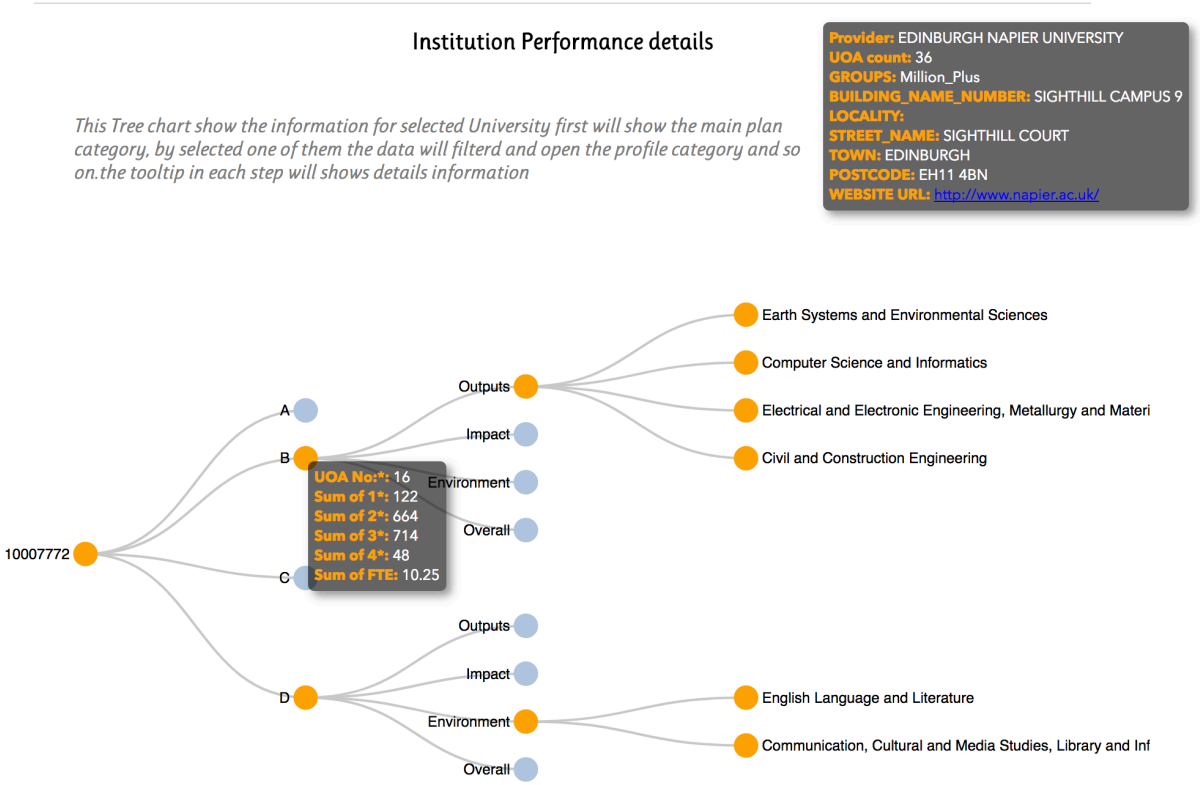


Figure 6

3. University management:

First thing appears once click on Early career is the Figure 7, that showing all the UOA in bar chart and all the Universities in map chart. And all other Figure from 8 to 12 explain more details.

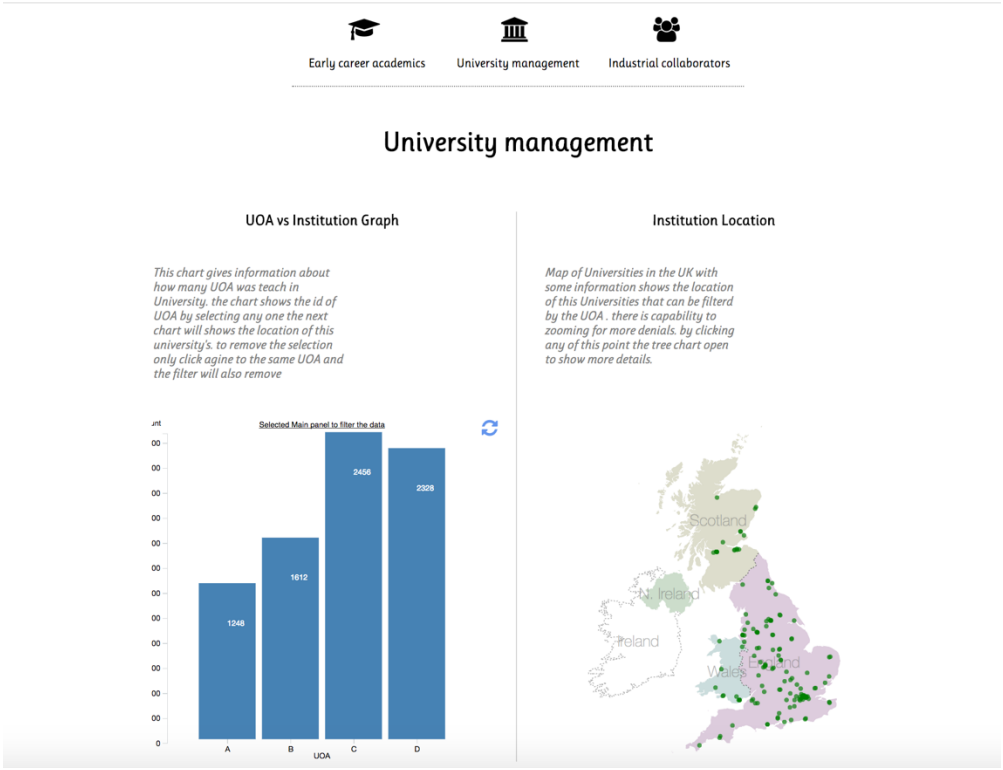


Figure 7

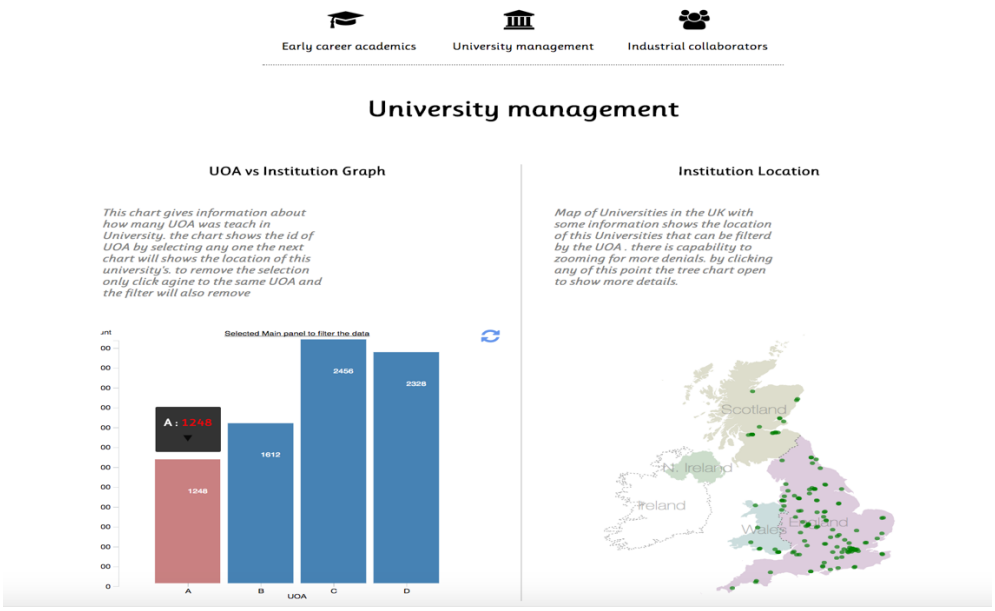


Figure 8

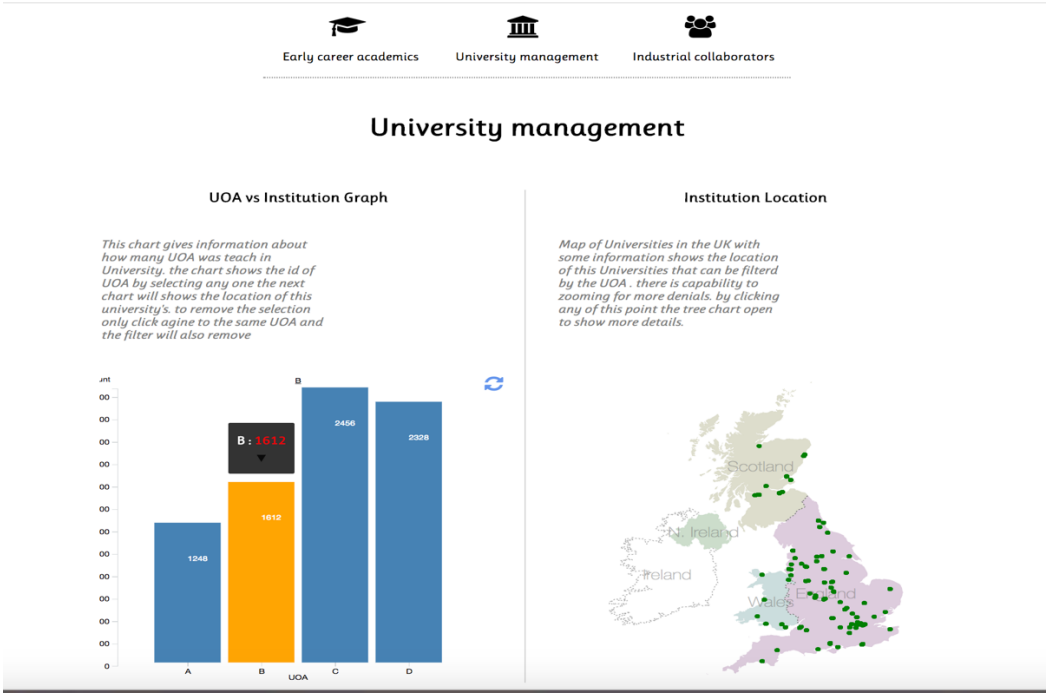


Figure 9

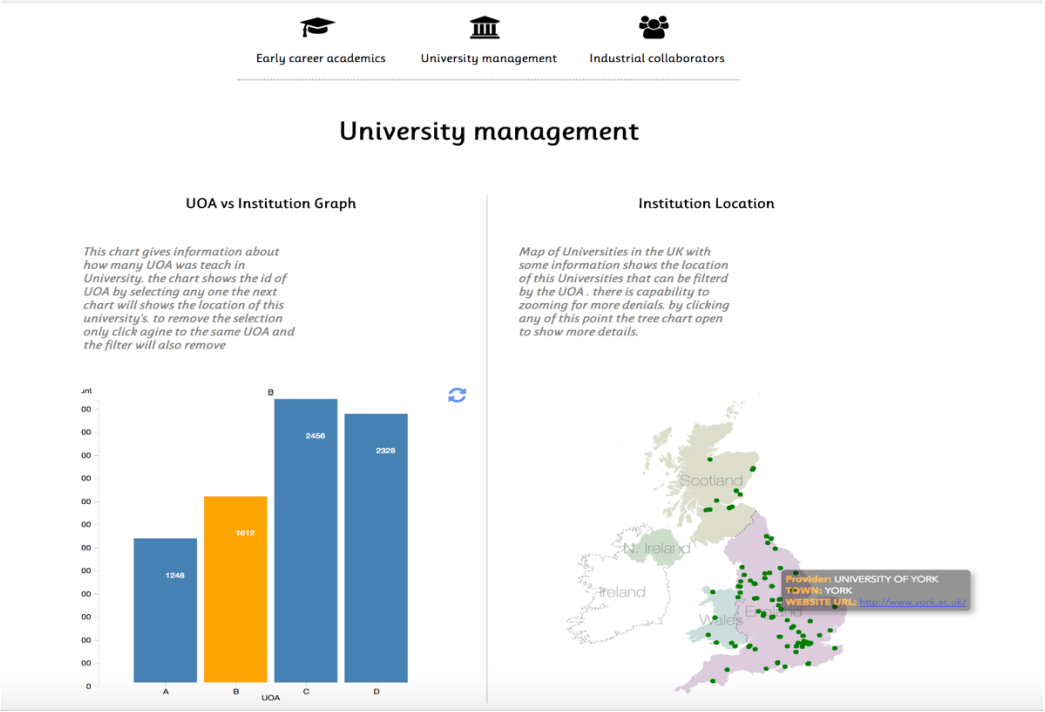


Figure 10

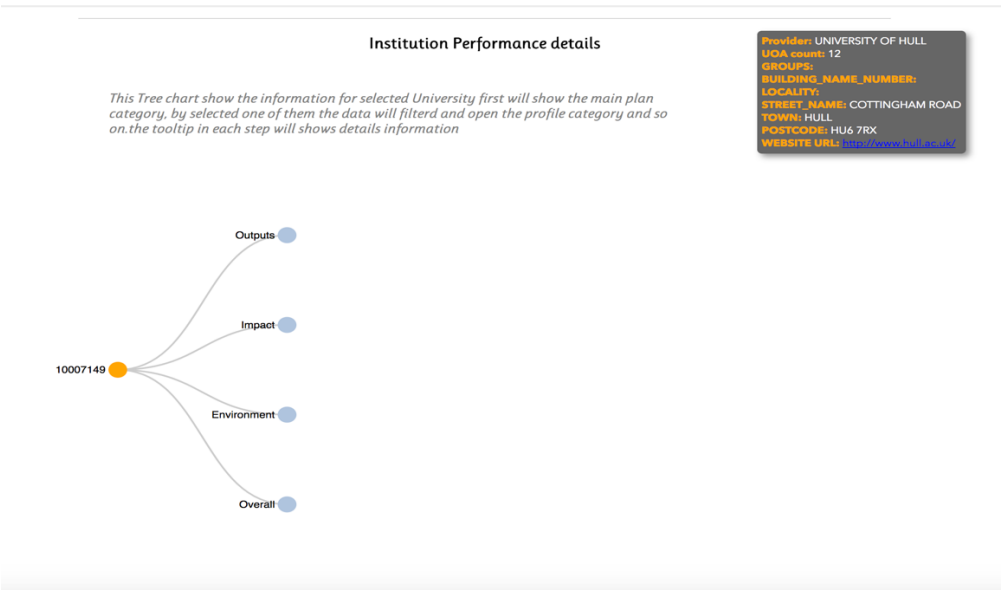


Figure 11

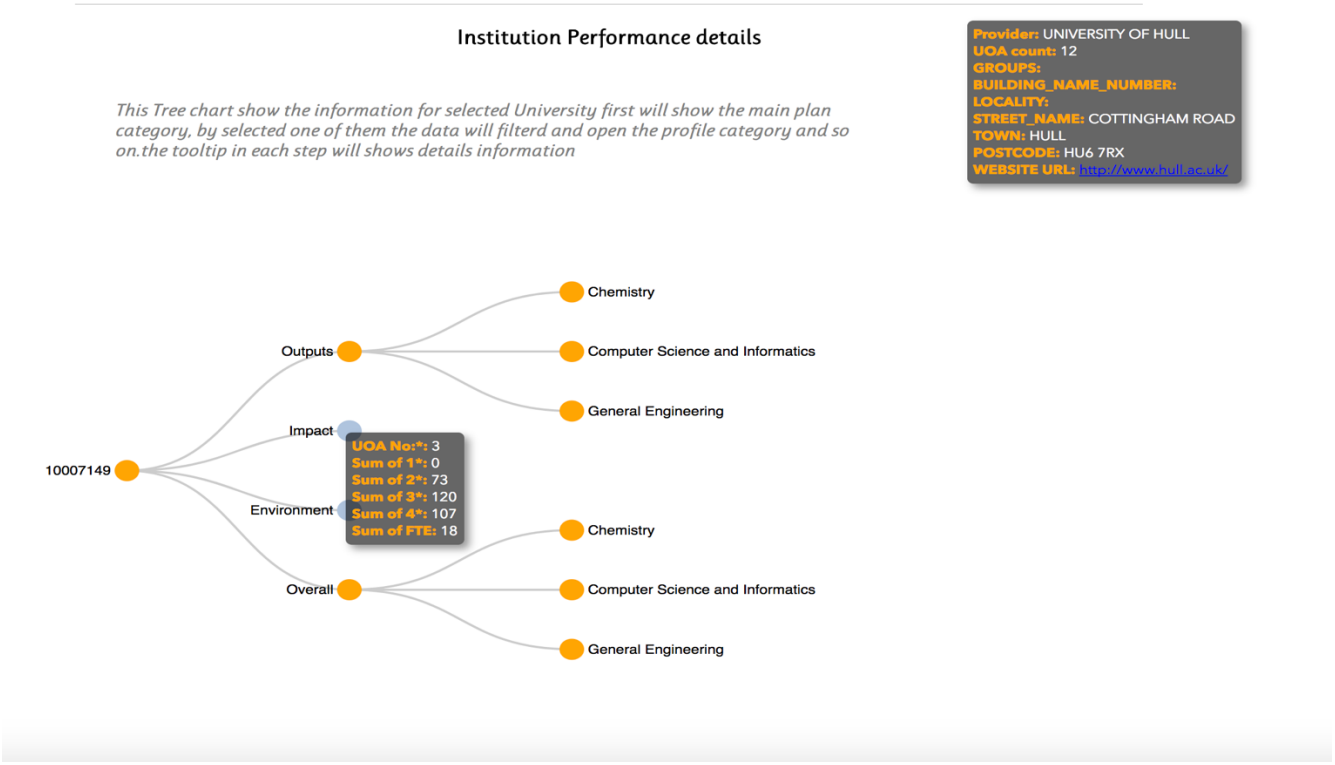


Figure 12

4. Industrial collaborators:

First thing appears once click on Early career is the Figure 13, that showing all the UOA in bar chart and all the Universities in map chart. And all other Figure from 14 to 17 explain more details.

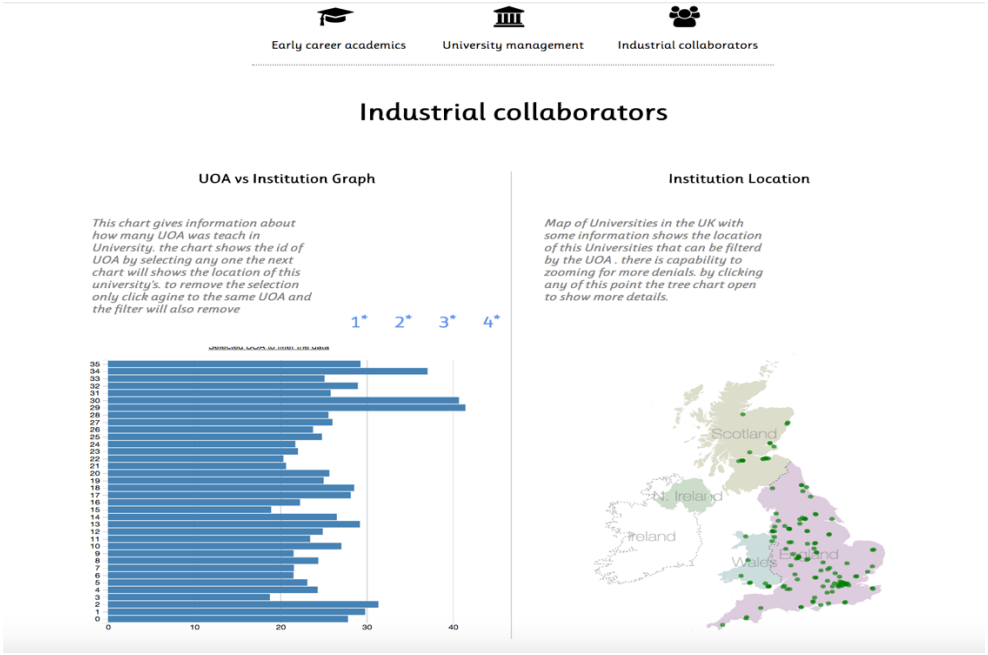


Figure 13

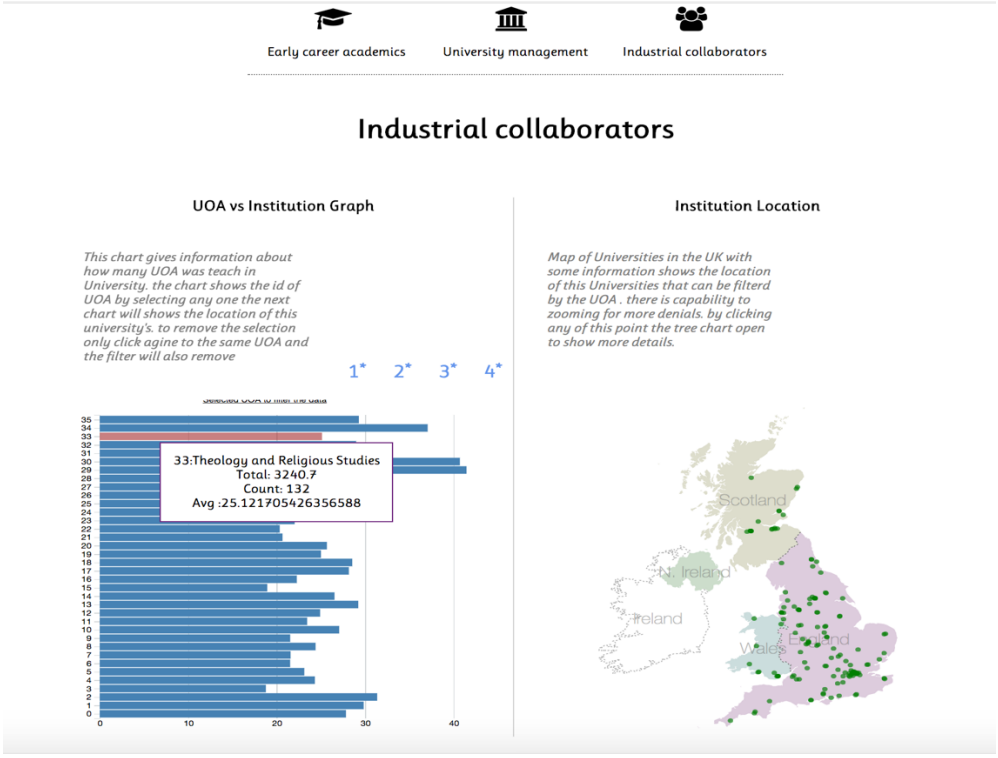


Figure 14

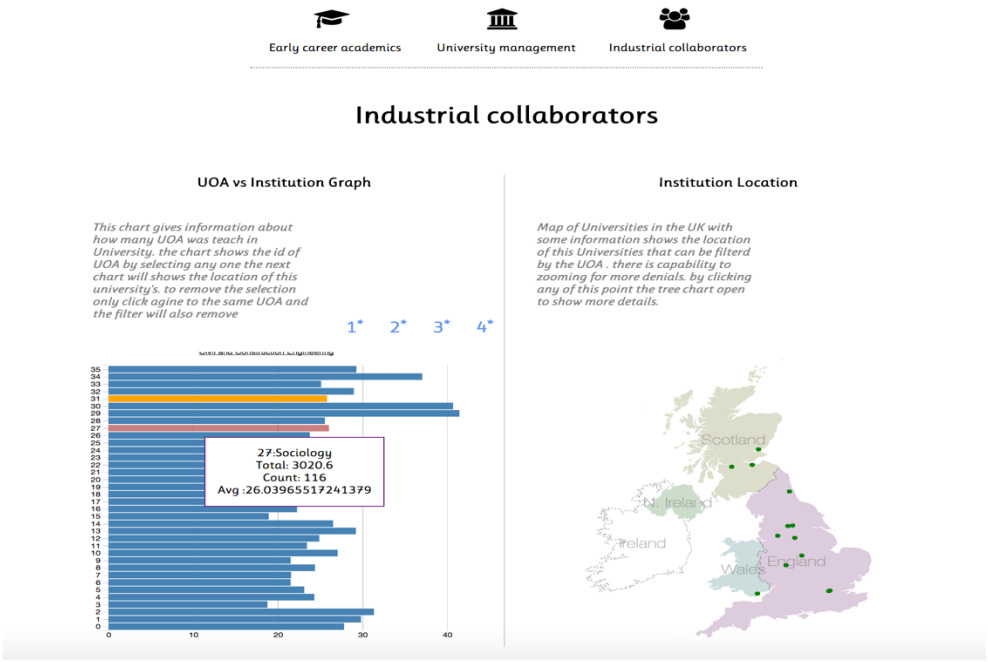


Figure 15

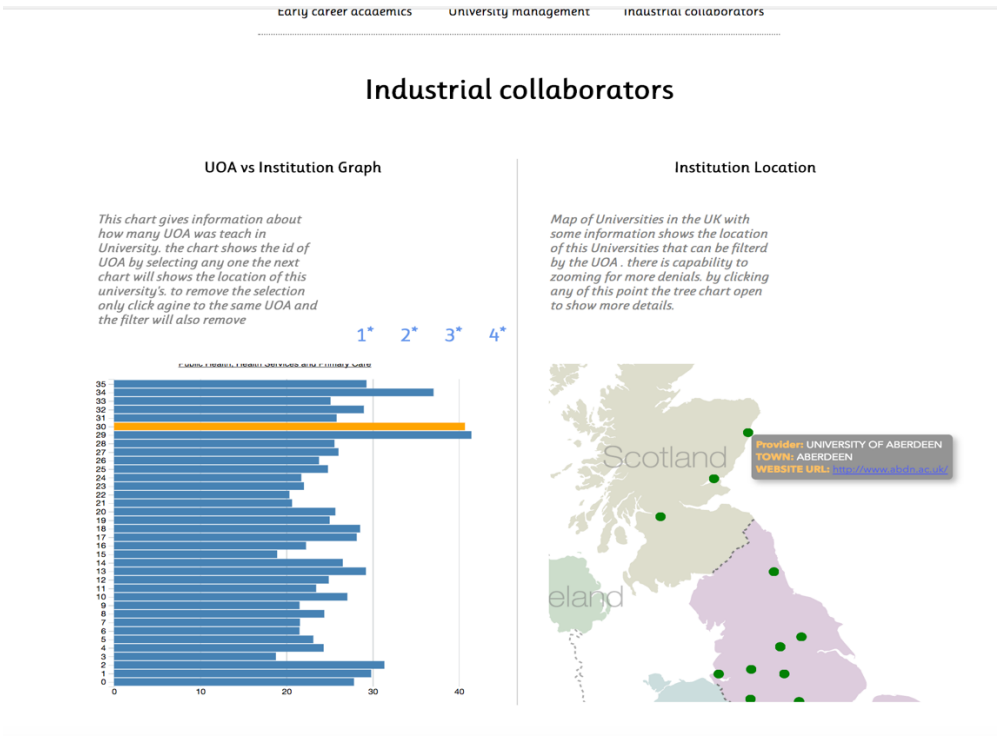


Figure 16

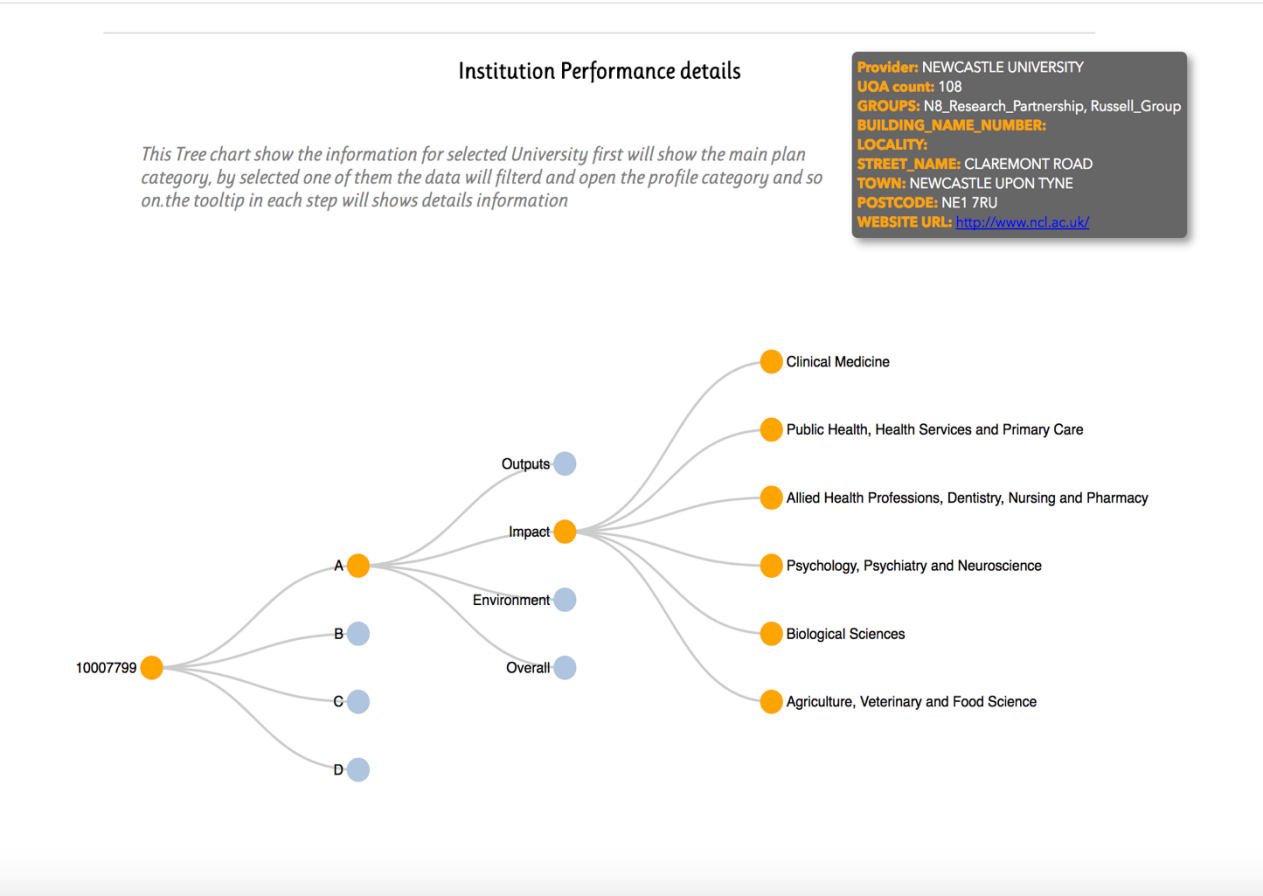


Figure 17

2. Application Design

1. Design Overview:
2. Reflection Design:
3. Use of interactions, and transitions:
4. Description of original features:
5. Design for three different user types:

3. Conclusions:

The feature of the project that I am most proud of

The most interesting aspect of Data Visualisation that I have learned from the project

Reflection on any changes to your approach that you would make for the next project

4. Source code file list:

This is a table, which has one row for each of your source code files.

File name	By Me	by course or d3 modules
Indx.html	90%	10% course example
main.js	70%	30% course example and other
topojson.v1.min.js	0%	Other source
d3.tip.js	0%	100 % d3 modules
d3.min.js	0%	100% d3 modules

5. Source code listings:

main.js:

```
<!--Author: Amer Eddin Al MAzloum-->
<!--Date:13-Nov-2017-->
<!--References (if any)-->

// for the map charts:

// https://bost.ocks.org/mike/map/
// https://mono.software/2017/08/10/d3-js-map-of-croatia/
// https://bl.ocks.org/d3noob/bf44061b1d443f455b3f857f82721372
// https://bl.ocks.org/mbhall88/126b3c2c54215b4d1ffbd2d778ce3973
// http://bl.ocks.org/d3noob/8375092

// For tree chart


// https://gist.github.com/d3noob/43a860bc0024792f8803bba8ca0d5ecd
// http://bl.ocks.org/d3noob/8375092

// Gerneral information

// https://bl.ocks.org/alandunning/7008d0332cc28a826b37b3cf6e7bd998


<!--Overall function of the code-->
<!--Usage (a brief description of public methods, properties, and events)-->
<!--The percentage of code written by the Me 70%-->
<!--The percentage of code taken from course examples or other source 30%-->




<!--Author: Amer Eddin Al MAzloum-->
<!--Date:13-Nov-2017-->
<!--References (if any)-->

// for the map charts:

// https://bost.ocks.org/mike/map/
// https://mono.software/2017/08/10/d3-js-map-of-croatia/
// https://bl.ocks.org/d3noob/bf44061b1d443f455b3f857f82721372
```

```
// https://bl.ocks.org/mbhall88/126b3c2c54215b4d1ffbd2d778ce3973
// http://bl.ocks.org/d3noob/8375092

// For tree chart


// https://gist.github.com/d3noob/43a860bc0024792f8803bba8ca0d5ecd
// http://bl.ocks.org/d3noob/8375092

// Gerneral information

// https://bl.ocks.org/alandunning/7008d0332cc28a826b37b3cf6e7bd998


<!--Overall function of the code-->
<!--Usage (a brief description of public methods, properties, and events)-->
<!--The percentage of code written by the Me 70%-->
<!--The percentage of code taken from course examples or other source 30%-->


//=================== Career Module Charts ========================


function barchart_cm(targetDOMelement) {

    //Delare the main object that will be returned to caller
    var barchartObject = {};

    //=================== PUBLIC FUNCTIONS ========================
    //


    barchartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.render = function (callbackFunction) {
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.loadAndRenderDataset = function (data, pdata) {
        dataset = data;
        InstitutionPointData = pdata;
        // console.log("dataset ",dataset);
        barData = d3.nest()
        //        .key(function(d) { return d.Profile; })
            .key(function (d) {
                return d["Unit of assessment name"];
            })
            .key(function (d) {
                return d["Institution code (UKPRN)"];
            })
            .rollup(function (v) {
                return v.length;
            })
```

```
            .entries(dataset);
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.height = function (h) {
        svgHeight = h;
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.width = function (w) {
        svgWidth = w;
        grp.attr("transform", "translate(" + [w / 2, svgHeight / 2] + ")")

        layoutAndRender();
        return barchartObject;
    }

    //=================== PRIVATE VARIABLES ====================================
    //Width and height of svg canvas

    // var tooltipclass = "toolTip"
    var dataset = [];
    var barData = [];
    var InstitutionPointData = [];
    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;

    var x = d3.scaleBand()
        .range([0, svgWidth], .1);

    var y = d3.scaleLinear()
        .range([svgHeight, 0]);

    var xAxis = d3.axisBottom(x);

    var yAxis = d3.axisLeft(y)
    //Declare and append tooltip that we will use to show tooltip barchart within the svg


    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom)
        .append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop + ")");

    svg.append("text")
        .attr("x", (svgWidth / 2))
        .attr("y", 2 - (margintop / 2))
        .attr('class', 'bartitleselected')
        .text("Selected UOA to filter the data");



    var tip = d3.tip();


    //Declare and append group that we will use in the barchart within the svg


    //=================== PRIVATE FUNCTIONS ====================================

    function layoutAndRender() {
        //Taken and addapted from https://github.com/d3/d3-shape/blob/master/README.md#pie
```

```
        tip = d3.tip()
            .attr('class', 'd3-tip')
            .offset([-10, 0])
            .html(function (d) {
                return "<strong>" + d.key + " :</strong> <span style='color:red'>" +
d.values.length + "</span>";
            });
        svg.attr("width", svgWidth + marginleft + marginright)
            .attr("height", svgHeight + margintop + marginbottom)
            .attr("transform", "translate(" + marginleft + "," + margintop + ")");


        x.domain(barData.map(function (d) {
            return barData.indexOf(d) + 1;
        }))
            .paddingInner(0.1)
            .paddingOuter(0.5);

        y.domain([0, d3.max(barData, function (d) {
            return (d.values.length + margintop);
        })]);


        svg.append("g")
            .attr("class", "x axis")
            .attr("transform", "translate(0," + (svgHeight - 5) + ")")
            .call(xAxis)
            .call(tip);

        svg.append("g")
            .attr("class", "y axis")
            .call(yAxis);

        svg.append("text")
            .attr("transform",
                "translate(" + (svgWidth / 2) + " ," + (svgHeight + marginbottom) + ")")
            .style("text-anchor", "middle")
            .text("UOA");

        svg.append("text")
            .attr("class", "label")
            .attr("y", -(marginleft / 2))
            .attr("x", -(margintop / 2) + 2)
            .style("text-anchor", "end")
            .text("Count");

        svg.selectAll(".bar")
            .data(barData)
            .enter()
            .append("rect")
            .attr("class", "bar")
            // .style("fill", function(d) {return color(barData.indexOf(d)+1);})
            .attr("x", function (d) {
                return x(barData.indexOf(d) + 1);
            })
            .attr("width", x.bandwidth())
            .attr("y", function (d) {
                return y(d.values.length) - 5;
            })
            .attr("height", function (d) {
                return svgHeight - y(d.values.length);
            })
            .on('mouseover', tip.show)
            .on('mouseout', tip.hide)
```

```
            .on('click', function (d) {
                // console.log("this", this.classList.contains("barselected"));
                if (this.classList.contains("barselected")) {

                    d3.selectAll(".barselected").attr("class", "bar");
                    d3.selectAll(".bartitleselected").text("Selected UOA to filter the
data");


                    // careerModulel2.Update(InstitutionPointData);


                } else {

                    d3.selectAll(".barselected")
                        .transition()
                        .duration(200)
                        .attr("class", "bar");

                    d3.select(this)
                        .transition()
                        .duration(200)
                        .attr("class", "barselected");
                    d3.selectAll(".bartitleselected").text(d.key);

                    updateotherchart(d);
                }

            });
        svg.selectAll(".barlabel")
            .data(barData)
            .enter()
            .append("text")
            .attr("class", "barlabel")
            .attr("x", (function (d) {
                return x(barData.indexOf(d) + 1);
            }  ))
            .attr("y", function (d) {
                return y(d.values.length) + 10;
            })
            .attr("dy", "0.001em")
            .text(function (d) {
                return d.values.length;
            });


    }

    function updateotherchart(parm) {

        var selected = [];
        parm.values.forEach(processUniversity);

        function processUniversity(dr) {
            InstitutionPointData.forEach(function (rec) {
                if (rec.UKPRN == dr.key) {
                    // console.log("rec.UKPRN: ",rec.UKPRN,"row.key : ",dr.key);
                    var str = '{  "UKPRN":' + rec.UKPRN + ', "PROVIDER_NAME": "' +
rec.PROVIDER_NAME + '", "LATITUDE":"' + rec.LATITUDE + '",   "LONGITUDE":"' + rec.LONGITUDE
+ '",   "TOWN":"' + rec.TOWN + '" ,   "WEBSITE_URL":"' + rec.WEBSITE_URL + '"}';
                    var result = JSON.parse(str);
                    selected.push(result);
                }
            })
```

```
        }

        cm2.Update(selected);
        cm3.clear();
    }

    function type(d) {
        return d;
    }

    //================== IMPORTANT do not delete ===================================
    return barchartObject; // return the main object to the caller to create an instance of
the 'class'
}


function ukMap_cm(targetDOMelement, jsonMapData) {
    //Delare the main object that will be returned to caller
    var mapObject = {};

    //=================== PUBLIC FUNCTIONS ========================
    //


    mapObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.render = function (callbackFunction) {

        layoutAndRender();
        return mapObject;
    }

    mapObject.loadAndRenderDataset = function (jsonPointData) {
        InstitutionPointData = jsonPointData;
        layoutAndRender();

        return mapObject;
    }
    mapObject.Update = function (Data) {
        InstitutionPointData = Data;
        // console.log("InstitutionPointData",InstitutionPointData)
        // layoutAndRender();
        GUP_towns(svg, InstitutionPointData);
        // var circle=  d3.selectAll("circle");
        // repeat();
        // function repeat() {
        //
        //     circle
        //         .attr("opacity", .7)
        //         .transition()        // apply a transition
        //         .duration(4000)      // apply it over 2000 milliseconds
        //         .attr("fill", "red")     // move the circle to 920 on the x axis
        //         .attr("r", "8px")
        //         .transition()        // apply a transition
```

```
        //          .duration(4000)      // apply it over 2000 milliseconds
        //          .attr("fill", "green")       // return the circle to 40 on the x axis
        //          .attr("r", "4px")
        //          .on("end", repeat);  // when the transition finishes start again
        // };
        return mapObject;
    }
    mapObject.height = function (h) {
        svgHeight = h;
        layoutAndRender();
        return mapObject;
    }
    mapObject.width = function (w) {
        svgWidth = w;
        projection.translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }
    mapObject.scale = function (scale) {
        projectionscale = scale;
        projection.scale(projectionscale)
            .translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }
//================== PRIVATE VARIABLES ==================================
    //Width and height of svg canvas

    // var tooltipclass = "toolTip"
    var InstitutionPointData = [];

    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;
    var projectionscale = 2500, pointRadius = 2, active = d3.select(null);

    var projection = d3.geoAlbers()
        .center([0, 55.4])
        .rotate([4.4, 0])
        .parallels([50, 60])
        .scale(projectionscale)
        .translate([svgWidth / 2, svgHeight / 3]);

    //Define path generator (takes projected 2D geometry and formats for SVG)
    var path = d3.geoPath()
        .projection(projection)
        .pointRadius(pointRadius);

    //Create SVG
    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom)
        .append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop * 3 + ")");

    svg.append("rect")
        .attr("width", svgWidth)
        .attr("height", svgHeight)
        .style("fill", "none")
        .style("pointer-events", "all")
        .call(d3.zoom()
            .scaleExtent([1 / 2, 4])
```

```
        .on("zoom", zoomed));

function zoomed() {
    svg.attr("transform", d3.event.transform);
}



var tooltip = d3.select("body").append("div")
    .attr("class", "tooltip")
    .style("opacity", 0)
    .style("width", 600);

//================== PRIVATE FUNCTIONS ====================================
function layoutAndRender() {


    //Read in JSON file of UK map and do all the D3 stuff:
    d3.json(jsonMapData, function (error, uk) {
        if (error) return console.error(error);
        console.log(uk);


        // Displaying Polygons
        var subunits = topojson.feature(uk, uk.objects.subunits).features;
        GUP_subunits(svg, subunits, uk);
        GUP_towns(svg, InstitutionPointData);


    });


    //
}

function GUP_subunits(svg, subunits, uk) {

    svg.append("path")
        .datum(subunits)
        .attr("d", path);
    console.log("svg", svg);

    // Styling Polygons
    svg.selectAll(".subunit")
        .data(subunits)
        .enter()
        .append("path")
        .attr("class", function (d) {
            return "subunit " + d.id;
        })
        .attr("d", path);


    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
            return a !== b && a.id !== "IRL";
        }))
        .attr("d", path)
        .attr("class", "subunit-boundary");

    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
```

```
                // console.log("a id",a.id);
                return a === b && a.id === "IRL";
            }))
            .attr("d", path)
            .attr("class", "subunit-boundary IRL");

        // Country Labels
        svg.selectAll(".subunit-label")
            .data(subunits)
            .enter().append("text")
            .attr("class", function (d) {
                return "subunit-label " + d.id;
            })
            .attr("transform", function (d) {
                return "translate(" + path.centroid(d) + ")";
            })
            .attr("dy", ".35em")
            .text(function (d) {
                return d.properties.name;
            });


    }

    function GUP_towns(svg, places) {

        var circle = svg.selectAll("circle");


        circle
            .remove().exit()
            .data(InstitutionPointData)
            .enter()
            .append("circle")
            .attr("cx", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[0];
            })
            .attr("cy", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[1];
            })
            .attr("r", "3px")
            .attr("fill", "green")
            .attr("opacity", .7)
            .on("mouseover", function (d) {
                // var tip = "<h3>" + d.PROVIDER_NAME + "</h3>";
                var t = "<strong>Provider: </strong><span class='details'>" +
d.PROVIDER_NAME + "<br/></span> <strong>TOWN: </strong> <span class='details'>" + d.TOWN +
"<br/></span> <strong>WEBSITE URL: </strong> <span class='details'> <a href= \"" +
d.WEBSITE_URL + "\" >" + d.WEBSITE_URL + "</a></span>";

                tooltip
                    .html(t)
                    .style("left", (d3.event.pageX) + "px")
                    .style("top", (d3.event.pageY) + "px")
                    .transition()
                    .duration(500)
                    .style("opacity", .7);


            })
            .on("mouseout", function (d) {
                tooltip.transition()
                    .duration(500)
                    .style("opacity", 0);
```

```
        })
        .on("click", function (d) {
            cm3.loadAndRenderDataset(preperTreeData(d));


        });


}



function preperTreeData(selectedpoint) {

    console.log("selectedpoint", selectedpoint);
    DataFiltered = ref14data.filter(function (d) {

        if (d["Institution code (UKPRN)"] == selectedpoint.UKPRN) {
            return d
        }
    });
    console.log("DataFiltered", DataFiltered);

    var treeData = d3.nest()
        .key(function (d) {
            return d["Main panel"];
        })
        .key(function (d) {
            return d["Profile"];
        })
        .key(function (d) {
            return d["Unit of assessment name"];
        })

        .rollup(function (v) {
            return v
        })
        .entries(DataFiltered);

    // console.log("treeData",treeData);

    var refJSON = JSON.stringify(treeData);
    refJSON = refJSON.replace(new RegExp('values', 'g'), 'children');
    refJSON = refJSON.replace(new RegExp('key', 'g'), 'name');

    var jsonObj = JSON.parse(refJSON);


    var augRefJSON = {"name": selectedpoint.UKPRN, "children": jsonObj};


    return augRefJSON;
}

function reset() {
    active.classed("active", false);
    active = d3.select(null);

    svg.transition()
        .duration(750)
        .call(zoom.transform, d3.zoomIdentity); // updated for d3 v4
}
```

```
    //================== IMPORTANT do not delete ===================================
    return mapObject; // return the main object to the caller to create an instance of the
'class'
}


function treechart_cm(targetDOMelement) {
//Delare the main object that will be returned to caller
    var treechartObject = {};
    //=================== PRIVATE VARIABLES ====================================
// Set the dimensions and margins of the diagram
    var margin = {top: 20, right: 90, bottom: 30, left: 90},
        width = 960 - margin.left - margin.right,
        height = 500 - margin.top - margin.bottom;
    var i = 0,
        duration = 750,
        root;
    var treeData = [];
    var nodes;

    var div = d3.select("body").append("div")
        .attr("class", "Treetooltip")
        .style("opacity", 1e-6);

    var aside = d3.select(targetDOMelement).append("aside")
        .attr("class", "selecteinfo");

// declares a tree layout and assigns the size
    var treemap = d3.tree().size([height, width]);


    var svg = d3.select(targetDOMelement).append("svg")
        .attr("width", width + margin.right + margin.left)
        .attr("height", height + margin.top + margin.bottom)
        .append("g")
        .attr("transform", "translate("
            + margin.left + "," + margin.top + ")");

    //=================== PUBLIC FUNCTIONS ========================
    //

    treechartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.clear = function () {


        svg.style("display", "none");
        aside.style("display", "none");

        return treechartObject;
    }
    treechartObject.loadAndRenderDataset = function (data) {

        treeData = data;
```

```
    // Assigns parent, children, height, depth
    root = d3.hierarchy(treeData, function (d) {
        return d.children;
    });
    root.x0 = height / 2;
    root.y0 = 0;
    // Collapse after the second level
    root.children.forEach(collapse);
    update(root);
    // Collapse the node and all it's children
    function collapse(d) {
        if (d.children) {
            d._children = d.children
            d._children.forEach(collapse)
            d.children = null
        }
    }

    return treechartObject;
}

function update(source) {
    // Assigns the x and y position for the nodes
    var treeData = treemap(root);
    addInfoData(treeData);
    svg.style("display", "block");
    aside.style("display", "block");
    // Compute the new tree layout.
    nodes = treeData.descendants(),
        links = treeData.descendants().slice(1);
    // Normalize for fixed-depth.
    nodes.forEach(function (d) {
        d.y = d.depth * 180
    });
    // ****************** Nodes section ***************************
    // Update the nodes...
    var node = svg.selectAll('g.node')
        .data(nodes, function (d) {
            return d.id || (d.id = ++i);
        });
    // Enter any new modes at the parent's previous position.
    var nodeEnter = node.enter().append('g')
        .attr('class', 'node')
        .attr("transform", function (d) {
            return "translate(" + source.y0 + "," + source.x0 + ")";
        })
        .on('click', click);
    // Add Circle for the nodes
    nodeEnter.append('circle')
        .on("mouseover", mouseover)
        .on("mousemove", function (d) {
            mousemove(d);
        })
        .on("mouseout", mouseout)
        .attr('class', 'node')
        .attr('r', 1e-6)
        .style("fill", function (d) {
            return d._children ? "lightsteelblue" : "#fff";
        });
    // Add labels for the nodes
    nodeEnter.append('text')
        .attr("dy", ".35em")
        .attr("x", function (d) {
            return d.children || d._children ? -13 : 13;
```

```
    })
    .attr("text-anchor", function (d) {
        return d.children || d._children ? "end" : "start";
    })
    .text(function (d) {
        return d.data.name;
    });
// UPDATE
var nodeUpdate = nodeEnter.merge(node);
// Transition to the proper position for the node
nodeUpdate.transition()
    .duration(duration)
    .attr("transform", function (d) {
        return "translate(" + d.y + "," + d.x + ")";
    });
// Update the node attributes and style
nodeUpdate.select('circle.node')
    .attr('r', 10)
    .style("fill", function (d) {

        return d._children ? "lightsteelblue" : "#ffa500";
    })
    .attr('cursor', 'pointer');
// Remove any exiting nodes
var nodeExit = node.exit().transition()
    .duration(duration)
    .attr("transform", function (d) {
        return "translate(" + source.y + "," + source.x + ")";
    })
    .remove();
// On exit reduce the node circles size to 0
nodeExit.select('circle')
    .attr('r', 1e-6);
// On exit reduce the opacity of text labels
nodeExit.select('text')
    .style('fill-opacity', 1e-6);
// ****************** links section ***************************
// Update the links...
var link = svg.selectAll('path.link')
    .data(links, function (d) {
        return d.id;
    });
// Enter any new links at the parent's previous position.
var linkEnter = link.enter().insert('path', "g")
    .attr("class", "link")
    .attr('d', function (d) {
        var o = {x: source.x0, y: source.y0}
        return diagonal(o, o)
    });
// UPDATE
var linkUpdate = linkEnter.merge(link);
// Transition back to the parent element position
linkUpdate.transition()
    .duration(duration)
    .attr('d', function (d) {
        return diagonal(d, d.parent)
    });
// Remove any exiting links
var linkExit = link.exit().transition()
    .duration(duration)
    .attr('d', function (d) {
        var o = {x: source.x, y: source.y}
        return diagonal(o, o)
    })
```

```
            .remove();
        // Store the old positions for transition.
        nodes.forEach(function (d) {
            d.x0 = d.x;
            d.y0 = d.y;
        });

        // Creates a curved (diagonal) path from parent to the child nodes
        function diagonal(s, d) {
            path = `M ${s.y} ${s.x}
            C ${(s.y + d.y) / 2} ${s.x},
              ${(s.y + d.y) / 2} ${d.x},
              ${d.y} ${d.x}`
            return path
        }

        function mouseover() {
            div.transition()
                .duration(300)
                .style("opacity", 1);
        }

        function mousemove(d) {
            // console.log("d data",d);
            var tooltiptext;
            // calcUniversityperformance(treeData);
            if (d.depth == 0) {
                tooltiptext = getUniversity(d, "html");
            } else {
                var perdata = getPerformance(d);
                if (perdata.CountofUOA > 1) {
                    tooltiptext = "<strong>UOA No:*: </strong><span class='details'>" +
perdata.CountofUOA +
                        "<br/></span> <strong>Sum of 1*: </strong><span class='details'>" +
perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                } else {
                    tooltiptext = "</span> <strong>Sum of 1*: </strong><span
class='details'>" + perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                }


            }

            div.html(tooltiptext)
                .style("left", (d3.event.pageX ) + "px")
                .style("top", (d3.event.pageY) + "px");
        }
```

```
        function mouseout() {
            div.transition()
                .duration(300)
                .style("opacity", 1e-6);
        }

        // Toggle children on click.
        function click(d) {

            if (d.children) {
                d._children = d.children;
                d.children = null;

                // div.transition()
                //     .duration(500)
                //     .style("opacity", 0);
                // tooltip.transition()
                //     .duration(500)
                //     .style("opacity", 0);
            } else {

                // ref14data.forEach(findlastnode);
                // function findlastnode(dr){
                //
                //     if (dr["Unit of assessment name"]==d.data.name){
                //         console.log("d.data.name",dr["Unit of assessment name"]);
                //
                //         var t=  "<strong>UOA: </strong><span class='details'>" + dr["Unit
of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>" +
dr["FTE Category A staff submitted"] +"<br/></span>";
                //         // var t=  "<strong>UOA: </strong><span class='details'>" +
dr["Unit of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>"
+ dr["FTE Category A staff submitted"] +"<br/></span> <strong>WEBSITE URL: </strong> <span
class='details'> <a href= \"" + d.WEBSITE_URL + "\" >" + d.WEBSITE_URL  + "</a></span>";
                //
                //         tooltip.html(t)
                //             .style("left", (d3.event.pageX) + "px")
                //             .style("top", (d3.event.pageY) + "px");
                //
                //         tooltip.transition()
                //             .duration(500)
                //             .style("opacity", .7);
                //
                //     }}

                d.children = d._children;
                d._children = null;
            }
            update(d);
        }


    }

    function addInfoData(objdata) {
        console.log("treeData.data", objdata);
        var textinfo = getUniversity(objdata, "html");
        aside.html(textinfo);

    }

    function getUniversity(un, output) {
        var result;
        console.log("d.data", un);
```

```
        learningProviders.forEach(function (rec) {

            if (rec.UKPRN == un.data.name) {
                if (output == "html") {
                    result = "<strong>Provider: </strong><span class='details'>" +
rec.PROVIDER_NAME +
                        "<br/></span> <strong>UOA count: </strong> <span class='details'>" +
getPerformance(un).CountofUOA +
                        "<br/></span> <strong>GROUPS: </strong> <span class='details'>" +
rec.GROUPS +
                        "<br/></span> <strong>BUILDING_NAME_NUMBER: </strong> <span
class='details'>" + rec.BUILDING_NAME_NUMBER +
                        "<br/></span> <strong>LOCALITY: </strong> <span class='details'>" +
rec.LOCALITY +
                        "<br/></span> <strong>STREET_NAME: </strong> <span class='details'>"
+ rec.STREET_NAME +
                        "<br/></span> <strong>TOWN: </strong> <span class='details'>" +
rec.TOWN +
                        "<br/></span> <strong>POSTCODE: </strong> <span class='details'>" +
rec.POSTCODE +
                        "<br/></span> <strong>WEBSITE URL: </strong> <span class='details'>
<a href= \"" + rec.WEBSITE_URL + "\" >" + rec.WEBSITE_URL +
                        "</a></span>";
                } else {
                    result = [rec.PROVIDER_NAME, calcUniversityperformance(), rec.GROUPS,
rec.BUILDING_NAME_NUMBER, rec.LOCALITY, rec.STREET_NAME, rec.TOWN, rec.POSTCODE,
rec.WEBSITE_URL]
                }


            }
            return result;
        });

        return result;
    }

    function getPerformance(obj) {
        var Performance = {CountofUOA: 0, sumOfOne: 0, sumOftwo: 0, sumOftree: 0, sumOffour:
0, sumFTB: 0};

        function getLeafNodes(leafNodes, obj) {

            if (obj.children) {

                obj.children.forEach(function (child) {
                    getLeafNodes(leafNodes, child)

                });
            } else {

                leafNodes.push(obj);
            }
        }

        var leafNodes = [];
        getLeafNodes(leafNodes, obj.data);
        Performance.CountofUOA = leafNodes.length;
        leafNodes.forEach(function (child) {
            var childobject = child.value[0];
            // console.log("childobject[\"1*\"]",childobject["1*"])
            Performance.sumOfOne += Math.round(parseFloat(childobject["1*"]));
            Performance.sumOftwo += Math.round(parseFloat(childobject["2*"]));
            Performance.sumOftree += Math.round(parseFloat(childobject["3*"]));
```

```
            Performance.sumOffour += Math.round(parseFloat(childobject["4*"]));
            Performance.sumFTB += Math.round(parseFloat(childobject["FTE Category A staff
submitted"])) / Performance.CountofUOA;
        });

        return Performance;
    }

    //================== IMPORTANT do not delete ===================================
    return treechartObject; // return the main object to the caller to create an instance of
the 'class'

}


//=================== University Management Charts ========================


function barchart_um(targetDOMelement) {

    //Delare the main object that will be returned to caller
    var barchartObject = {};

    //=================== PUBLIC FUNCTIONS ========================
    //

    barchartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.render = function (callbackFunction) {
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.loadAndRenderDataset = function (data, pdata) {
        dataset = data;
        InstitutionPointData = pdata;
        // console.log("dataset ",dataset);
        barData = d3.nest()
        //        .key(function(d) { return d.Profile; })
            .key(function (d) {
                return d["Main panel"];
            })
            .rollup(function (v) {
                console.log("v", v);
                return v.length;
            })
            .entries(dataset);
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.height = function (h) {
        svgHeight = h;
        layoutAndRender();
        return barchartObject;
```

```
    }
    barchartObject.width = function (w) {
        svgWidth = w;
        grp.attr("transform", "translate(" + [w / 2, svgHeight / 2] + ")")

        layoutAndRender();
        return barchartObject;
    }

    //=================== PRIVATE VARIABLES ====================================
    //Width and height of svg canvas

    var dataset = [];
    var barData = [];
    var InstitutionPointData = [];
    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;

    var x = d3.scaleBand()
        .range([0, svgWidth], .1);

    var y = d3.scaleLinear()
        .range([svgHeight, 0]);

    var xAxis = d3.axisBottom(x);

    var yAxis = d3.axisLeft(y)
    //Declare and append tooltip that we will use to show tooltip barchart within the svg

    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom)
        .append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop + ")");

    svg.append("text")
        .attr("x", (svgWidth / 2))
        .attr("y", 2 - (margintop / 2))
        .attr('class', 'bartitleselected')
        .text("Selected Main panel to filter the data");

    var tip = d3.tip();


    //Declare and append group that we will use in the barchart within the svg


    //=================== PRIVATE FUNCTIONS ====================================

    function layoutAndRender() {
        console.log("barData ", barData);
        //Taken and addapted from https://github.com/d3/d3-shape/blob/master/README.md#pie
        tip = d3.tip()
            .attr('class', 'd3-tip')
            .offset([-10, 0])
            .html(function (d) {
                return "<strong>" + d.key + " :</strong> <span style='color:red'>" + d.value
+ "</span>";
            });
        svg.attr("width", svgWidth + marginleft + marginright)
            .attr("height", svgHeight + margintop + marginbottom)
            .attr("transform", "translate(" + marginleft + "," + margintop + ")");
```

```
        x.domain(barData.map(function (d) {
            return d.key;
        }))
            .paddingInner(0.1)
            .paddingOuter(0.5);
        console.log("d.value ", barData[3].value);
        y.domain([0, d3.max(barData, function (d) {
            return (d.value + margintop);
        })]);


        svg.append("g")
            .attr("class", "x axis")
            .attr("transform", "translate(0," + (svgHeight - 5) + ")")
            .call(xAxis)
            .call(tip);

        svg.append("g")
            .attr("class", "y axis")
            .call(yAxis);

        svg.append("text")
            .attr("transform",
                "translate(" + (svgWidth / 2) + " ," + (svgHeight + marginbottom) + ")")
            .style("text-anchor", "middle")
            .text("UOA");

        svg.append("text")
            .attr("class", "label")
            .attr("y", -(marginleft / 2))
            .attr("x", -(margintop / 2) + 2)
            .style("text-anchor", "end")
            .text("Count");

        svg.selectAll(".bar")
            .data(barData)
            .enter()
            .append("rect")
            .attr("class", "bar")
            // .style("fill", function(d) {return color(barData.indexOf(d)+1);})
            .attr("x", function (d) {
                return x(d.key);
            })
            .attr("width", x.bandwidth())
            .attr("y", function (d) {
                return y(d.value) - 5;
            })
            .attr("height", function (d) {
                return svgHeight - y(d.value);
            })
            .on('mouseover', tip.show)
            .on('mouseout', tip.hide)
            .on('click', function (d) {
                // console.log("this", this.classList.contains("barselected"));
                if (this.classList.contains("barselected")) {

                    d3.selectAll(".barselected").attr("class", "bar");
                    d3.selectAll(".bartitleselected").text("Selected UOA to filter the
data");

                    // careerModulel2.Update(InstitutionPointData);
```

```
                } else {

                    d3.selectAll(".barselected")
                        .transition()
                        .duration(200)
                        .attr("class", "bar");

                    d3.select(this)
                        .transition()
                        .duration(200)
                        .attr("class", "barselected");
                    d3.selectAll(".bartitleselected").text(d.key);

                    updateotherchart(d);
                }

            });
        svg.selectAll(".barlabel")
            .data(barData)
            .enter()
            .append("text")
            .attr("class", "barlabel")
            .attr("x", (function (d) {
                return x(d.key) + x.bandwidth() / 2;
            }  ))
            .attr("y", function (d) {
                return y(d.value) + 50;
            })
            .attr("dy", "0.001em")
            .text(function (d) {
                return d.value;
            });


    }

    function updateotherchart(parm) {
        console.log("parm", parm);
        updatemapchart(parm);

        function updatemapchart(parm) {

            var selected = [];

            var filtereddata = dataset.filter(function (d) {
                return d["Main panel"] == parm.key;
            });
            console.log("filtereddata", filtereddata);

            filtereddata.forEach(processUniversity);

            function processUniversity(dr) {
                InstitutionPointData.forEach(function (rec) {

                    if (rec.UKPRN == dr["Institution code (UKPRN)"]) {
                        // console.log("rec.UKPRN: ",rec.UKPRN,"row.key : ",dr.key);
                        var str = '{  "UKPRN":' + rec.UKPRN + ', "PROVIDER_NAME": "' +
rec.PROVIDER_NAME + '", "Main_panel": "' + dr["Main panel"] + '", "LATITUDE":"' +
rec.LATITUDE + '",   "LONGITUDE":"' + rec.LONGITUDE + '",   "TOWN":"' + rec.TOWN + '" ,
"WEBSITE_URL":"' + rec.WEBSITE_URL + '"}';

                        var result = JSON.parse(str);
                        selected.push(result);
                    }
```

```
                })
            }

            // svg.selectAll(".d3-tip").style("fill","red");
            console.log("selected Data", selected);
            um2.Update(selected);
        }

        um3.clear();


    }

    function type(d) {
        // d.values.length = +d.values.length;
        return d;
    }

    //================== IMPORTANT do not delete ===================================
    return barchartObject; // return the main object to the caller to create an instance of
the 'class'
}


function ukMap_um(targetDOMelement, jsonMapData) {
    //Delare the main object that will be returned to caller
    var mapObject = {};

    //================== PUBLIC FUNCTIONS ========================
    //


    mapObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.render = function (callbackFunction) {

        layoutAndRender();
        return mapObject;
    }

    mapObject.loadAndRenderDataset = function (jsonPointData) {
        InstitutionPointData = jsonPointData;
        layoutAndRender();

        return mapObject;
    }
    mapObject.Update = function (Data) {
        InstitutionPointData = Data;
        // layoutAndRender();
        GUP_towns(svg, InstitutionPointData);

        return mapObject;
    }
    mapObject.height = function (h) {
```

```
        svgHeight = h;
        layoutAndRender();
        return mapObject;
    }
    mapObject.width = function (w) {
        svgWidth = w;
        projection.translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }
    mapObject.scale = function (scale) {
        projectionscale = scale;
        projection.scale(projectionscale)
            .translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }
//================== PRIVATE VARIABLES ==================================
    //Width and height of svg canvas

    // var tooltipclass = "toolTip"
    var InstitutionPointData = [];

    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;
    var projectionscale = 2500, pointRadius = 2, active = d3.select(null);

    var projection = d3.geoAlbers()
        .center([0, 55.4])
        .rotate([4.4, 0])
        .parallels([50, 60])
        .scale(projectionscale)
        .translate([svgWidth / 2, svgHeight / 3]);

    //Define path generator (takes projected 2D geometry and formats for SVG)
    var path = d3.geoPath()
        .projection(projection)
        .pointRadius(pointRadius);

    //Create SVG
    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom)
        .append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop * 3 + ")");

    svg.append("rect")
        .attr("width", svgWidth)
        .attr("height", svgHeight)
        .style("fill", "none")
        .style("pointer-events", "all")
        .call(d3.zoom()
            .scaleExtent([1 / 2, 4])
            .on("zoom", zoomed));

    function zoomed() {
        svg.attr("transform", d3.event.transform);
    }


    var tooltip = d3.select("body").append("div")
```

```
    .attr("class", "tooltip")
    .style("opacity", 0)
    .style("width", 600);

//=================== PRIVATE FUNCTIONS ====================================
function layoutAndRender() {


    //Read in JSON file of UK map and do all the D3 stuff:
    d3.json(jsonMapData, function (error, uk) {
        if (error) return console.error(error);
        console.log(uk);


        // Displaying Polygons
        var subunits = topojson.feature(uk, uk.objects.subunits).features;
        // var places = topojson.feature(uk, uk.objects.places).features;
        GUP_subunits(svg, subunits, uk);
        GUP_towns(svg, InstitutionPointData);


    });


}

function GUP_subunits(svg, subunits, uk) {

    svg.append("path")
        .datum(subunits)
        .attr("d", path);
    console.log("svg", svg);

    // Styling Polygons
    svg.selectAll(".subunit")
        .data(subunits)
        .enter()
        .append("path")
        .attr("class", function (d) {
            return "subunit " + d.id;
        })
        .attr("d", path);


    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
            return a !== b && a.id !== "IRL";
        }))
        .attr("d", path)
        .attr("class", "subunit-boundary");

    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
            // console.log("a id",a.id);
            return a === b && a.id === "IRL";
        }))
        .attr("d", path)
        .attr("class", "subunit-boundary IRL");

    // Country Labels
    svg.selectAll(".subunit-label")
        .data(subunits)
```

```
            .enter().append("text")
            .attr("class", function (d) {
                return "subunit-label " + d.id;
            })
            .attr("transform", function (d) {
                return "translate(" + path.centroid(d) + ")";
            })
            .attr("dy", ".35em")
            .text(function (d) {
                return d.properties.name;
            });


    }

    function GUP_towns(svg, places) {

        var circle = svg.selectAll("circle");

        circle
            .remove().exit()
            .data(InstitutionPointData)
            .enter()
            .append("circle")
            .attr("cx", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[0];
            })
            .attr("cy", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[1];
            })
            .attr("r", "3px")
            .attr("fill", "green")
            .attr("opacity", .7)
            .on("mouseover", function (d) {
                // var tip = "<h3>" + d.PROVIDER_NAME + "</h3>";
                var t = "<strong>Provider: </strong><span class='details'>" +
d.PROVIDER_NAME + "<br/></span> <strong>TOWN: </strong> <span class='details'>" + d.TOWN +
"<br/></span> <strong>WEBSITE URL: </strong> <span class='details'> <a href= \"" +
d.WEBSITE_URL + "\" >" + d.WEBSITE_URL + "</a></span>";

                tooltip
                    .html(t)
                    .style("left", (d3.event.pageX) + "px")
                    .style("top", (d3.event.pageY) + "px")
                    .transition()
                    .duration(500)
                    .style("opacity", .7);


            })
            .on("mouseout", function (d) {
                tooltip.transition()
                    .duration(500)
                    .style("opacity", 0);
            })
            .on("click", function (d) {
                um3.loadAndRenderDataset(preperTreeData(d));

            });

    }


    function preperTreeData(selectedpoint) {
```

```
        console.log("selectedpoint", selectedpoint);
        DataFiltered = ref14data.filter(function (d) {

            if (d["Institution code (UKPRN)"] == selectedpoint.UKPRN && d["Main panel"] ==
selectedpoint.Main_panel) {
                return d
            }
        });
        console.log("DataFiltered", DataFiltered);

        var treeData = d3.nest()
        // .key(function(d) { return d["Main panel"]; })
            .key(function (d) {
                return d["Profile"];
            })
            // .key(function(d) { return d["FTE Category A staff submitted"]; })
            .key(function (d) {
                return d["Unit of assessment name"];
            })

            .rollup(function (v) {
                return v
            })
            .entries(DataFiltered);

        // console.log("treeData",treeData);

        var refJSON = JSON.stringify(treeData);
        refJSON = refJSON.replace(new RegExp('values', 'g'), 'children');
        refJSON = refJSON.replace(new RegExp('key', 'g'), 'name');

        var jsonObj = JSON.parse(refJSON);

        // console.log("jsonObj",jsonObj);

        var augRefJSON = {"name": selectedpoint.UKPRN, "children": jsonObj};

        // console.log("augRefJSON",augRefJSON);

        return augRefJSON;
    }

    function reset() {
        active.classed("active", false);
        active = d3.select(null);

        svg.transition()
            .duration(750)
            // .call( zoom.transform, d3.zoomIdentity.translate(0, 0).scale(1) ); // not in
d3 v4
            .call(zoom.transform, d3.zoomIdentity); // updated for d3 v4
    }


    //================== IMPORTANT do not delete ===================================
    return mapObject; // return the main object to the caller to create an instance of the
'class'
}


function treechart_um(targetDOMelement) {
//Delare the main object that will be returned to caller
    var treechartObject = {};
    //=================== PRIVATE VARIABLES ====================================
```

```
// Set the dimensions and margins of the diagram
    var margin = {top: 20, right: 90, bottom: 30, left: 90},
        width = 960 - margin.left - margin.right,
        height = 500 - margin.top - margin.bottom;
    var i = 0,
        duration = 750,
        root;
    var treeData = [];
    var nodes;
    // var div = d3.select(targetDOMelement).append("div")
    //     .attr("class", "tooltip")
    //     .style("opacity", 0);

    // var  tooltip= d3.select("body").append("div")
    //     .attr("class", "Treetooltip")
    //     .style("opacity", 0)
    //     .style("width", 600);
    var div = d3.select("body").append("div")
        .attr("class", "Treetooltip")
        .style("opacity", 1e-6);

    var aside = d3.select(targetDOMelement).append("aside")
        .attr("class", "selecteinfo");

// declares a tree layout and assigns the size
    var treemap = d3.tree().size([height, width]);

// append the svg object to the body of the page
// appends a 'group' element to 'svg'
// moves the 'group' element to the top left margin

    var svg = d3.select(targetDOMelement).append("svg")
        .attr("width", width + margin.right + margin.left)
        .attr("height", height + margin.top + margin.bottom)
        .append("g")
        .attr("transform", "translate("
            + margin.left + "," + margin.top + ")");

    //=================== PUBLIC FUNCTIONS ========================
    //

    treechartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.clear = function () {


        svg.style("display", "none");
        aside.style("display", "none");

        return treechartObject;
    }
    treechartObject.loadAndRenderDataset = function (data) {
        // console.log("treeData inside",treeData);
        svg.style("display", "block");
```

```
        aside.style("display", "block");
        treeData = data;
        // Assigns parent, children, height, depth
        root = d3.hierarchy(treeData, function (d) {
            return d.children;
        });
        root.x0 = height / 2;
        root.y0 = 0;
        // Collapse after the second level
        root.children.forEach(collapse);
        update(root);
        // addInfoData();
        // Collapse the node and all it's children
        function collapse(d) {
            if (d.children) {
                d._children = d.children
                d._children.forEach(collapse)
                d.children = null
            }
        }

        return treechartObject;
    }

    function update(source) {
        // Assigns the x and y position for the nodes
        var treeData = treemap(root);
        addInfoData(treeData);
        // Compute the new tree layout.
        nodes = treeData.descendants(),
            links = treeData.descendants().slice(1);
        // Normalize for fixed-depth.
        nodes.forEach(function (d) {
            d.y = d.depth * 180
        });
        // ****************** Nodes section ***************************
        // Update the nodes...
        var node = svg.selectAll('g.node')
            .data(nodes, function (d) {
                return d.id || (d.id = ++i);
            });
        // Enter any new modes at the parent's previous position.
        var nodeEnter = node.enter().append('g')
            .attr('class', 'node')
            .attr("transform", function (d) {
                return "translate(" + source.y0 + "," + source.x0 + ")";
            })
            .on('click', click);
        // Add Circle for the nodes
        nodeEnter.append('circle')
            .on("mouseover", mouseover)
            .on("mousemove", function (d) {
                mousemove(d);
            })
            .on("mouseout", mouseout)
            .attr('class', 'node')
            .attr('r', 1e-6)
            .style("fill", function (d) {
                return d._children ? "lightsteelblue" : "#fff";
            });
        // Add labels for the nodes
        nodeEnter.append('text')
            .attr("dy", ".35em")
            .attr("x", function (d) {
```

```
            return d.children || d._children ? -13 : 13;
        })
        .attr("text-anchor", function (d) {
            return d.children || d._children ? "end" : "start";
        })
        .text(function (d) {
            return d.data.name;
        });
    // UPDATE
    var nodeUpdate = nodeEnter.merge(node);
    // Transition to the proper position for the node
    nodeUpdate.transition()
        .duration(duration)
        .attr("transform", function (d) {
            return "translate(" + d.y + "," + d.x + ")";
        });
    // Update the node attributes and style
    nodeUpdate.select('circle.node')
        .attr('r', 10)
        .style("fill", function (d) {

            return d._children ? "lightsteelblue" : "#ffa500";
        })
        .attr('cursor', 'pointer');
    // Remove any exiting nodes
    var nodeExit = node.exit().transition()
        .duration(duration)
        .attr("transform", function (d) {
            return "translate(" + source.y + "," + source.x + ")";
        })
        .remove();
    // On exit reduce the node circles size to 0
    nodeExit.select('circle')
        .attr('r', 1e-6);
    // On exit reduce the opacity of text labels
    nodeExit.select('text')
        .style('fill-opacity', 1e-6);
    // ****************** links section ***************************
    // Update the links...
    var link = svg.selectAll('path.link')
        .data(links, function (d) {
            return d.id;
        });
    // Enter any new links at the parent's previous position.
    var linkEnter = link.enter().insert('path', "g")
        .attr("class", "link")
        .attr('d', function (d) {
            var o = {x: source.x0, y: source.y0}
            return diagonal(o, o)
        });
    // UPDATE
    var linkUpdate = linkEnter.merge(link);
    // Transition back to the parent element position
    linkUpdate.transition()
        .duration(duration)
        .attr('d', function (d) {
            return diagonal(d, d.parent)
        });
    // Remove any exiting links
    var linkExit = link.exit().transition()
        .duration(duration)
        .attr('d', function (d) {
            var o = {x: source.x, y: source.y}
            return diagonal(o, o)
```

```
            })
            .remove();
        // Store the old positions for transition.
        nodes.forEach(function (d) {
            d.x0 = d.x;
            d.y0 = d.y;
        });

        // Creates a curved (diagonal) path from parent to the child nodes
        function diagonal(s, d) {
            path = `M ${s.y} ${s.x}
            C ${(s.y + d.y) / 2} ${s.x},
              ${(s.y + d.y) / 2} ${d.x},
              ${d.y} ${d.x}`
            return path
        }

        function mouseover() {
            div.transition()
                .duration(300)
                .style("opacity", 1);
        }

        function mousemove(d) {
            // console.log("d data",d);
            var tooltiptext;
            // calcUniversityperformance(treeData);
            if (d.depth == 0) {
                tooltiptext = getUniversity(d, "html");
            } else {
                var perdata = getPerformance(d);
                if (perdata.CountofUOA > 1) {
                    tooltiptext = "<strong>UOA No:*: </strong><span class='details'>" +
perdata.CountofUOA +
                        "<br/></span> <strong>Sum of 1*: </strong><span class='details'>" +
perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                } else {
                    tooltiptext = "</span> <strong>Sum of 1*: </strong><span
class='details'>" + perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                }


            }

            div.html(tooltiptext)
                .style("left", (d3.event.pageX ) + "px")
                .style("top", (d3.event.pageY) + "px");
        }
```

```
        function mouseout() {
            div.transition()
                .duration(300)
                .style("opacity", 1e-6);
        }

        // Toggle children on click.
        function click(d) {

            if (d.children) {
                d._children = d.children;
                d.children = null;

                // div.transition()
                //     .duration(500)
                //     .style("opacity", 0);
                // tooltip.transition()
                //     .duration(500)
                //     .style("opacity", 0);
            } else {

                // ref14data.forEach(findlastnode);
                // function findlastnode(dr){
                //
                //     if (dr["Unit of assessment name"]==d.data.name){
                //         console.log("d.data.name",dr["Unit of assessment name"]);
                //
                //         var t=  "<strong>UOA: </strong><span class='details'>" + dr["Unit
of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>" +
dr["FTE Category A staff submitted"] +"<br/></span>";
                //         // var t=  "<strong>UOA: </strong><span class='details'>" +
dr["Unit of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>"
+ dr["FTE Category A staff submitted"] +"<br/></span> <strong>WEBSITE URL: </strong> <span
class='details'> <a href= \"" + d.WEBSITE_URL + "\" >" + d.WEBSITE_URL  + "</a></span>";
                //
                //         tooltip.html(t)
                //             .style("left", (d3.event.pageX) + "px")
                //             .style("top", (d3.event.pageY) + "px");
                //
                //         tooltip.transition()
                //             .duration(500)
                //             .style("opacity", .7);
                //
                //     }}

                d.children = d._children;
                d._children = null;
            }
            update(d);
        }


    }

    function addInfoData(objdata) {
        console.log("treeData.data", objdata);
        var textinfo = getUniversity(objdata, "html");
        aside.html(textinfo);

    }

    function getUniversity(un, output) {
        var result;
```

```
        console.log("d.data", un);
        learningProviders.forEach(function (rec) {

            if (rec.UKPRN == un.data.name) {
                if (output == "html") {
                    result = "<strong>Provider: </strong><span class='details'>" +
rec.PROVIDER_NAME +
                        "<br/></span> <strong>UOA count: </strong> <span class='details'>" +
getPerformance(un).CountofUOA +
                        "<br/></span> <strong>GROUPS: </strong> <span class='details'>" +
rec.GROUPS +
                        "<br/></span> <strong>BUILDING_NAME_NUMBER: </strong> <span
class='details'>" + rec.BUILDING_NAME_NUMBER +
                        "<br/></span> <strong>LOCALITY: </strong> <span class='details'>" +
rec.LOCALITY +
                        "<br/></span> <strong>STREET_NAME: </strong> <span class='details'>"
+ rec.STREET_NAME +
                        "<br/></span> <strong>TOWN: </strong> <span class='details'>" +
rec.TOWN +
                        "<br/></span> <strong>POSTCODE: </strong> <span class='details'>" +
rec.POSTCODE +
                        "<br/></span> <strong>WEBSITE URL: </strong> <span class='details'>
<a href= \"" + rec.WEBSITE_URL + "\" >" + rec.WEBSITE_URL +
                        "</a></span>";
                } else {
                    result = [rec.PROVIDER_NAME, calcUniversityperformance(), rec.GROUPS,
rec.BUILDING_NAME_NUMBER, rec.LOCALITY, rec.STREET_NAME, rec.TOWN, rec.POSTCODE,
rec.WEBSITE_URL]
                }


            }
            return result;
        });
        // console.log("result data",result);

        return result;
    }

    function getPerformance(obj) {
        var Performance = {CountofUOA: 0, sumOfOne: 0, sumOftwo: 0, sumOftree: 0, sumOffour:
0, sumFTB: 0};

        function getLeafNodes(leafNodes, obj) {

            if (obj.children) {

                obj.children.forEach(function (child) {
                    getLeafNodes(leafNodes, child)

                });
            } else {

                leafNodes.push(obj);
            }
        }

        var leafNodes = [];
        getLeafNodes(leafNodes, obj.data);
        Performance.CountofUOA = leafNodes.length;
        leafNodes.forEach(function (child) {
            var childobject = child.value[0];
            // console.log("childobject[\"1*\"]",childobject["1*"])
            Performance.sumOfOne += Math.round(parseFloat(childobject["1*"]));
```

```
            Performance.sumOftwo += Math.round(parseFloat(childobject["2*"]));
            Performance.sumOftree += Math.round(parseFloat(childobject["3*"]));
            Performance.sumOffour += Math.round(parseFloat(childobject["4*"]));
            Performance.sumFTB += Math.round(parseFloat(childobject["FTE Category A staff
submitted"])) / Performance.CountofUOA;
        });

        return Performance;
    }

    //================== IMPORTANT do not delete ===================================
    return treechartObject; // return the main object to the caller to create an instance of
the 'class'

}


//=================== industrial Module Charts ========================


function barchart_ic(targetDOMelement) {

    //Delare the main object that will be returned to caller
    var barchartObject = {};

    //=================== PUBLIC FUNCTIONS ========================
    //


    barchartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.render = function (callbackFunction) {
        layoutAndRender();
        return barchartObject;
    }

    barchartObject.loadAndRenderDataset = function (data, pdata) {
        dataset = data;
        InstitutionPointData = pdata;
        // console.log("dataset ",dataset);
        barData = d3.nest()
            .key(function (d) {
                return d["Unit of assessment name"];
            })

            .rollup(function (v) {
                return {
                    count: v.length,
                    total: d3.sum(v, function (d) {
                        return parseFloat(d["4*"]);
                    }),
                    max: d3.max(v, function (d) {
                        return parseFloat(d["4*"]);
                    }),
```

```
                    min: d3.min(v, function (d) {
                        return parseFloat(d["4*"]);
                    }),
                    avg: d3.mean(v, function (d) {
                        return parseFloat(d["4*"])
                    })
                };

            })
            .entries(dataset);
        console.log("barData ic ", barData);
        // console.log("l1Data values: ",barData.values.length);
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.update = function (val) {
        console.log("dataset ", dataset);
        console.log("barData ", barData);
        barData = d3.nest()
            .key(function (d) {
                return d["Unit of assessment name"];
            })
            // .key(function(d) { return d["Institution code (UKPRN)"]; })
            // .rollup(function(v) {
            //         console.log("v",v);
            //     return v.length; })
            .rollup(function (v) {
                return {
                    count: v.length,
                    total: d3.sum(v, function (d) {
                        return parseFloat(d["3*"]);
                    }),
                    max: d3.max(v, function (d) {
                        return parseFloat(d["3*"]);
                    }),
                    min: d3.min(v, function (d) {
                        return parseFloat(d["3*"]);
                    }),
                    avg: d3.mean(v, function (d) {
                        return parseFloat(d["3*"])
                    })
                };

            })
            .entries(dataset);
        console.log("barData ic val", barData);
        // console.log("l1Data values: ",barData.values.length);
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.height = function (h) {
        svgHeight = h;
        layoutAndRender();
        return barchartObject;
    }
    barchartObject.width = function (w) {
        svgWidth = w;
        grp.attr("transform", "translate(" + [w / 2, svgHeight / 2] + ")")

        layoutAndRender();
        return barchartObject;
    }

    //================== PRIVATE VARIABLES ==================================
```

```
    //Width and height of svg canvas

    // var tooltipclass = "toolTip"
    var dataset = [];
    var barData = [];
    var InstitutionPointData = [];
    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;

    var x;
    var y;

    var xAxis;
    var yAxis;


    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom);

    var g = svg.append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop + ")");

    svg.append("text")
        .attr("x", (svgWidth / 2))
        .attr("y", (margintop / 6))
        .attr('class', 'bartitleselected')
        .text("Selected UOA to filter the data");


    // var tip = d3.tip();
    var tooltip = d3.select("body").append("div").attr("class", "uitoolTip");


    //Declare and append group that we will use in the barchart within the svg


    //=================== PRIVATE FUNCTIONS ===================================

    function layoutAndRender() {
        console.log("barData ", barData);
        //Taken and addapted from https://github.com/d3/d3-shape/blob/master/README.md#pie
        x = d3.scaleLinear().range([0, svgWidth]);
        y = d3.scaleBand().range([svgHeight, 0]);

        xAxis = d3.axisBottom(x).ticks(5).tickFormat(function (d) {
            return parseInt(d / 1);
        }).tickSizeInner([-svgHeight]);
        yAxis = d3.axisLeft(y);

        barData.sort(function (a) {
            return a.key;
        });

        svg.attr("width", svgWidth + marginleft + marginright)
            .attr("height", svgHeight + margintop + marginbottom);
        g.attr("transform", "translate(" + marginleft + "," + margintop + ")");

        x.domain([0, d3.max(barData, function (d) {
            return d.value.avg;
        })]);

        y.domain(barData.map(function (d) {
```

```
            return barData.indexOf(d);
        }))
            .padding(0.1);

        g.append("g")
            .attr("class", "x axis")
            .attr("transform", "translate(0," + svgHeight + ")")
            .call(xAxis);

        g.append("g").attr("class", "y axis")
            .call(yAxis);

        g.selectAll(".bar")
            .data(barData)
            .enter()
            .append("rect")
            .attr("class", "bar")
            .attr("x", 0)
            .attr("height", y.bandwidth())
            .attr("y", function (d) {
                return y(barData.indexOf(d));
            })
            .attr("width", function (d) {
                return x(d.value.avg);
            })
            .on("click", function (d) {

                console.log("this", this.classList.contains("barselected"));
                if (this.classList.contains("barselected")) {

                    d3.selectAll(".barselected").attr("class", "bar");
                    d3.selectAll(".bartitleselected").text("Selected UOA to filter the
data");

                    // careerModulel2.Update(InstitutionPointData);


                } else {

                    d3.selectAll(".barselected")
                        .transition()
                        .duration(200)
                        .attr("class", "bar");

                    d3.select(this)
                        .transition()
                        .duration(200)
                        .attr("class", "barselected");
                    d3.selectAll(".bartitleselected").text(d.key);

                    // updateotherchart(d);
                }

            })
            .on("mouseover", function (d) {
                tooltip
                    .style("left", d3.event.pageX - 50 + "px")
                    .style("top", d3.event.pageY + 10 + "px")
                    .style("display", "inline-block")
                    .html(barData.indexOf(d) + ":" + (d.key)
                        + "</br>" + "Total: " + (d.value.total)
                        + "</br>" + "Count: " + (d.value.count)
                        // + "<br>" + "Max  : " + (d.value.max)
                        // + "<br>" + "Min  : " + (d.value.min)
```

```
                        + "</br>" + "Avg  :" + (d.value.avg));
            })
            .on("mouseout", function (d) {
                tooltip.style("display", "none");
            })
            .on('click', function (d) {
                // console.log("this", this.classList.contains("barselected"));
                if (this.classList.contains("barselected")) {

                    d3.selectAll(".barselected").attr("class", "bar");
                    d3.selectAll(".bartitleselected").text("Selected UOA to filter the
data");

                    // careerModulel2.Update(InstitutionPointData);


                } else {

                    d3.selectAll(".barselected")
                        .transition()
                        .duration(200)
                        .attr("class", "bar");

                    d3.select(this)
                        .transition()
                        .duration(200)
                        .attr("class", "barselected");
                    d3.selectAll(".bartitleselected").text(d.key);

                    updateotherchart(d);
                }

            });


        // svg.append("g")
        //     .attr("class", "x axis")
        //     .attr("transform", "translate(0," + (svgHeight-5) + ")")
        //     .call(xAxis)
        //     .call(tip);
        //
        // svg.append("g")
        //     .attr("class", "y axis")
        //     .call(yAxis);
        //
        // svg.append("text")
        //     .attr("transform",
        //         "translate(" + (svgWidth/2) + " ," + (svgHeight+ marginbottom) + ")")
        //     .style("text-anchor", "middle")
        //     .text("UOA");
        //
        // svg.append("text")
        //     .attr("class", "label")
        //     .attr("y", -(marginleft/2))
        //     .attr("x", -(margintop/2)+2 )
        //     .style("text-anchor", "end")
        //     .text("Count");
        //
        // svg.selectAll(".bar")
        //     .data(barData)
        //     .enter()
        //     .append("rect")
        //     .attr("class", "bar")
        //     // .style("fill", function(d) {return color(barData.indexOf(d)+1);})
```

```
        //     .attr("x", function(d) { return x(d.key); })
        //     .attr("width", x.bandwidth())
        //     .attr("y", function(d) { return y(d.value)-5; })
        //     .attr("height", function(d) { return svgHeight - y(d.value); })
        //     .on('mouseover', tip.show)
        //     .on('mouseout', tip.hide)
        //     .on('click', function (d) {
        //       // console.log("this", this.classList.contains("barselected"));
        //         if(this.classList.contains("barselected")){
        //
        //             d3.selectAll(".barselected").attr("class", "bar");
        //             d3.selectAll(".bartitleselected").text("Selected UOA to filter the
data");
        //
        //             // careerModulel2.Update(InstitutionPointData);
        //
        //
        //         }else{
        //
        //             d3.selectAll(".barselected")
        //                 .transition()
        //                 .duration(200)
        //                 .attr("class", "bar");
        //
        //             d3.select(this)
        //                 .transition()
        //                 .duration(200)
        //                 .attr("class","barselected");
        //             d3.selectAll(".bartitleselected").text( d.key);
        //
        //             updateotherchart(d);
        //         }
        //
        //     } );
        // svg.selectAll(".barlabel")
        //     .data(barData)
        //     .enter()
        //     .append("text")
        //     .attr("class","barlabel")
        //     .attr("x", (function(d) { return x(d.key)+ x.bandwidth()/2; }  ))
        //     .attr("y", function(d) { return y(d.value)+50; })
        //     .attr("dy", "0.001em")
        //     .text(function(d) { return d.value; });


    }

    function updateotherchart(parm) {
        console.log("parm", parm);
        updatemapchart(parm);
        ic3.clear();

        function updatemapchart(parm) {

            var selected = [];

            var filtereddata = dataset.filter(function (d) {
                return d["Unit of assessment name"] == parm.key;
            });
            console.log("filtereddata", filtereddata);

            filtereddata.forEach(processUniversity);

            function processUniversity(dr) {
```

```
                InstitutionPointData.forEach(function (rec) {

                    if (rec.UKPRN == dr["Institution code (UKPRN)"]) {
                        // console.log("rec.UKPRN: ",rec.UKPRN,"row.key : ",dr.key);
                        var str = '{  "UKPRN":' + rec.UKPRN + ', "PROVIDER_NAME": "' +
rec.PROVIDER_NAME + '", "Main_panel": "' + dr["Main panel"] + '", "LATITUDE":"' +
rec.LATITUDE + '",   "LONGITUDE":"' + rec.LONGITUDE + '",   "TOWN":"' + rec.TOWN + '" ,
"WEBSITE_URL":"' + rec.WEBSITE_URL + '"}';

                        var result = JSON.parse(str);
                        selected.push(result);
                    }
                })
            }

            // svg.selectAll(".d3-tip").style("fill","red");
            console.log("selected Data", selected);
            ic2.Update(selected);

        }



    }

    function type(d) {
        // d.values.length = +d.values.length;
        return d;
    }

    //================== IMPORTANT do not delete ===================================
    return barchartObject; // return the main object to the caller to create an instance of
the 'class'
}


function ukMap_ic(targetDOMelement, jsonMapData) {
    //Delare the main object that will be returned to caller
    var mapObject = {};

    //================== PUBLIC FUNCTIONS ========================
    //


    mapObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        layoutAndRender();
        return mapObject;
    }

    mapObject.render = function (callbackFunction) {

        layoutAndRender();
        return mapObject;
    }

    mapObject.loadAndRenderDataset = function (jsonPointData) {
        InstitutionPointData = jsonPointData;
```

```
        layoutAndRender();

        return mapObject;
    }
    mapObject.Update = function (Data) {
        InstitutionPointData = Data;
        // console.log("InstitutionPointData",InstitutionPointData)
        // layoutAndRender();
        GUP_towns(svg, InstitutionPointData);
        // var circle=  d3.selectAll("circle");
        // repeat();
        // function repeat() {
        //
        //     circle
        //         .attr("opacity", .7)
        //         .transition()        // apply a transition
        //         .duration(4000)      // apply it over 2000 milliseconds
        //         .attr("fill", "red")     // move the circle to 920 on the x axis
        //         .attr("r", "8px")
        //         .transition()        // apply a transition
        //         .duration(4000)      // apply it over 2000 milliseconds
        //         .attr("fill", "green")       // return the circle to 40 on the x axis
        //         .attr("r", "4px")
        //         .on("end", repeat);  // when the transition finishes start again
        // };
        return mapObject;
    }
    mapObject.height = function (h) {
        svgHeight = h;
        layoutAndRender();
        return mapObject;
    }
    mapObject.width = function (w) {
        svgWidth = w;
        projection.translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }
    mapObject.scale = function (scale) {
        projectionscale = scale;
        projection.scale(projectionscale)
            .translate([svgWidth / 2, svgHeight / 2]);

        layoutAndRender();
        return mapObject;
    }

//================== PRIVATE VARIABLES ==================================
    //Width and height of svg canvas

    // var tooltipclass = "toolTip"
    var InstitutionPointData = [];

    var svgWidth = 400, svgHeight = 400, margintop = 20, marginright = 20, marginbottom =
20, marginleft = 20;
    var projectionscale = 2500, pointRadius = 2, active = d3.select(null);

    var projection = d3.geoAlbers()
        .center([0, 55.4])
        .rotate([4.4, 0])
        .parallels([50, 60])
        .scale(projectionscale)
        .translate([svgWidth / 2, svgHeight / 3]);
```

```
    //Define path generator (takes projected 2D geometry and formats for SVG)
    var path = d3.geoPath()
        .projection(projection)
        .pointRadius(pointRadius);

    //Create SVG
    var svg = d3.select(targetDOMelement)
        .append("svg")
        .attr("width", svgWidth + marginleft + marginright)
        .attr("height", svgHeight + margintop + marginbottom)
        .append("g")
        .attr("transform", "translate(" + marginleft + "," + margintop * 3 + ")");

    svg.append("rect")
        .attr("width", svgWidth)
        .attr("height", svgHeight)
        .style("fill", "none")
        .style("pointer-events", "all")
        .call(d3.zoom()
            .scaleExtent([1 / 2, 4])
            .on("zoom", zoomed));

    function zoomed() {
        svg.attr("transform", d3.event.transform);
    }

    // .call(d3.zoom().scaleExtent([1, 8]).on("zoom", function () {
    //     svg.style("stroke-width", 1.5 / d3.event.transform.k + "px");
    //     svg.attr("transform", d3.event.transform)
    // }))
    // .on("click", function(){
    //     if (active.node() === this) return reset();
    //     active.classed("active", false);
    //     active = d3.select(this).classed("active", true);
    //
    //     // var bounds = path.bounds(d),
    //     //     dx = bounds[1][0] - bounds[0][0],
    //     //     dy = bounds[1][1] - bounds[0][1],
    //     //     x = (bounds[0][0] + bounds[1][0]) / 2,
    //     //     y = (bounds[0][1] + bounds[1][1]) / 2,
    //     //     scale = Math.max(1, Math.min(8, 0.9 / Math.max(dx / svgWidth, dy /
svgHeight))),
    //     //     translate = [svgWidth / 2 - scale * x, svgHeight / 2 - scale * y];
    //     //
    //     // svg.transition()
    //     //     .duration(750)
    //     //     .call( zoom.transform,
d3.zoomIdentity.translate(translate[0],translate[1]).scale(scale) ); // updated for d3 v4
    //
    // });

    /*svg.append("text")
        .attr("x", (svgWidth / 2))
        .attr("y", 0 - (margintop / 2))
        .attr("text-anchor", "middle")
        .style("font-size", "16px")
        .style("text-decoration", "underline")
        .text("Institution Location ");*/

    var tooltip = d3.select("body").append("div")
        .attr("class", "tooltip")
        .style("opacity", 0)
        .style("width", 600);
```

```
//=================== PRIVATE FUNCTIONS ===================================
function layoutAndRender() {


    //Read in JSON file of UK map and do all the D3 stuff:
    d3.json(jsonMapData, function (error, uk) {
        if (error) return console.error(error);
        console.log(uk);


        // Displaying Polygons
        var subunits = topojson.feature(uk, uk.objects.subunits).features;
        // var places = topojson.feature(uk, uk.objects.places).features;
        GUP_subunits(svg, subunits, uk);
        GUP_towns(svg, InstitutionPointData);


    });


    //
}

function GUP_subunits(svg, subunits, uk) {

    svg.append("path")
        .datum(subunits)
        .attr("d", path);
    console.log("svg", svg);

    // Styling Polygons
    svg.selectAll(".subunit")
        .data(subunits)
        .enter()
        .append("path")
        .attr("class", function (d) {
            return "subunit " + d.id;
        })
        .attr("d", path);


    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
            return a !== b && a.id !== "IRL";
        }))
        .attr("d", path)
        .attr("class", "subunit-boundary");

    // Displaying Boundaries
    svg.append("path")
        .datum(topojson.mesh(uk, uk.objects.subunits, function (a, b) {
            // console.log("a id",a.id);
            return a === b && a.id === "IRL";
        }))
        .attr("d", path)
        .attr("class", "subunit-boundary IRL");

    // Country Labels
    svg.selectAll(".subunit-label")
        .data(subunits)
        .enter().append("text")
        .attr("class", function (d) {
```

```
                return "subunit-label " + d.id;
            })
            .attr("transform", function (d) {
                return "translate(" + path.centroid(d) + ")";
            })
            .attr("dy", ".35em")
            .text(function (d) {
                return d.properties.name;
            });


    }

    function GUP_towns(svg, places) {

        var circle = svg.selectAll("circle");
        // console.log("InstitutionPointData",InstitutionPointData);
        // tip = d3.tip()
        //     .attr('class', 'd3-tip')
        //     .offset([-10, 0])
        //     .html(function(d) {
        //         return "<strong>" + d.PROVIDER_NAME + " :</strong> >";
        //     });


        circle
            .remove().exit()
            .data(InstitutionPointData)
            .enter()
            .append("circle")
            .attr("cx", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[0];
            })
            .attr("cy", function (d) {
                return projection([d.LONGITUDE, d.LATITUDE])[1];
            })
            .attr("r", "3px")
            .attr("fill", "green")
            .attr("opacity", .7)
            .on("mouseover", function (d) {
                // var tip = "<h3>" + d.PROVIDER_NAME + "</h3>";
                var t = "<strong>Provider: </strong><span class='details'>" +
d.PROVIDER_NAME + "<br/></span> <strong>TOWN: </strong> <span class='details'>" + d.TOWN +
"<br/></span> <strong>WEBSITE URL: </strong> <span class='details'> <a href= \"" +
d.WEBSITE_URL + "\" >" + d.WEBSITE_URL + "</a></span>";

                tooltip
                    .html(t)
                    .style("left", (d3.event.pageX) + "px")
                    .style("top", (d3.event.pageY) + "px")
                    .transition()
                    .duration(500)
                    .style("opacity", .7);


            })
            .on("mouseout", function (d) {
                tooltip.transition()
                    .duration(500)
                    .style("opacity", 0);
            })
            .on("click", function (d) {
                // console.log("careerModulel3",careerModulel3);
                ic3.loadAndRenderDataset(preperTreeData(d));
```

```
                // careerModulel3.data(preperTreeData(d));
                // d3.select('#careerModulel3')
                //     .call(careerModulel3);
                // careerModulel3.exit().remove();


            });


        // console.log("InstitutionPointData",InstitutionPointData[0].LATITUDE);

        // svg.selectAll(".place-label")
        //     .data(InstitutionPointData)
        //     .enter().append("text")
        //     .attr("class", "place-label")
        //     .attr("transform", function(d) { return "translate(" +
projection([d.LONGITUDE,d.LATITUDE]) + ")"; })
        //     .attr("x", function(d) { return [d.LONGITUDE,d.LATITUDE][0] > -1 ? 6 : -6; })
        //     .attr("dy", ".35em")
        //     .style("text-anchor", function(d) { return [d.LONGITUDE,d.LATITUDE][0] > -1 ?
"start" : "end"; })
        //     .text(function(d) { return InstitutionPointData.indexOf(d)+1; });


    }


    function preperTreeData(selectedpoint) {

        console.log("selectedpoint", selectedpoint);
        DataFiltered = ref14data.filter(function (d) {

            if (d["Institution code (UKPRN)"] == selectedpoint.UKPRN) {
                // console.log("ref14data d val",d["Institution code (UKPRN)"]);
                // console.log("selectedpoint",selectedpoint.UKPRN);
                return d
            }
        });
        console.log("DataFiltered", DataFiltered);

        var treeData = d3.nest()
            .key(function (d) {
                return d["Main panel"];
            })
            .key(function (d) {
                return d["Profile"];
            })
            // .key(function(d) { return d["FTE Category A staff submitted"]; })
            .key(function (d) {
                return d["Unit of assessment name"];
            })

            .rollup(function (v) {
                return v
            })
            .entries(DataFiltered);

        // console.log("treeData",treeData);

        var refJSON = JSON.stringify(treeData);
        refJSON = refJSON.replace(new RegExp('values', 'g'), 'children');
        refJSON = refJSON.replace(new RegExp('key', 'g'), 'name');

        var jsonObj = JSON.parse(refJSON);
```

```
        // console.log("jsonObj",jsonObj);

        var augRefJSON = {"name": selectedpoint.UKPRN, "children": jsonObj};

        // console.log("augRefJSON",augRefJSON);

        return augRefJSON;
    }

    function reset() {
        active.classed("active", false);
        active = d3.select(null);

        svg.transition()
            .duration(750)
            // .call( zoom.transform, d3.zoomIdentity.translate(0, 0).scale(1) ); // not in
d3 v4
            .call(zoom.transform, d3.zoomIdentity); // updated for d3 v4
    }


    //================== IMPORTANT do not delete ===================================
    return mapObject; // return the main object to the caller to create an instance of the
'class'
}


function treechart_ic(targetDOMelement) {
//Delare the main object that will be returned to caller
    var treechartObject = {};
    //================== PRIVATE VARIABLES ===================================
// Set the dimensions and margins of the diagram
    var margin = {top: 20, right: 90, bottom: 30, left: 90},
        width = 960 - margin.left - margin.right,
        height = 500 - margin.top - margin.bottom;
    var i = 0,
        duration = 750,
        root;
    var treeData = [];
    var nodes;
    // var div = d3.select(targetDOMelement).append("div")
    //     .attr("class", "tooltip")
    //     .style("opacity", 0);

    // var  tooltip= d3.select("body").append("div")
    //     .attr("class", "Treetooltip")
    //     .style("opacity", 0)
    //     .style("width", 600);
    var div = d3.select("body").append("div")
        .attr("class", "Treetooltip")
        .style("opacity", 1e-6);

    var aside = d3.select(targetDOMelement).append("aside")
        .attr("class", "selecteinfo");

// declares a tree layout and assigns the size
    var treemap = d3.tree().size([height, width]);

// append the svg object to the body of the page
// appends a 'group' element to 'svg'
// moves the 'group' element to the top left margin

    var svg = d3.select(targetDOMelement).append("svg")
```

```
        .attr("width", width + margin.right + margin.left)
        .attr("height", height + margin.top + margin.bottom)
        .append("g")
        .attr("transform", "translate("
            + margin.left + "," + margin.top + ")");

    //================== PUBLIC FUNCTIONS ========================
    //

    treechartObject.overrideMouseOverFunction = function (callbackFunction) {
        mouseOverFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.overrideMouseOutFunction = function (callbackFunction) {
        mouseOutFunction = callbackFunction;
        // layoutAndRender();
        return treechartObject;
    }

    treechartObject.clear = function () {


        svg.style("display", "none");
        aside.style("display", "none");

        return treechartObject;
    }
    treechartObject.loadAndRenderDataset = function (data) {
        // console.log("treeData inside",treeData);
        svg.style("display", "block");
        aside.style("display", "block");

        treeData = data;
        // Assigns parent, children, height, depth
        root = d3.hierarchy(treeData, function (d) {
            return d.children;
        });
        root.x0 = height / 2;
        root.y0 = 0;
        // Collapse after the second level
        root.children.forEach(collapse);
        update(root);
        addInfoData();

        // Collapse the node and all it's children
        function collapse(d) {
            if (d.children) {
                d._children = d.children
                d._children.forEach(collapse)
                d.children = null
            }
        }

        return treechartObject;
    }

    function update(source) {
        // Assigns the x and y position for the nodes
        var treeData = treemap(root);
        addInfoData(treeData);
        // Compute the new tree layout.
        nodes = treeData.descendants(),
```

```
    links = treeData.descendants().slice(1);
// Normalize for fixed-depth.
nodes.forEach(function (d) {
    d.y = d.depth * 180
});
// ****************** Nodes section ***************************
// Update the nodes...
var node = svg.selectAll('g.node')
    .data(nodes, function (d) {
        return d.id || (d.id = ++i);
    });
// Enter any new modes at the parent's previous position.
var nodeEnter = node.enter().append('g')
    .attr('class', 'node')
    .attr("transform", function (d) {
        return "translate(" + source.y0 + "," + source.x0 + ")";
    })
    .on('click', click);
// Add Circle for the nodes
nodeEnter.append('circle')
    .on("mouseover", mouseover)
    .on("mousemove", function (d) {
        mousemove(d);
    })
    .on("mouseout", mouseout)
    .attr('class', 'node')
    .attr('r', 1e-6)
    .style("fill", function (d) {
        return d._children ? "lightsteelblue" : "#fff";
    });
// Add labels for the nodes
nodeEnter.append('text')
    .attr("dy", ".35em")
    .attr("x", function (d) {
        return d.children || d._children ? -13 : 13;
    })
    .attr("text-anchor", function (d) {
        return d.children || d._children ? "end" : "start";
    })
    .text(function (d) {
        return d.data.name;
    });
// UPDATE
var nodeUpdate = nodeEnter.merge(node);
// Transition to the proper position for the node
nodeUpdate.transition()
    .duration(duration)
    .attr("transform", function (d) {
        return "translate(" + d.y + "," + d.x + ")";
    });
// Update the node attributes and style
nodeUpdate.select('circle.node')
    .attr('r', 10)
    .style("fill", function (d) {

        return d._children ? "lightsteelblue" : "#ffa500";
    })
    .attr('cursor', 'pointer');
// Remove any exiting nodes
var nodeExit = node.exit().transition()
    .duration(duration)
    .attr("transform", function (d) {
        return "translate(" + source.y + "," + source.x + ")";
    })
```

```
    .remove();
// On exit reduce the node circles size to 0
nodeExit.select('circle')
    .attr('r', 1e-6);
// On exit reduce the opacity of text labels
nodeExit.select('text')
    .style('fill-opacity', 1e-6);
// ****************** links section ***************************
// Update the links...
var link = svg.selectAll('path.link')
    .data(links, function (d) {
        return d.id;
    });
// Enter any new links at the parent's previous position.
var linkEnter = link.enter().insert('path', "g")
    .attr("class", "link")
    .attr('d', function (d) {
        var o = {x: source.x0, y: source.y0}
        return diagonal(o, o)
    });
// UPDATE
var linkUpdate = linkEnter.merge(link);
// Transition back to the parent element position
linkUpdate.transition()
    .duration(duration)
    .attr('d', function (d) {
        return diagonal(d, d.parent)
    });
// Remove any exiting links
var linkExit = link.exit().transition()
    .duration(duration)
    .attr('d', function (d) {
        var o = {x: source.x, y: source.y}
        return diagonal(o, o)
    })
    .remove();
// Store the old positions for transition.
nodes.forEach(function (d) {
    d.x0 = d.x;
    d.y0 = d.y;
});

// Creates a curved (diagonal) path from parent to the child nodes
function diagonal(s, d) {
    path = `M ${s.y} ${s.x}
    C ${(s.y + d.y) / 2} ${s.x},
      ${(s.y + d.y) / 2} ${d.x},
      ${d.y} ${d.x}`
    return path
}

function mouseover() {
    div.transition()
        .duration(300)
        .style("opacity", 1);
}

function mousemove(d) {
    // console.log("d data",d);
    var tooltiptext;
    // calcUniversityperformance(treeData);
    if (d.depth == 0) {
        tooltiptext = getUniversity(d, "html");
    } else {
```

```
                var perdata = getPerformance(d);
                if (perdata.CountofUOA > 1) {
                    toolttiptext = "<strong>UOA No:*: </strong><span class='details'>" +
perdata.CountofUOA +
                        "<br/></span> <strong>Sum of 1*: </strong><span class='details'>" +
perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                } else {
                    toolttiptext = "</span> <strong>Sum of 1*: </strong><span
class='details'>" + perdata.sumOfOne +
                        "<br/></span> <strong>Sum of 2*: </strong> <span class='details'>" +
perdata.sumOftwo +
                        "<br/></span> <strong>Sum of 3*: </strong> <span class='details'>" +
perdata.sumOftree +
                        "<br/></span> <strong>Sum of 4*: </strong> <span class='details'>" +
perdata.sumOffour +
                        "<br/></span> <strong>Sum of FTE: </strong> <span class='details'>"
+ perdata.sumFTB + "</span>";
                }


            }

            div.html(toolttiptext)
                .style("left", (d3.event.pageX ) + "px")
                .style("top", (d3.event.pageY) + "px");
        }

        function mouseout() {
            div.transition()
                .duration(300)
                .style("opacity", 1e-6);
        }

        // Toggle children on click.
        function click(d) {

            if (d.children) {
                d._children = d.children;
                d.children = null;

                // div.transition()
                //     .duration(500)
                //     .style("opacity", 0);
                // tooltip.transition()
                //     .duration(500)
                //     .style("opacity", 0);
            } else {

                // ref14data.forEach(findlastnode);
                // function findlastnode(dr){
                //
                //     if (dr["Unit of assessment name"]==d.data.name){
                //         console.log("d.data.name",dr["Unit of assessment name"]);
                //
                //         var t=  "<strong>UOA: </strong><span class='details'>" + dr["Unit
of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>" +
```

```
dr["FTE Category A staff submitted"] +"<br/></span>";
                //         // var t=  "<strong>UOA: </strong><span class='details'>" +
dr["Unit of assessment name"] + "<br/></span> <strong>FTE: </strong> <span class='details'>"
+ dr["FTE Category A staff submitted"] +"<br/></span> <strong>WEBSITE URL: </strong> <span
class='details'> <a href= \"" + d.WEBSITE_URL + "\" >" + d.WEBSITE_URL  + "</a></span>";
                //
                //         tooltip.html(t)
                //             .style("left", (d3.event.pageX) + "px")
                //             .style("top", (d3.event.pageY) + "px");
                //
                //         tooltip.transition()
                //             .duration(500)
                //             .style("opacity", .7);
                //
                //     }}

                d.children = d._children;
                d._children = null;
            }
            update(d);
        }


    }

    function addInfoData(objdata) {
        console.log("treeData.data", objdata);
        var textinfo = getUniversity(objdata, "html");
        aside.html(textinfo);

    }

    function getUniversity(un, output) {
        var result;
        console.log("d.data", un);
        learningProviders.forEach(function (rec) {

            if (rec.UKPRN == un.data.name) {
                if (output == "html") {
                    result = "<strong>Provider: </strong><span class='details'>" +
rec.PROVIDER_NAME +
                        "<br/></span> <strong>UOA count: </strong> <span class='details'>" +
getPerformance(un).CountofUOA +
                        "<br/></span> <strong>GROUPS: </strong> <span class='details'>" +
rec.GROUPS +
                        "<br/></span> <strong>BUILDING_NAME_NUMBER: </strong> <span
class='details'>" + rec.BUILDING_NAME_NUMBER +
                        "<br/></span> <strong>LOCALITY: </strong> <span class='details'>" +
rec.LOCALITY +
                        "<br/></span> <strong>STREET_NAME: </strong> <span class='details'>"
+ rec.STREET_NAME +
                        "<br/></span> <strong>TOWN: </strong> <span class='details'>" +
rec.TOWN +
                        "<br/></span> <strong>POSTCODE: </strong> <span class='details'>" +
rec.POSTCODE +
                        "<br/></span> <strong>WEBSITE URL: </strong> <span class='details'>
<a href= \"" + rec.WEBSITE_URL + "\" >" + rec.WEBSITE_URL +
                        "</a></span>";
                } else {
                    result = [rec.PROVIDER_NAME, calcUniversityperformance(), rec.GROUPS,
rec.BUILDING_NAME_NUMBER, rec.LOCALITY, rec.STREET_NAME, rec.TOWN, rec.POSTCODE,
rec.WEBSITE_URL]
                }
```

```
            }
            return result;
        });
        // console.log("result data",result);

        return result;
    }

    function getPerformance(obj) {
        var Performance = {CountofUOA: 0, sumOfOne: 0, sumOftwo: 0, sumOftree: 0, sumOffour:
0, sumFTB: 0};

        function getLeafNodes(leafNodes, obj) {

            if (obj.children) {

                obj.children.forEach(function (child) {
                    getLeafNodes(leafNodes, child)

                });
            } else {

                leafNodes.push(obj);
            }
        }

        var leafNodes = [];
        getLeafNodes(leafNodes, obj.data);
        Performance.CountofUOA = leafNodes.length;
        leafNodes.forEach(function (child) {
            var childobject = child.value[0];
            // console.log("childobject[\"1*\"]",childobject["1*"])
            Performance.sumOfOne += Math.round(parseFloat(childobject["1*"]));
            Performance.sumOftwo += Math.round(parseFloat(childobject["2*"]));
            Performance.sumOftree += Math.round(parseFloat(childobject["3*"]));
            Performance.sumOffour += Math.round(parseFloat(childobject["4*"]));
            Performance.sumFTB += Math.round(parseFloat(childobject["FTE Category A staff
submitted"])) / Performance.CountofUOA;
        });

        return Performance;
    }

    //================== IMPORTANT do not delete ===================================
    return treechartObject; // return the main object to the caller to create an instance of
the 'class'

}


//================== End Charts ========================
```