ID2222 Data Mining

Homework 4: Graph Spectra

Graph 2

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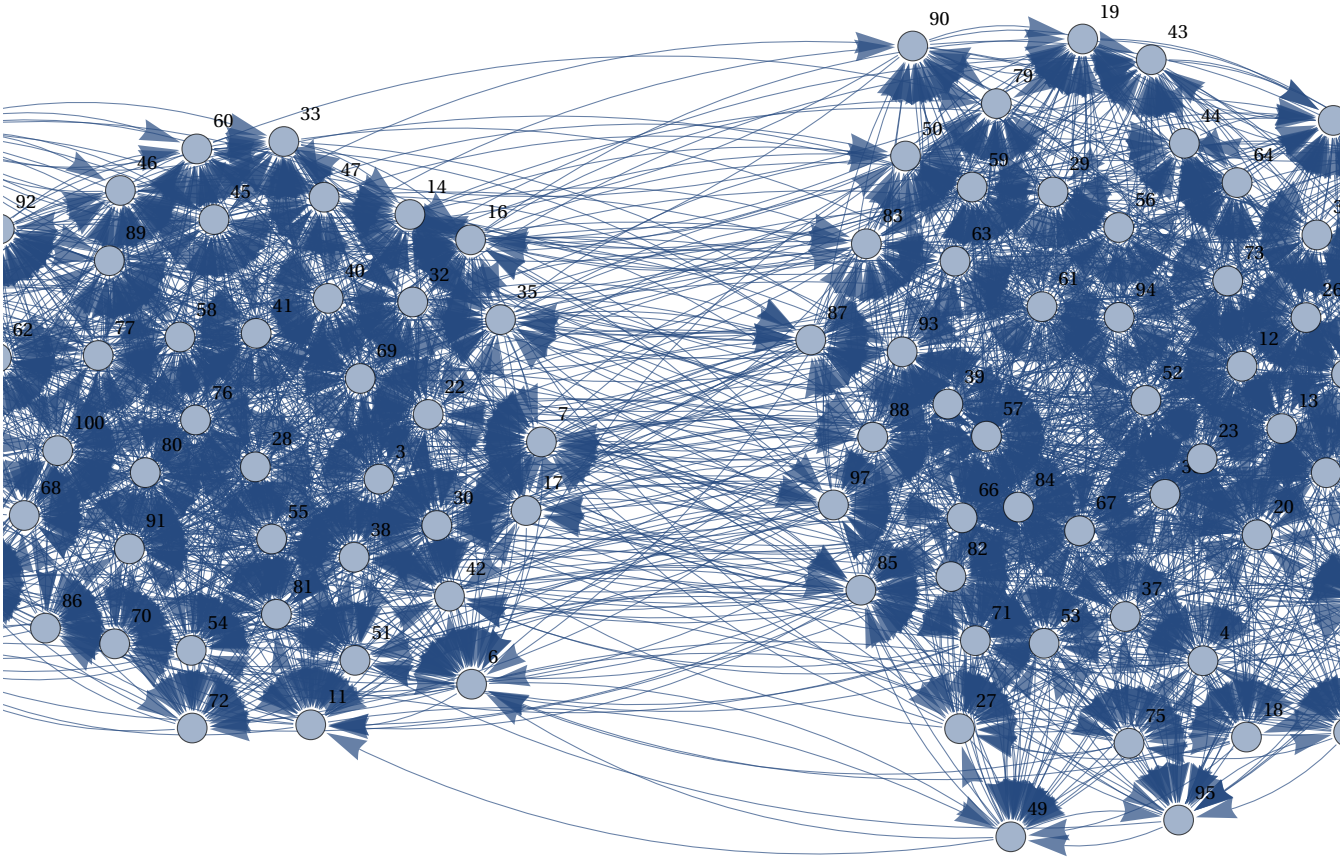
Graph Import

```
SetDirectory[NotebookDirectory[]];
edgeList = Import["example2.csv","Data"];
graph = Graph[DirectedEdge@@@ edgeList,VertexLabels→"Name"];
```



General Graph Properties

Edge Count

```
EdgeCount[graph];
```

2418

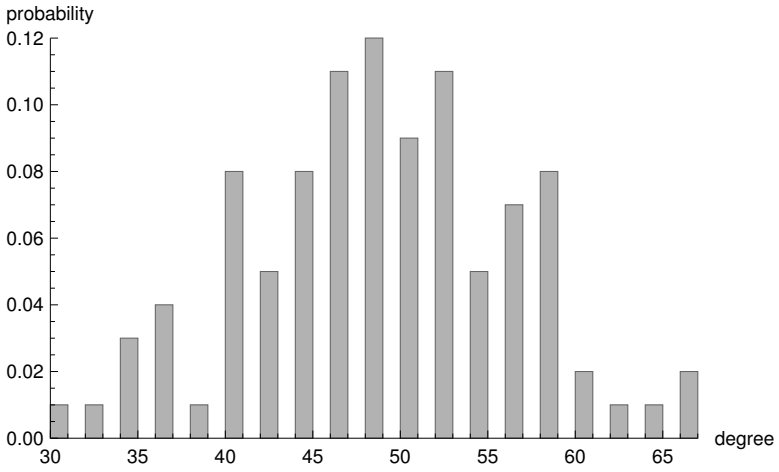
Vertex Count

```
VertexCount[graph];
```

100

Degree Distribution

```
Histogram[VertexDegree[graph],{1},"Probability",AxesLabel→{"degree","probability"}];
```



Global Clustering Coefficient

```
GlobalClusteringCoefficient[graph];
```

$$\frac{3649}{9580}$$

Graph Communities

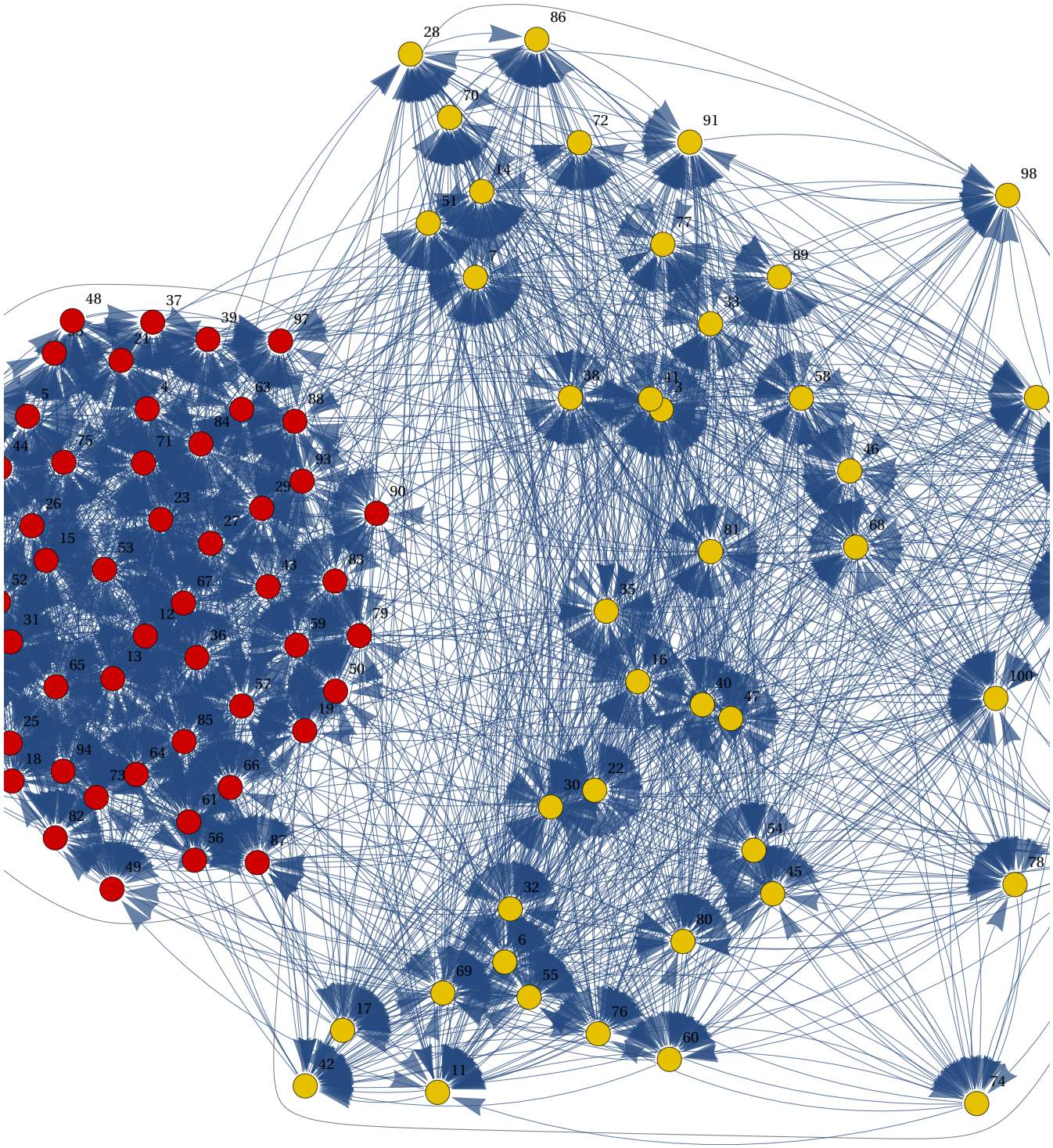
Communities Count

```
Length[FindGraphCommunities[graph]];
```

2

Communities Plot

```
CommunityGraphPlot[graph];
```



Graph Spectra

Graph Spectra

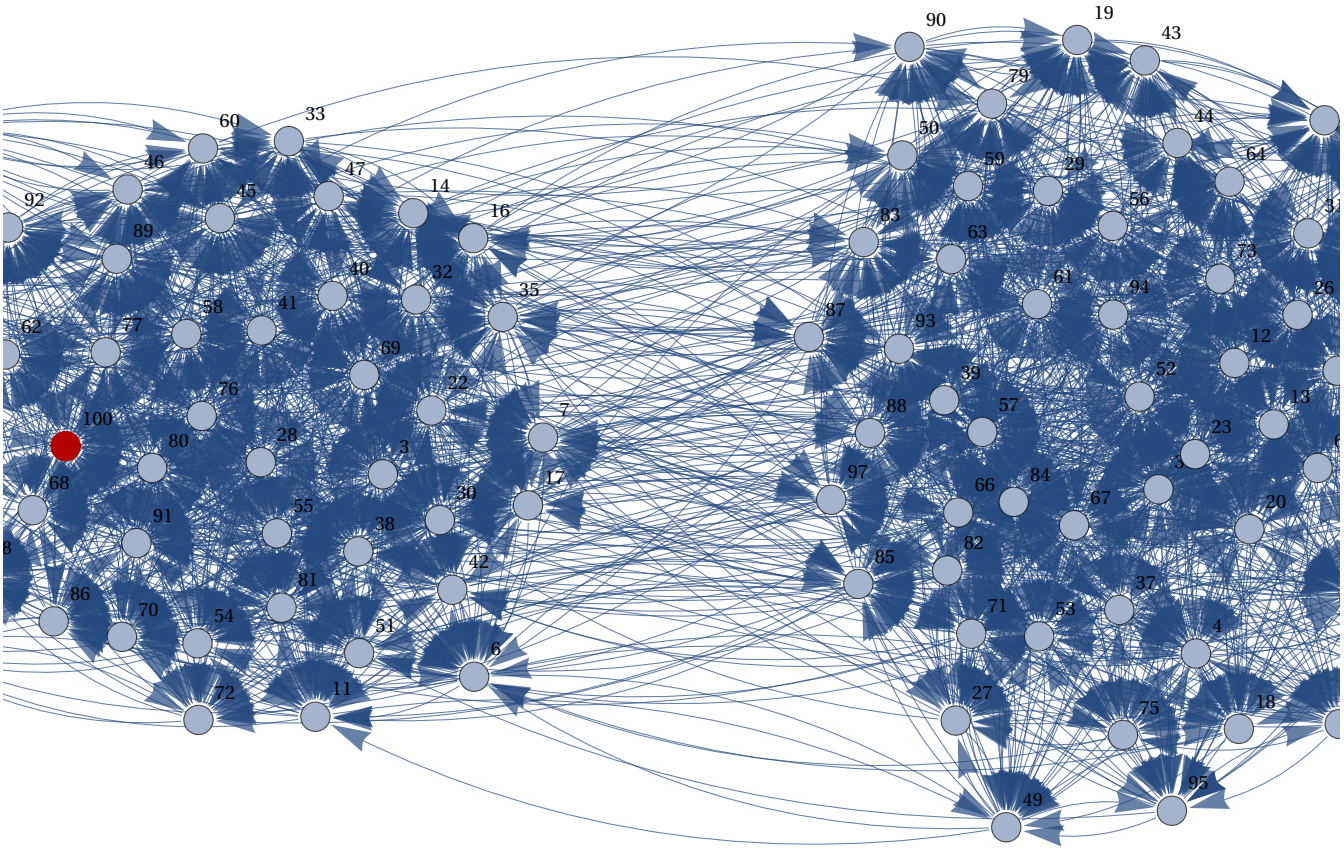
```
A = AdjacencyMatrix[graph];
{eigenVals,eigenVecs} =Eigensystem[N[A]];
laplacian = KirchhoffMatrix[graph];
{minEigenVal, minEigenVec} = Eigensystem[N[A], -1];
```

Node Centralities

PageRank Centrality

```
MaxPageRankCentralNode = VertexList[graph][[Position[PageRankCentrality[graph],
Max[PageRankCentrality[graph]]][[1]]]];
HighlightGraph[graph, MaxPageRankCentralNode];
```

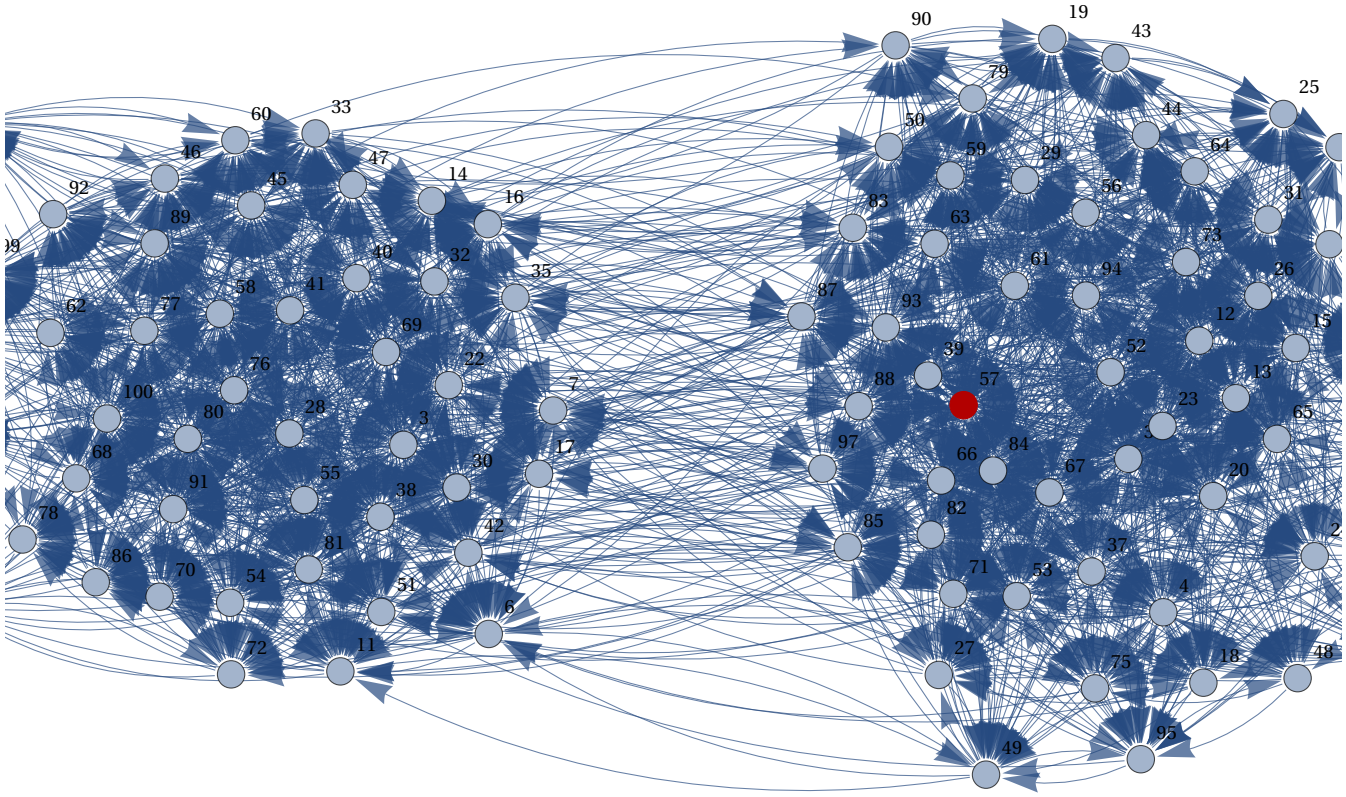
{100}



Degree Centrality

```
MaxDegreeCentralNode = VertexList[graph][[Position[DegreeCentrality[graph],
Max[DegreeCentrality[graph]]][[1]]]];
HighlightGraph[graph, MaxDegreeCentralNode];
```

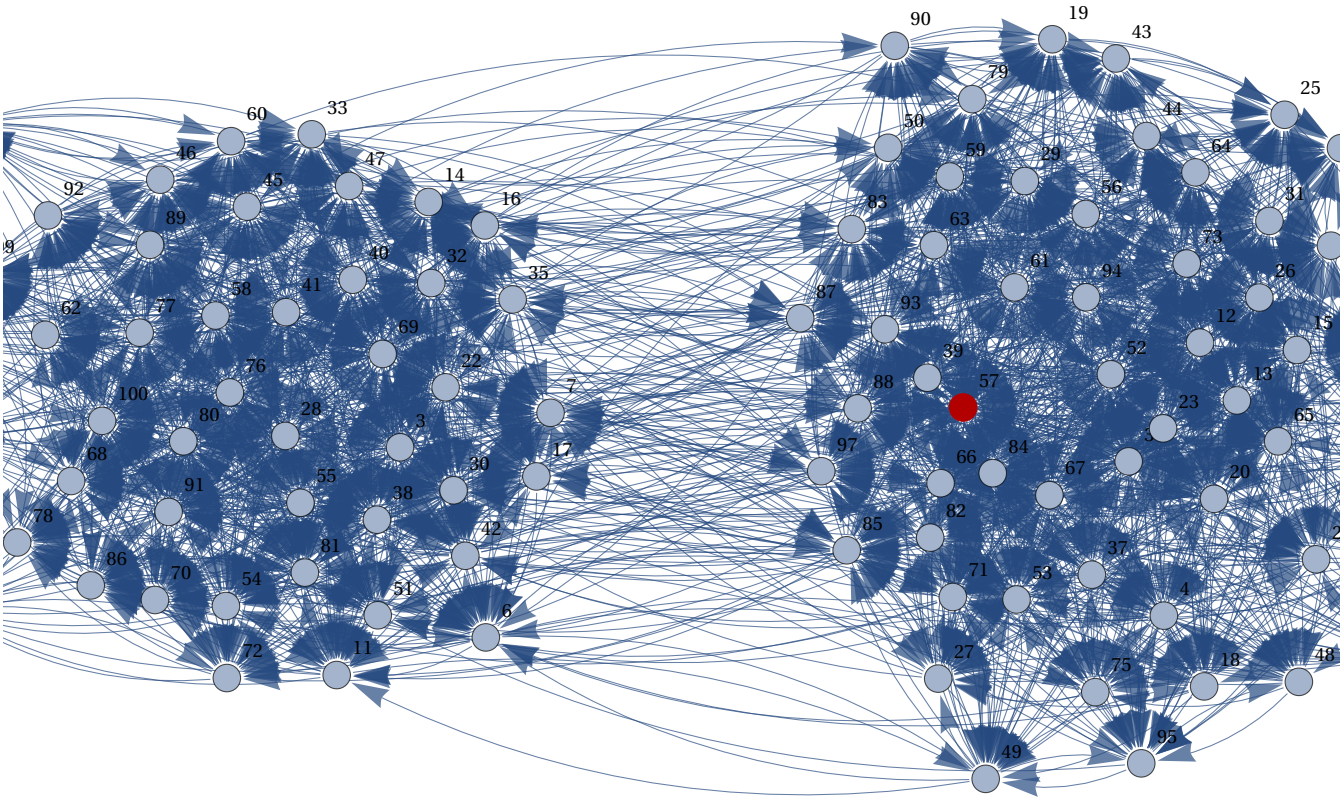
{57}



Closeness Centrality

```
MaxClosenessCentralityNode = VertexList[graph][[Position[ClosenessCentrality[graph],
Max[ClosenessCentrality[graph]]][[1]]]];
HighlightGraph[graph, MaxClosenessCentralityNode];
```

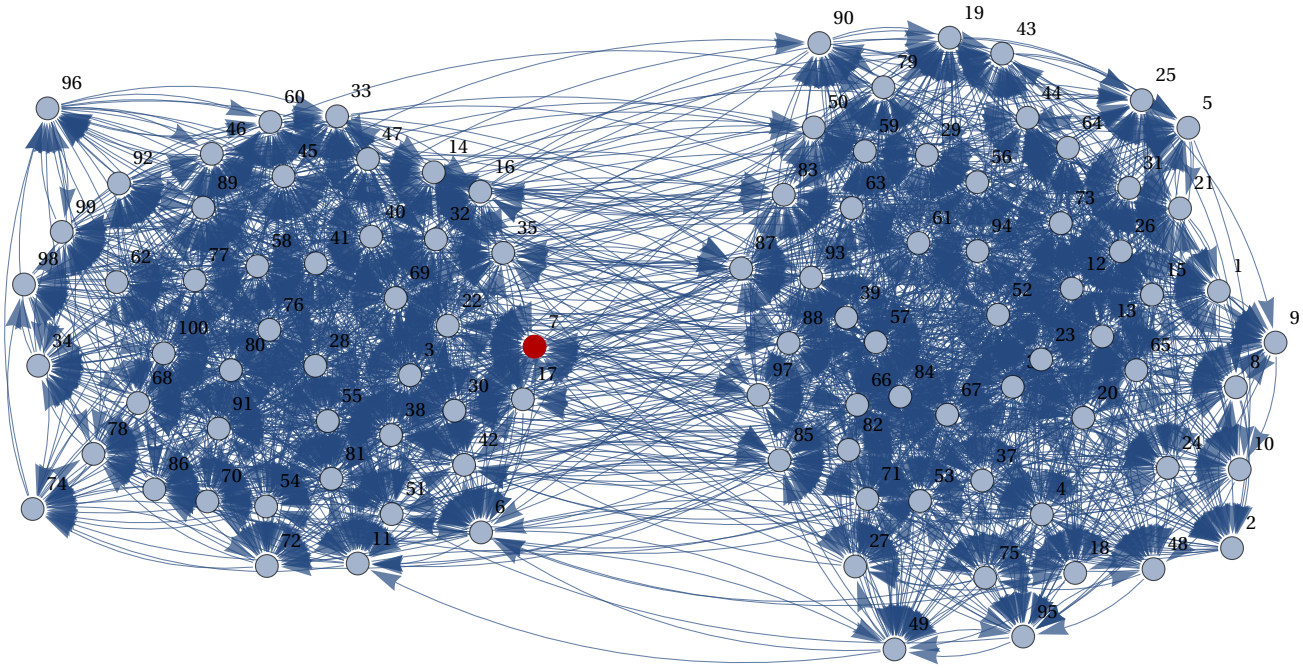
{57}



Betweenness Centrality

```
MaxBetweenessCentralityNode = VertexList[graph][[Position[BetweennessCentrality[graph],
Max[BetweennessCentrality[graph]]][[1]]]];
HighlightGraph[graph, MaxBetweenessCentralityNode];
```

{7}

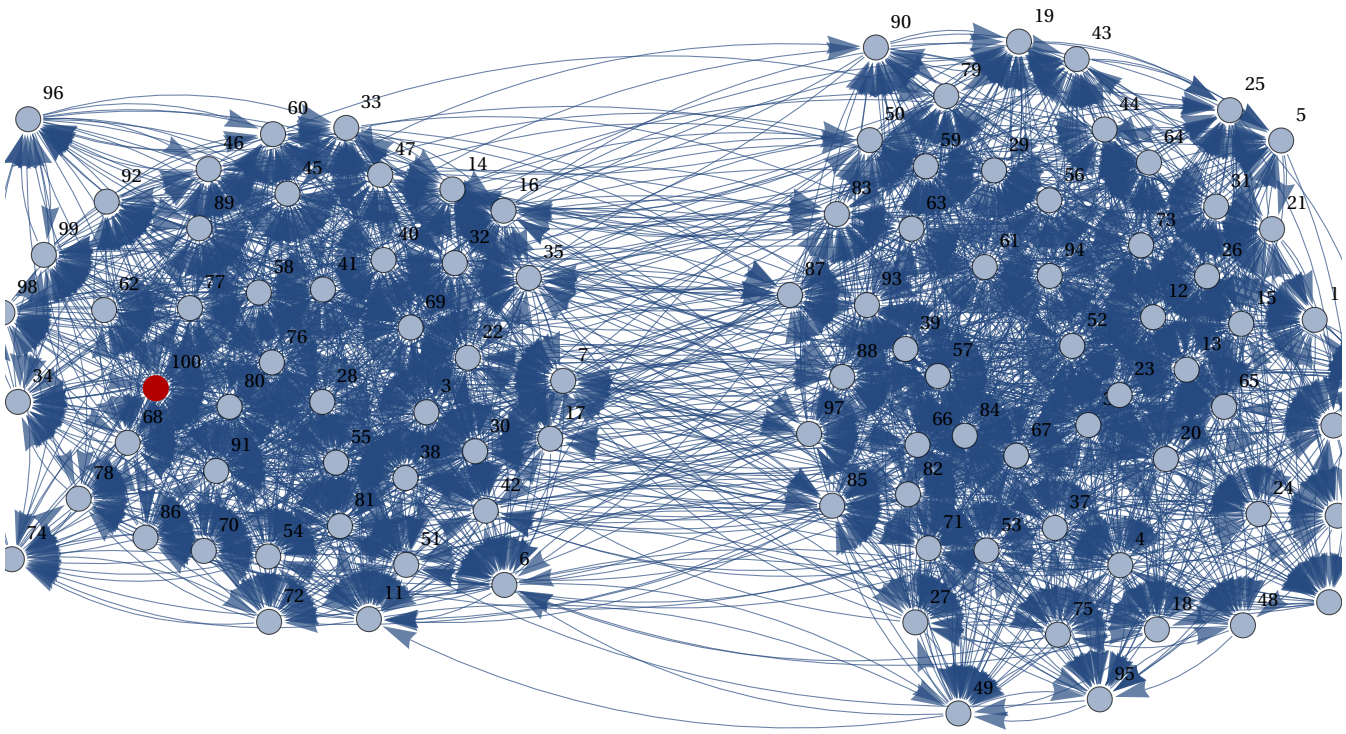


{15}

EigenVector Centrality

```
MaxEigenVectorCentralityNode = VertexList[graph][[Position[EigenvectorCentrality[graph]
Max[EigenvectorCentrality[graph]]][[1]]]];
HighlightGraph[graph, MaxEigenVectorCentralityNode];
```

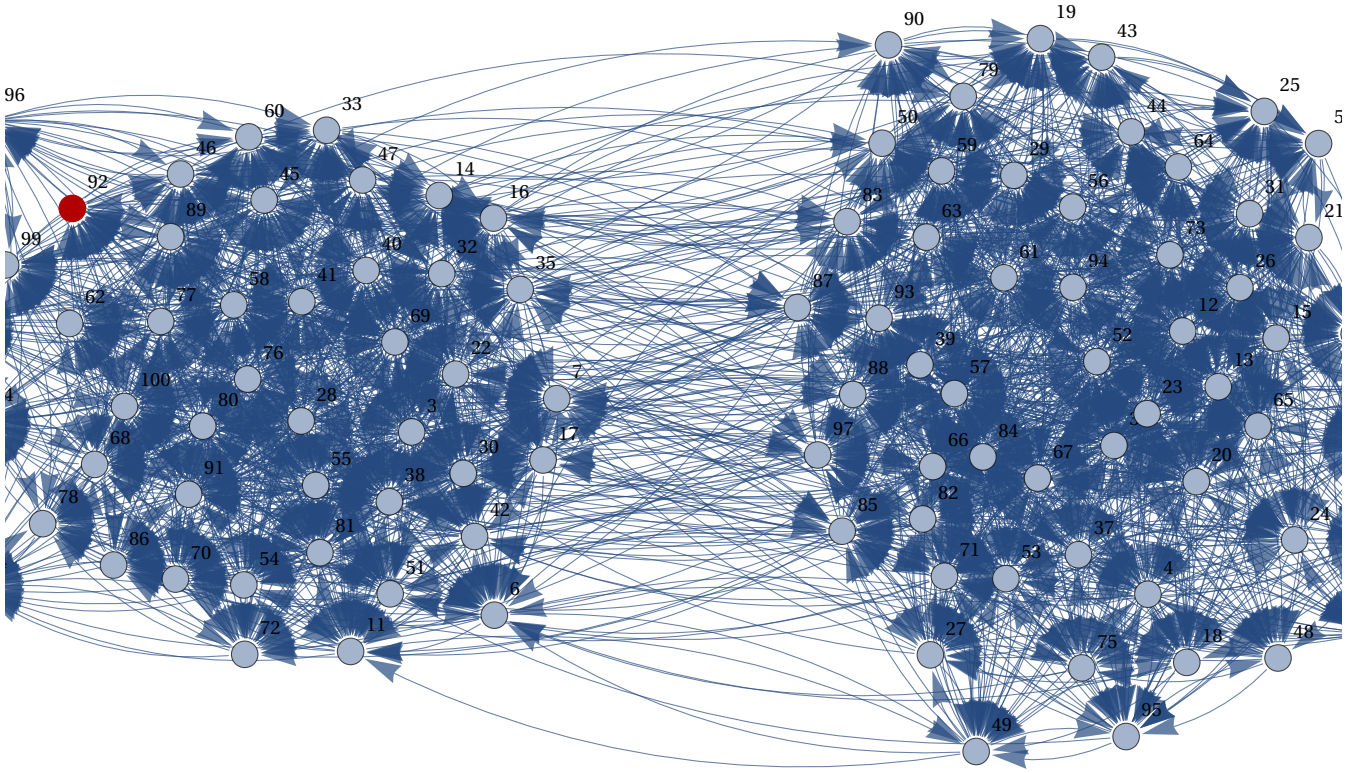
{100}



Clustering Coefficient

```
MaxClusterNode = VertexList[graph][[Position[LocalClusteringCoefficient[graph],
Max[LocalClusteringCoefficient[graph]]][[1]]]];
HighlightGraph[graph, MaxClusterNode];
```

{92}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