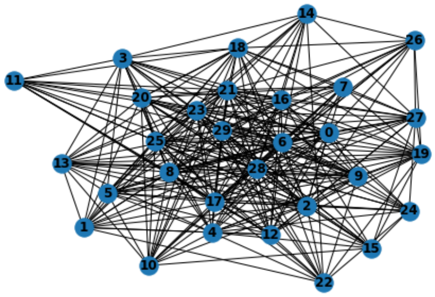
```
In [30]: import networkx as nx
         import matplotlib.pyplot as plt
         import numpy as np
         import random
         import scipy as sp
```

```
In [31]: from parse import *
```

Randomly remove edges

```
In [32]: Gg = read_input_file("inputs/small/small-1.in")
```

```
In [33]: nx.draw(Gg, with_labels=True, font_weight='bold')
```



```
In [34]: l = len(list(Gg.edges))
         l

Out[34]: 292
```

```
In [35]: sp.special.binom(l, l - 15)

Out[35]: 5.074866030134501e+24
```

```
In [36]: nx.dijkstra_path_length(Gg, 0, 29)

Out[36]: 25.282
```

```
In [37]: def rem_random(G, k):
             """
             G: graph input
             k: number of random graphs to consider
             """
             v = G.number_of_nodes() - 1
             path = nx.dijkstra_path(G, 0, v)
             longest_min_path = nx.dijkstra_path_length(G, 0, v)
             rm_edges = 0
             rm_node = 0

             nodes = np.sort(list(G.nodes))[1:][:-1]

             for n in nodes:
                 G_prime = nx.Graph(G)
                 G_prime.remove_node(n)

                 G_prime_edges = list(G_prime.edges)

                 for _ in range(k):
                     to_remove = random.sample(G_prime_edges, 15)
                     G_prime.remove_edges_from(to_remove)

                     if nx.is_connected(G_prime):
                         new_min_path = nx.dijkstra_path_length(G_prime, 0, v)

                         if new_min_path > longest_min_path:
                             longest_min_path = new_min_path
                             rm_edges = to_remove
                             path = nx.dijkstra_path(G_prime, 0, v)
                             rm_node = n

             return path, longest_min_path, rm_edges, rm_node
```

```
In [38]: r = rem_random(Gg, 50000)
         r

Out[38]: ([0, 21, 7, 17, 26, 29],
          198.658,
          [(20, 23),
           (2, 0),
           (11, 17),
           (0, 27),
           (3, 14),
           (15, 20),
           (0, 20),
           (4, 10),
           (5, 8),
           (4, 5),
           (1, 28),
           (22, 23),
           (12, 29),
           (19, 28),
           (1, 8)],
          25)
```

```
In [ ]:
```

```
In [39]: Gg2 = read_input_file("inputs/small/small-8.in")
```

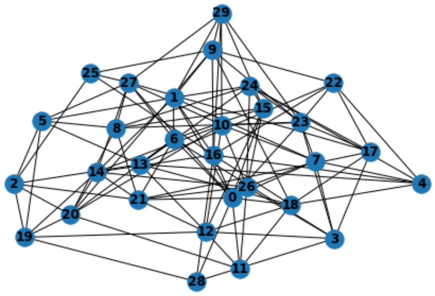
```
In [40]: r2 = rem_random(Gg2, 50000)
         r2
```

```
Out[40]: ([0, 28, 16, 4, 22, 9, 1, 29],
          314.0,
          [(0, 16),
           (19, 12),
           (6, 15),
           (15, 12),
           (3, 17),
           (24, 4),
           (20, 10),
           (0, 18),
           (11, 26),
           (14, 26),
           (16, 29),
           (27, 14),
           (2, 25),
           (0, 21),
           (15, 26)],
          5)
```

```
In [41]: print("This graph has", Gg2.number_of_nodes(), "nodes and", Gg2.number_of_edges(), "edges")

         nx.draw(Gg2, with_labels=True, font_weight='bold');
```

```
This graph has 30 nodes and 111 edges
```



```
In [29]: nx.dijkstra_path_length(Gg2, 0, 29)
```

```
Out[29]: 34.0
```

```
In [ ]:
```