Analysis of USAir97 network

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General information

US Air 97 Network has **332** nodes and **2126** edges.

Data are from company US Airways, from year 1997.

Nodes represent Airports in the United States and edges represent routes between these airtports.

Each edge has weights with indicated how many flights were on given route.

Each node has x and y coordinates that can be mapped to the geographical location of the airport.

Top US airports

Top ten airports with flights to/from most other airports:

- Chicago O'hare Intl
- Dallas/Fort Worth Intl
- The William B Hartsfield Atlan
- Pittsburgh Intll
- Lambert-St Louis Intl
- Charlotte/Douglas Intl
- Stapleton Intl
- Minneapolis-St Paul Intl/Wold-
- Detroit Metropolitan Wayne Cou
- San Francisco Intl

Top US airports

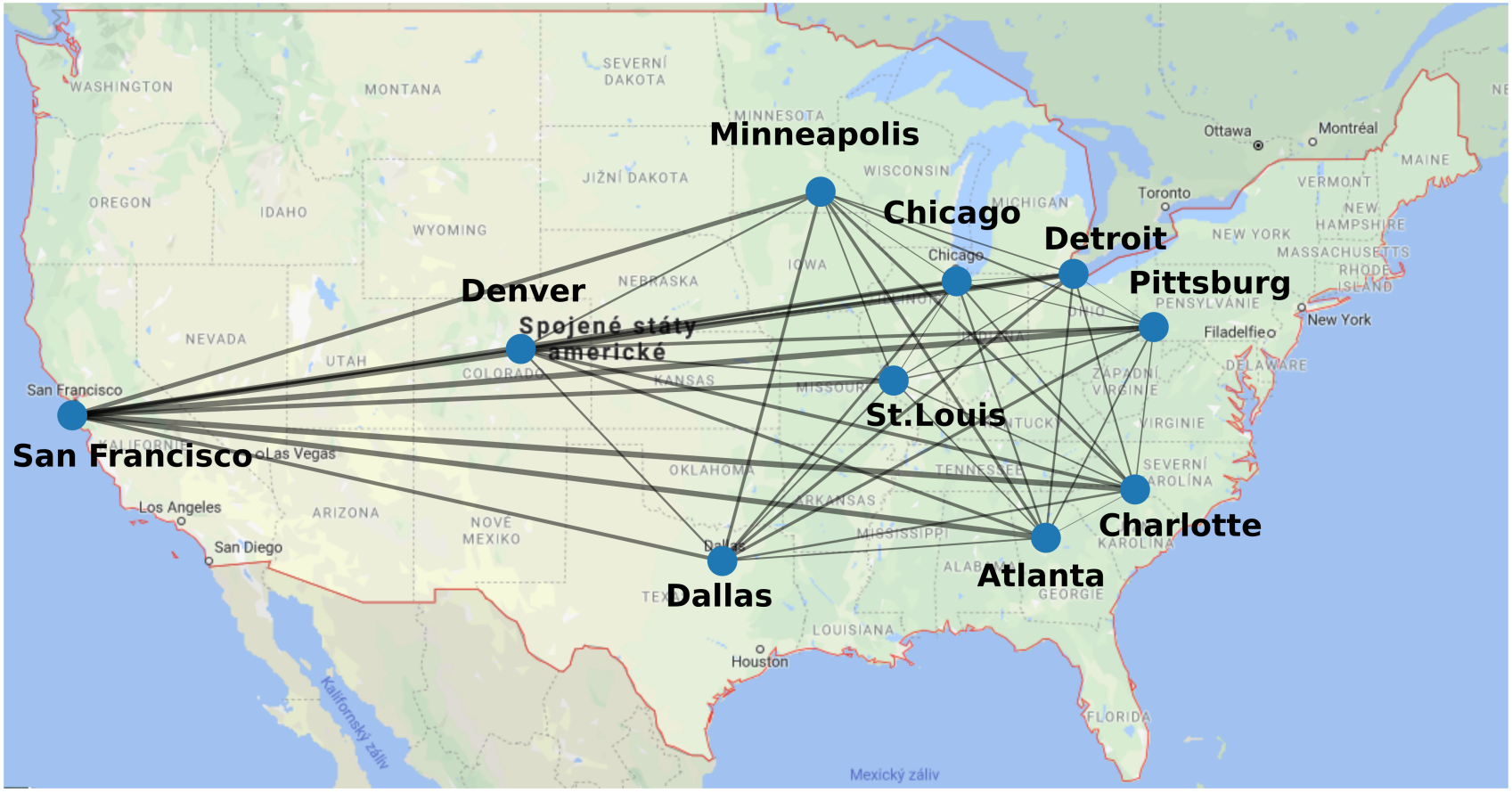


Figure 1: Airports with flights to/from most other airports - map

Top US airports

Top ten airports with most flights:

- Chicago O'hare Intl
- Dallas/Fort Worth Intl
- Los Angeles Intl
- Minneapolis-St Paul Intl/Wold-
- The William B Hartsfield Atlan
- Seattle-Tacoma Intl
- Stapleton Intl
- San Francisco Intl
- Lambert-St Louis Intl
- Newark Intl

Top US airports

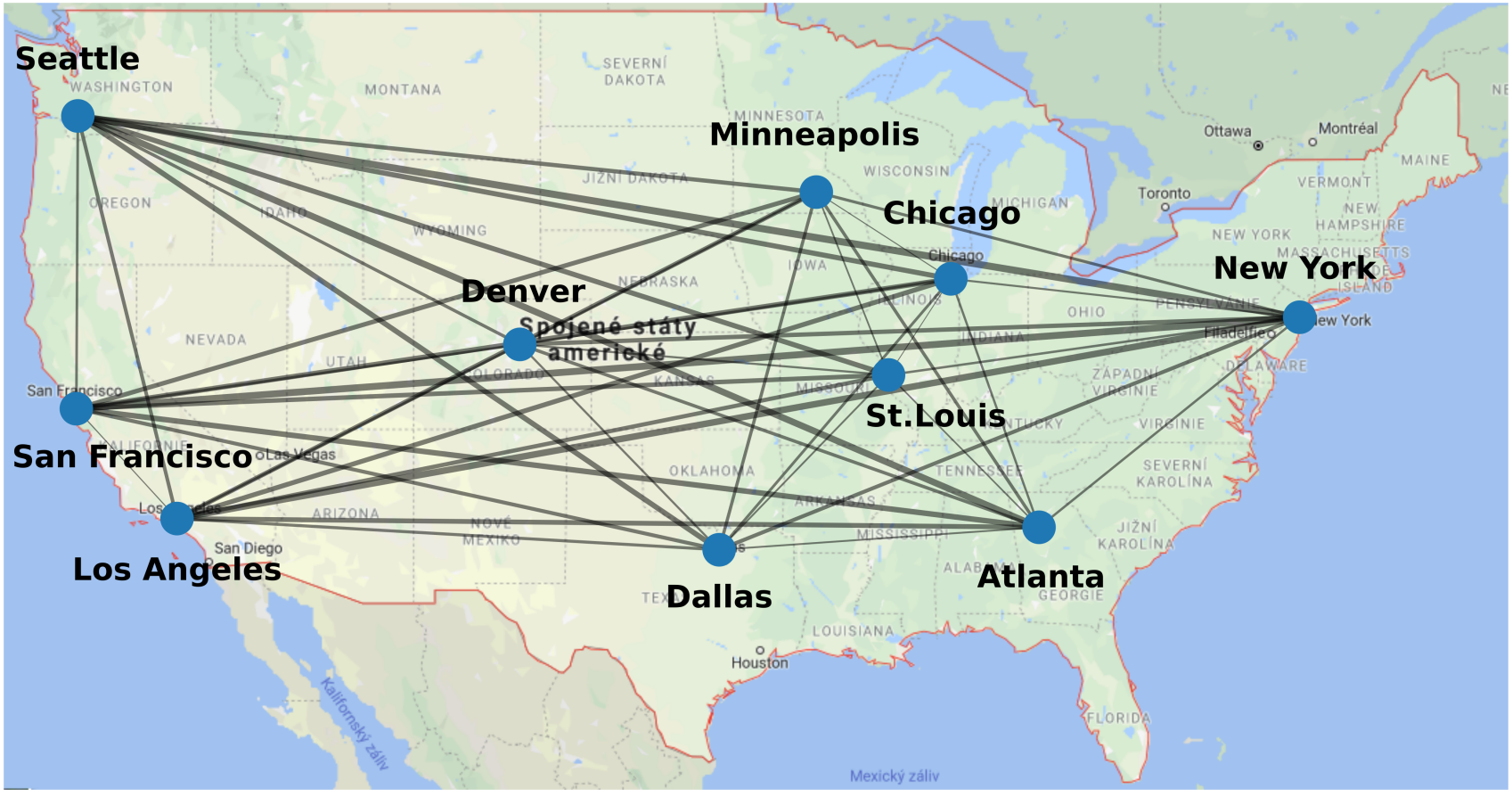


Figure 2: Airports with most flights - map

Centralities

Degree centrality:

- **Chicago O'hare Intl: 0.4199395770392749**
- Dallas/Fort Worth Intl: 0.3564954682779456
- Los Angeles Intl: 0.178247734138972 8
- Minneapolis-St Paul Intl/Wold-: 0.2356495468277945 7
- The William B Hartsfield Atlan: 0.3051359516616314 3
- Seattle-Tacoma Intl: 0.1722054380664652 7
- Stapleton Intl: 0.256797583081571
- San Francisco Intl: 0.2054380664652568
- Lambert-St Louis Intl: 0.283987915407855
- Newark Intl: 0.2024169184290030 3

Centralities

Closeness centrality:

- **Chicago O'hare Intl: 0.6073394495412844**
- Dallas/Fort Worth Intl: 0.5544388609715243
- Los Angeles Intl: 0.5245641838351822
- Minneapolis-St Paul Intl/Wold-: 0.5399673735725938
- The William B Hartsfield Atlan: 0.535598705501618 1
- Seattle-Tacoma Intl: 0.5262321144674086
- Stapleton Intl: 0.5245641838351822
- San Francisco Intl: 0.533011272141707
- Lambert-St Louis Intl: 0.5287539936102237
- Newark Intl: 0.4932935916542474

Centralities

Edge betweenness:

- Anchorage Intl – Chicago O'hare Intl: 0.0502085326335433 5
- Anchorage Intl – Los Angeles Intl: 0.012798272676311534
- Anchorage Intl – San Francisco Intl: 0.01880392654368538 7
- Anchorage Intl – Detroit Metropolitan Wayne Cou: 0.017291165030171723
- Anchorage Intl – Minneapolis-St Paul Intl/Wold-: 0.018444832769086 97
- Anchorage Intl – Seattle-Tacoma Intl: 0.012622179299409222
- Anchorage Intl – Salt Lake City Intl: 0.014831607119189455
- Anchorage Intl – Bethel: **0.0694500054599061**
- Juneau Intl – Seattle-Tacoma Intl: 0.015151054817792723
- Honolulu Intl – Guam Intll: 0.029756488188403 16

Graph diameter

Social networks have small diameter

Random network with the same amount of nodes and edges has diameter **4**

Our network has diameter **6**

- Number of routes with max shortest length: **56**
- All of them start: *West Tinian* - *Saipan* - *Guam* - *Honolulu*
- Most of them end: *Anchorage* - *Bethel* - *SAT*
- Where SAT stands for Small Alaskan Town $= \{$Tuluksak, Akiachak, Akiak, Kwethluk, Napaskiak, Napakiak, Tuntutuliak, Eek, Kongiganak, Kwigillingok, Quinhagak$\}$

Islands in Pacific Ocean

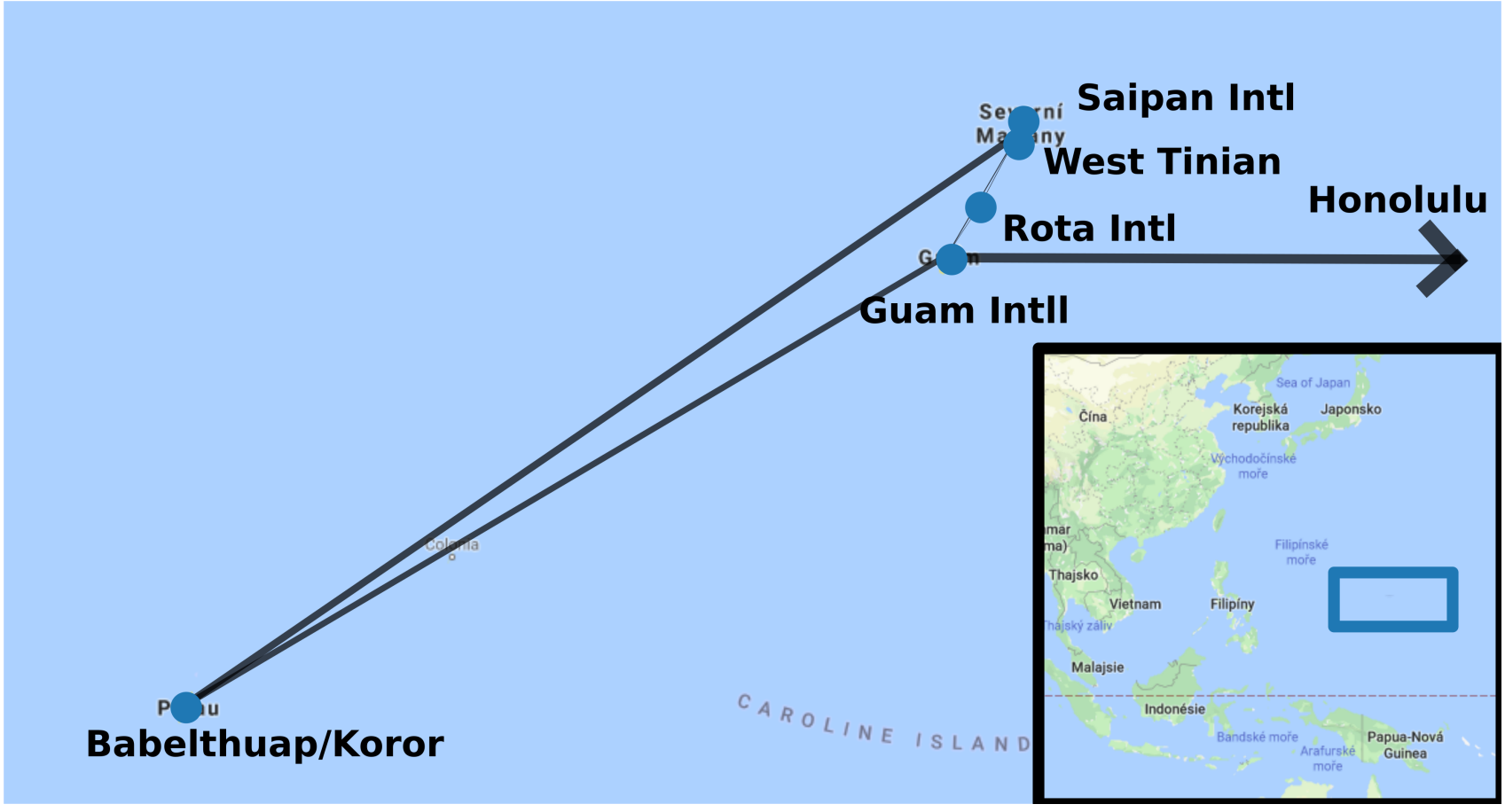


Figure 3: Airports around Guam territory - map

Small Alaskan Towns

Figure 4: Airports in southern Alaska - map

Other properties

Radius of the graph: **3**

Density of the graph: **0.0386925344884068**

Density of the graph of top airports: **1.0**

US Air 97 is **connected** network.

It has **56** bridges.

Most important bridge is **Honolulu Intl** to **Guam Intll**.

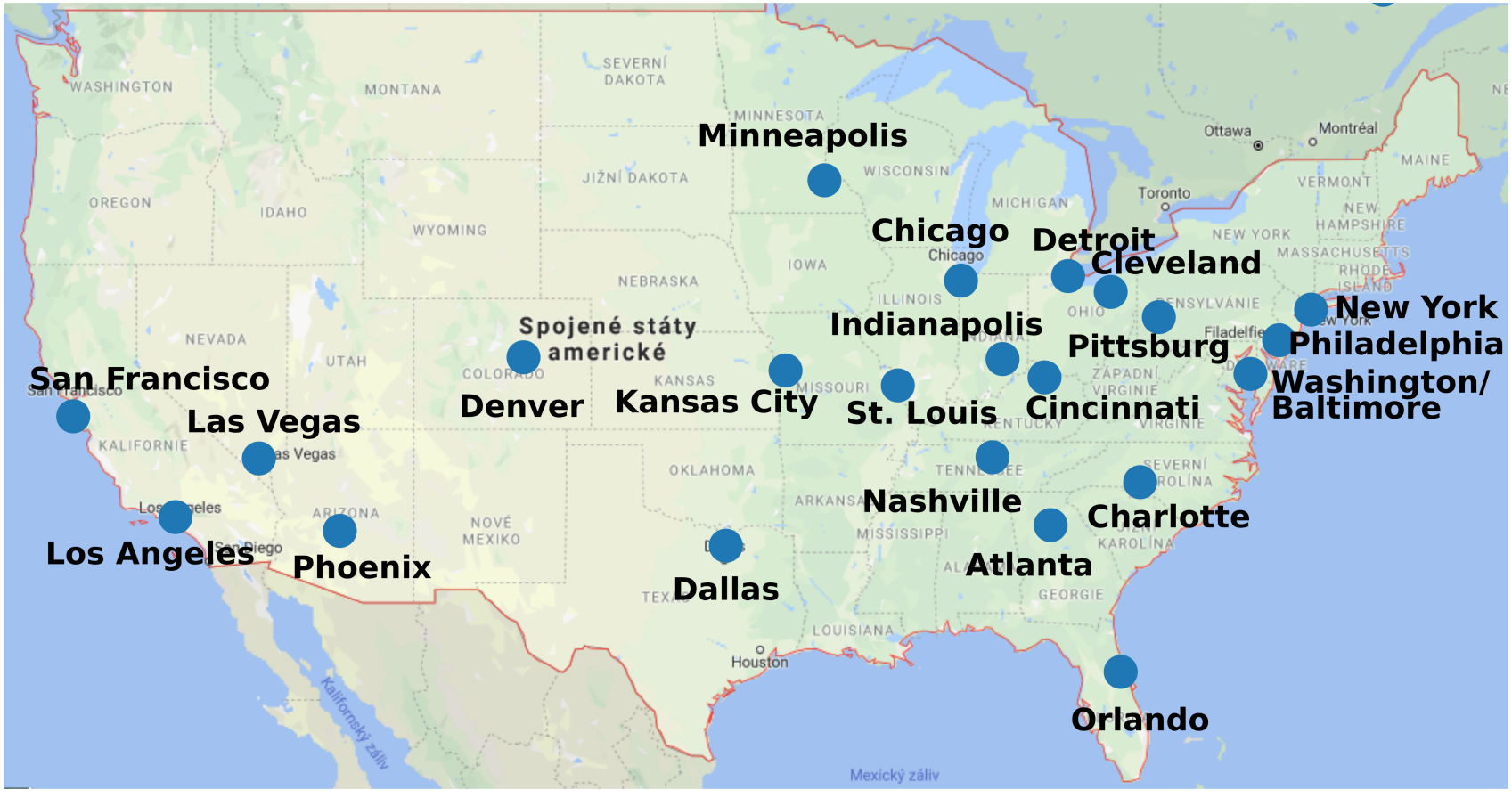
Maximal degree is **139**.

Minimal degree is **1**.

Average degree is **12.807228915662 65**.

Max clique

Size of max clique: **22**



Small world effect

Social networks tend to be characterized by very short paths between randomly chosen pairs of people.

We compared average shortes path length in our graph and randomly generated graph with the same amount of nodes and edges.

US Air 97: **2.7381247042550867**

Random graph: **2.556127834601245**

Small world effect not present

Power-law degree distribution

Random graph - homogenous degree distribution -> Binomial degree distribution

Real world network - heterogenous degree distribution -> **Power-law degree** distribution

- many nodes with only few neighbors
- few hubs with large number of links

Our graph has power-law degree distribution see next slides

Degree distribution: UsAir97

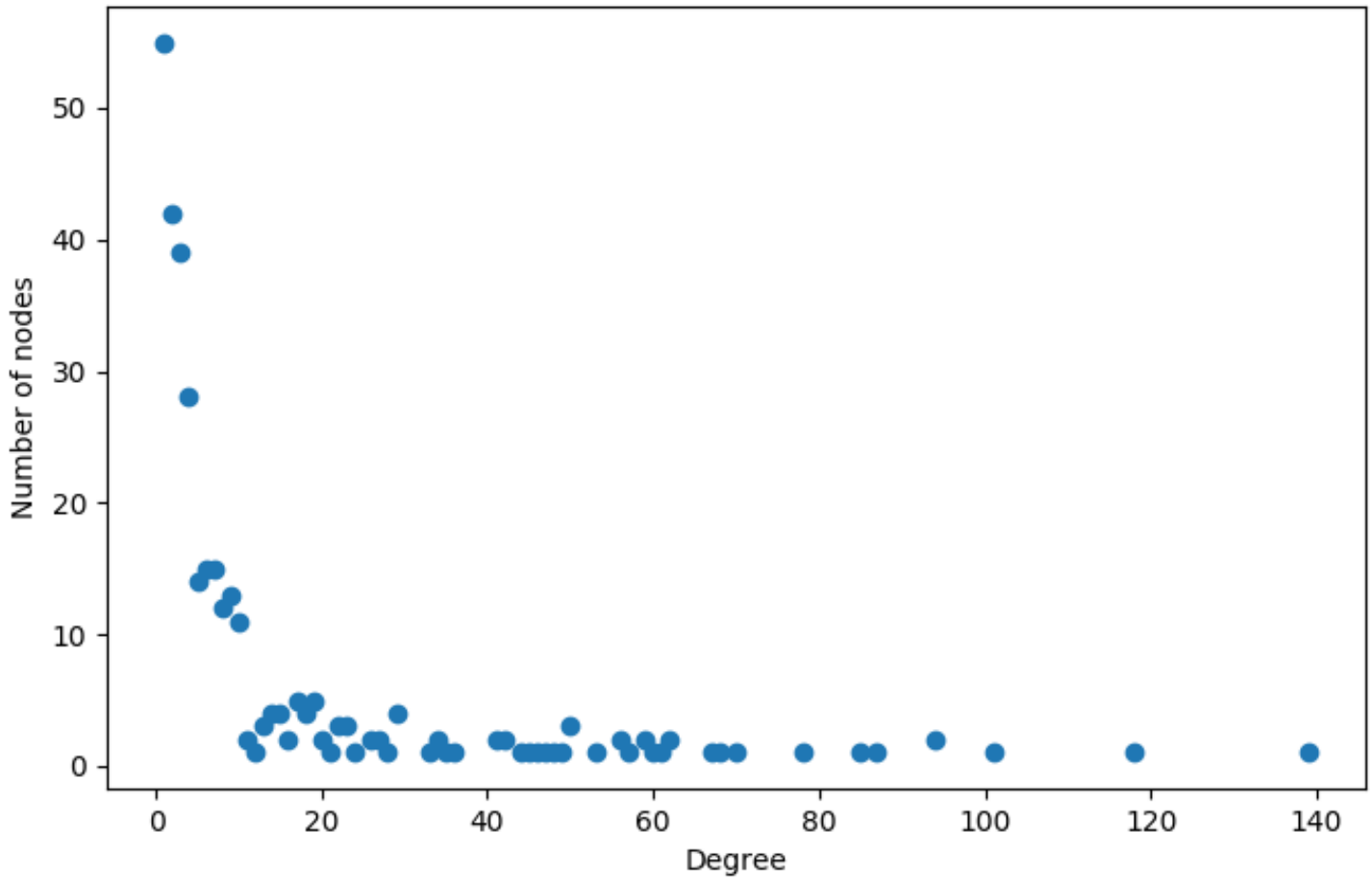


Figure 5: Degree distribution UsAir97

Degree distribution: RandomGraph

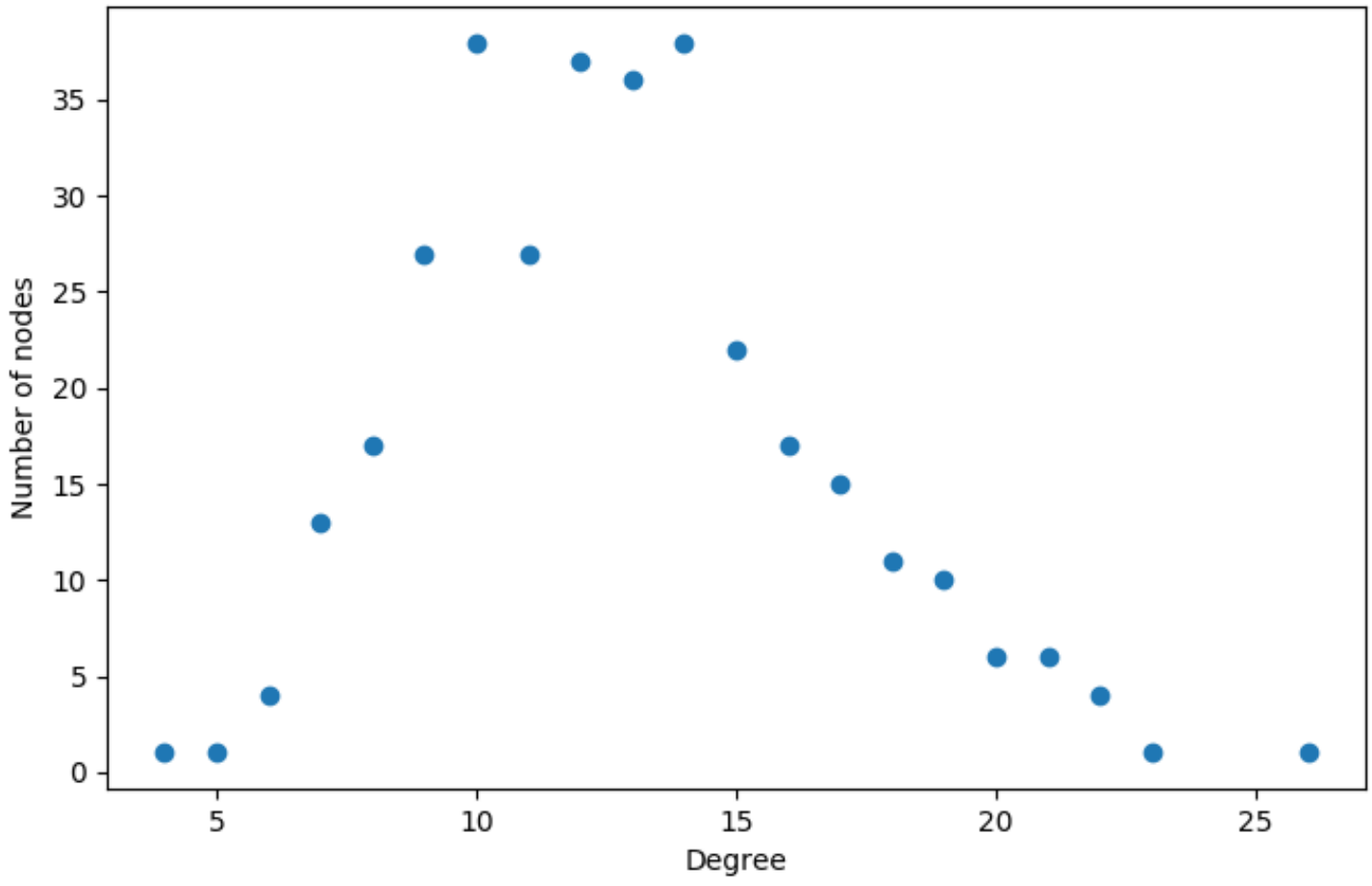


Figure 6: Degree distribution RandomGraph