Graph of Marvel Cinematic Universe

Create a network graph of the Marvel Cinematic Universe (including Avengers: Endgame - hopefully no spoilers!)

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Read and parse movie and character data

Get the movie data from OMDb and list of characters appearing in the movie from IMDb.

*****Note:** You will need a key to read the data through the OMDb API. The data are provided in `marvelData.mat` otherwise.

```
% apikey = "1111ee1";          % Use API key in this form
[movieData,characterData,Movie] = readParseMovieData(apikey);
```

Examine the data.

```
head(movieData)
```

ans = 8×24 table

...

	Title	Year	Rated	Released	Runtime	Genre	Director	Writer
1	"Iron Man"	2008	"PG-13"	02-May-2008	"126 min"	"Action, ...	"Jon Favreau"	"Mark Fer...
2	"The Incr...	2008	"PG-13"	13-Jun-2008	"112 min"	"Action, ...	"Louis Let...	"Zak Penn...
3	"Iron Man 2"	2010	"PG-13"	07-May-2010	"124 min"	"Action, ...	"Jon Favreau"	"Justin T...
4	"Thor"	2011	"PG-13"	06-May-2011	"115 min"	"Action, ...	"Kenneth B...	"Ashley M...
5	"Captain ...	2011	"PG-13"	22-Jul-2011	"124 min"	"Action, ...	"Joe Johnston"	"Christop...
6	"The Aven...	2012	"PG-13"	04-May-2012	"143 min"	"Action, ...	"Joss Whedon"	"Joss Whe...
7	"Iron Man 3"	2013	"PG-13"	03-May-2013	"130 min"	"Action, ...	"Shane Black"	"Drew Pea...
8	"Thor: Th...	2013	"PG-13"	08-Nov-2013	"112 min"	"Action, ...	"Alan Taylor"	"Christop...

```
head(characterData)
```

ans = 8×2 table

	Character	Movie
1	Abu Bakaar	Iron Man
2	Agent Coulson	Iron Man
3	Ahmed	Iron Man
4	Amira Ahmed	Iron Man
5	CAOC Analyst	Iron Man

	Character	Movie
6	Christine E...	Iron Man
7	Colonel Craig	Iron Man
8	General Gab...	Iron Man

Who appears in the most movies?

```
charCounts = groupsummary(characterData,1);
charCounts = sortrows(charCounts,'GroupCount','descend');
charCounts(1:10,:)
```

ans = 10×2 table

	Character	GroupCount
1	Tony Stark ...	9
2	Steve Roger...	8
3	James Rhode...	7
4	Natasha Rom...	7
5	Nick Fury	7
6	Pepper Potts	7
7	Thor	7
8	Bruce Banne...	6
9	Howard Stark	6
10	Loki	6

Not suprised to see it's Iron Man !

Save the data for a rainy day.

```
% save marvelData.mat movieData characterData charCounts
```

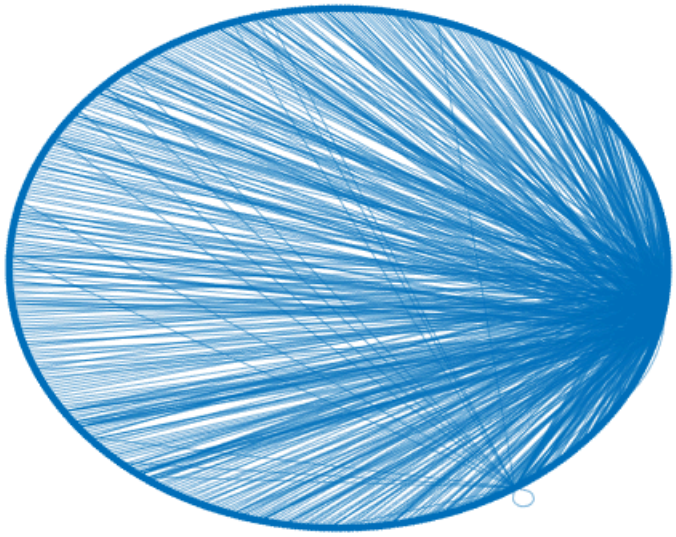
Create graph of universe

Visualize the graph of all characters and movies in the list.

```
g = graph(characterData.Character,characterData.Movie);
```

Visualize the graph in 2D using different layouts (select from the drop down)

```
layout = "circle";
figure
plot(g,'Layout',layout);
axis off
```

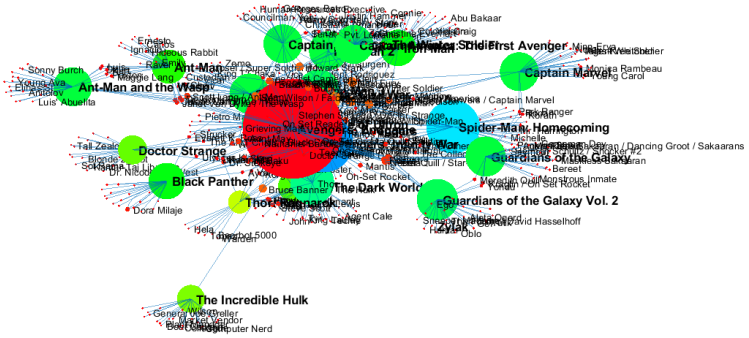


Plot in 3D and size and color the nodes based on degree. Label the nodes (not all of them since it's hard to read)

```
figure('units','normalized','outerposition',[0 0 1 1])
colormap hsv
p = plot(g,'Layout','force3','UseGravity','on',...
    'MarkerSize',degree(g));
p.NodeCData = degree(g);

% Label the nodes
labels = string(g.Nodes.Name);
% Display fewer labels for readability (keep important ones)
% Keep labels for most frequent characters
mostFreq = charCounts.Character(charCounts.GroupCount >=2);
idxFreq = ismember(labels,string(mostFreq));
% Keep a random sample of all characters
[~,idxSamp] = datasample(labels,150);
newlbls = strings(size(labels));
newlbls(idxFreq) = labels(idxFreq);
newlbls(idxSamp)= labels(idxSamp);
% Keep movie labels
newlbls(end-21:end)=labels(end-21:end);
p.NodeLabel = newlbls;
% Update font size of movies
x = ones(size(labels))*8;
x(end-21:end) = 10;
p.NodeFontSize = x;
wts = repmat("normal",size(labels));
```

```
wts(end-21:end) = "bold";
p.NodeFontWeight = wts;
axis off
```



You can clearly see the larger, colorful movie nodes, with Avengers: Endgame in the middle, being the most connected. Rotating and zooming into the graph allows you to see more interesting connections!

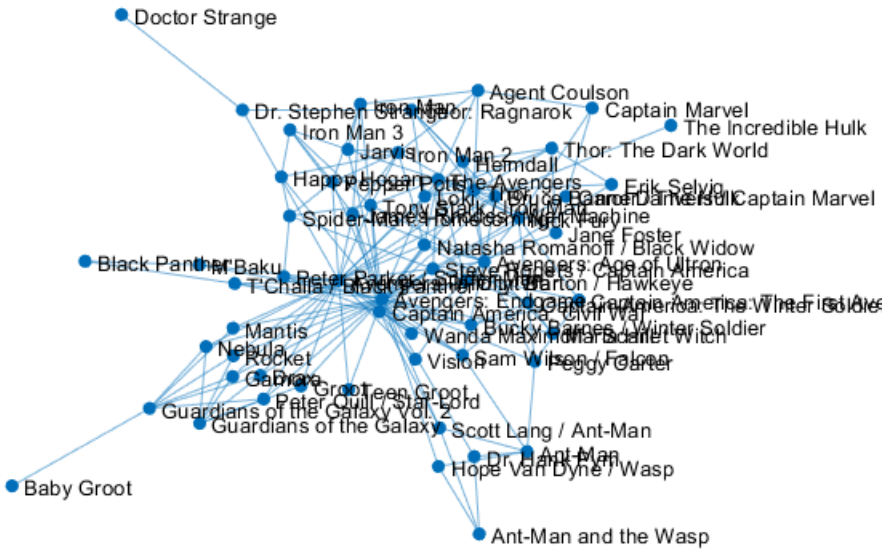
Create graph of main characters

Select only the main characters using the function below (well, main characters and my favorites!)

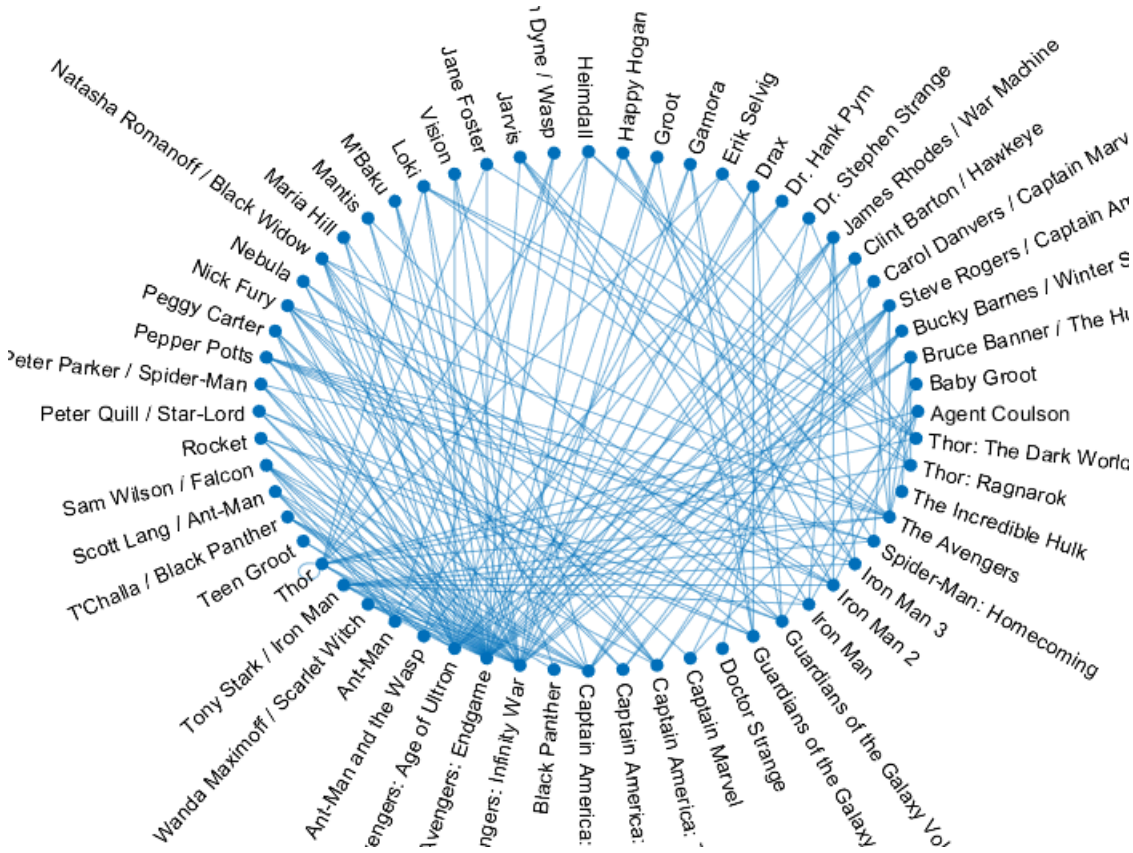
```
mainCharData = selectMainChars(characterData);
```

Create the graph and select different layouts

```
g = graph(mainCharData.Character,mainCharData.Movie);
figure
plot(g);
axis off
```



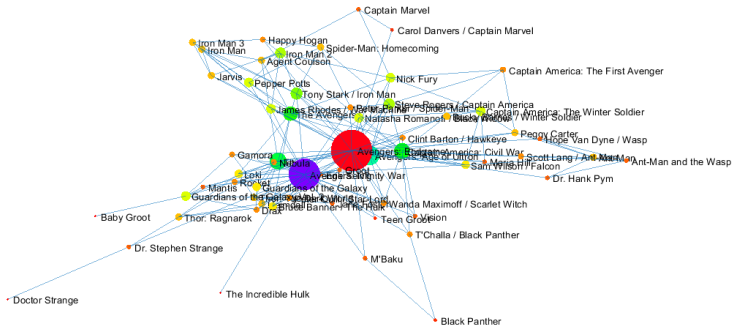

```
layout = "circle";
figure
plot(g,'Layout',layout);
axis off
```



The circle plot makes it easy to read the graph when fewer characters included and you can clearly see the connections between people and movies.

Plot in 3D with color and sizes based on degree.

```
g = graph(mainCharData.Character,mainCharData.Movie);
figure('units','normalized','outerposition',[0 0 1 1])
colormap hsv
p = plot(g,'Layout','force3','UseGravity','on',...
    'MarkerSize',degree(g));
p.NodeCData = degree(g);
axis off
```



This is really interesting if you zoom, pan, rotate!

You can easily see some that arent as connected - like Doctor Strange and the Incredible Hulk (the other Avengers characters did not appear as they did in other films).

You can rotate the graph and save it as a .gif using the included function `saveGraphAsGif`.

Helper function

```
function mainCharData = selectMainChars(characterData)
mainChars = ["Dr. Stephen Strange" "Bruce Banner / The Hulk" ...
    "Carol Danvers / Captain Marvel" "Tony Stark / Iron Man" ...
    "Pepper Potts" "Happy Hogan" "Jarvis" "Vision" "James Rhodes / War Machine" ...
    "Natasha Romanoff / Black Widow" "Clint Barton / Hawkeye" "Sam Wilson / Falcon" ...
    "Steve Rogers / Captain America" "Bucky Barnes / Winter Soldier" ...
    "Peter Parker / Spider-Man" "T'Challa / Black Panther" "M'Baku" ...
    "Wanda Maximoff / Scarlet Witch" "Agent Coulson" "Peggy Carter"...
    "Nick Fury" "Maria Hill" "Thor" "Loki" "Heimdall" "Erik Selvig" "Jane Foster"...
    "Peter Quill / Star-Lord" "Gamora" "Drax" "Nebula" "Rocket" "Groot" "Teen Groot"...
    "Baby Groot" "Mantis" "Scott Lang / Ant-Man" "Hope Van Dyne / Wasp" "Dr. Hank Pym"];
idx = ismember(string(characterData.Character),mainChars);
mainCharData = characterData(idx,:);
mainCharData.Character = removecats(mainCharData.Character);
end
```