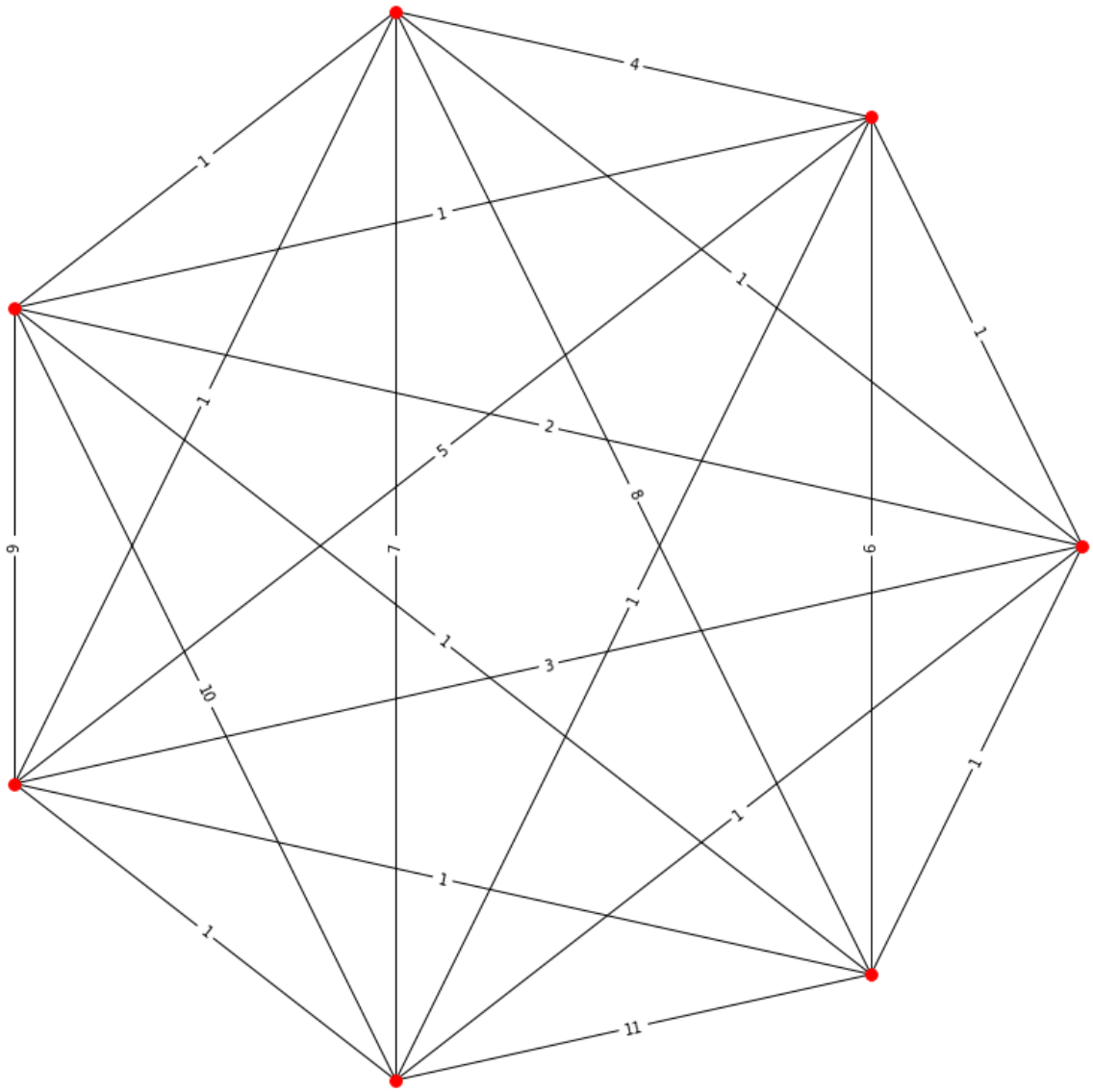
```
In [10]: rainbow_methods.present_results(7,4)

Graf pełny o 7 wierzchołkach.
Ma 21.0 krawędzi.
Będziemy kolorować na 11 kolorów.
Tak by nie było gwiazdy TMC o 5 krawędziach.

WYNIK

Wykorzystano 11 kolorów.

Pokolorowanie, lista krawędzi:
[(0, 1, {'color': 1}),
 (0, 2, {'color': 1}),
 (0, 3, {'color': 2}),
 (0, 4, {'color': 3}),
 (0, 5, {'color': 1}),
 (0, 6, {'color': 1}),
 (1, 2, {'color': 4}),
 (1, 3, {'color': 1}),
 (1, 4, {'color': 5}),
 (1, 5, {'color': 1}),
 (1, 6, {'color': 6}),
 (2, 3, {'color': 1}),
 (2, 4, {'color': 1}),
 (2, 5, {'color': 7}),
 (2, 6, {'color': 8}),
 (3, 4, {'color': 9}),
 (3, 5, {'color': 10}),
 (3, 6, {'color': 1}),
 (4, 5, {'color': 1}),
 (4, 6, {'color': 1}),
 (5, 6, {'color': 11})]

Pokolorowanie, macierz sąsiedztwa (0 - brak krawędzi):
[[  0.   1.   1.   2.   3.   1.   1.]
 [  1.   0.   4.   1.   5.   1.   6.]
 [  1.   4.   0.   1.   1.   7.   8.]
 [  2.   1.   1.   0.   9.  10.   1.]
 [  3.   5.   1.   9.   0.   1.   1.]
 [  1.   1.   7.  10.   1.   0.  11.]
 [  1.   6.   8.   1.   1.  11.   0.]]

Liczba kolorów na które są pokolorowane wszystkie krawędzie kolejnych wierzchołków
{0: 3, 1: 4, 2: 4, 3: 4, 4: 4, 5: 4, 6: 4}

Największy tęczowy podgraf jest pokolorowany na: 4 różnych kolorów.
```

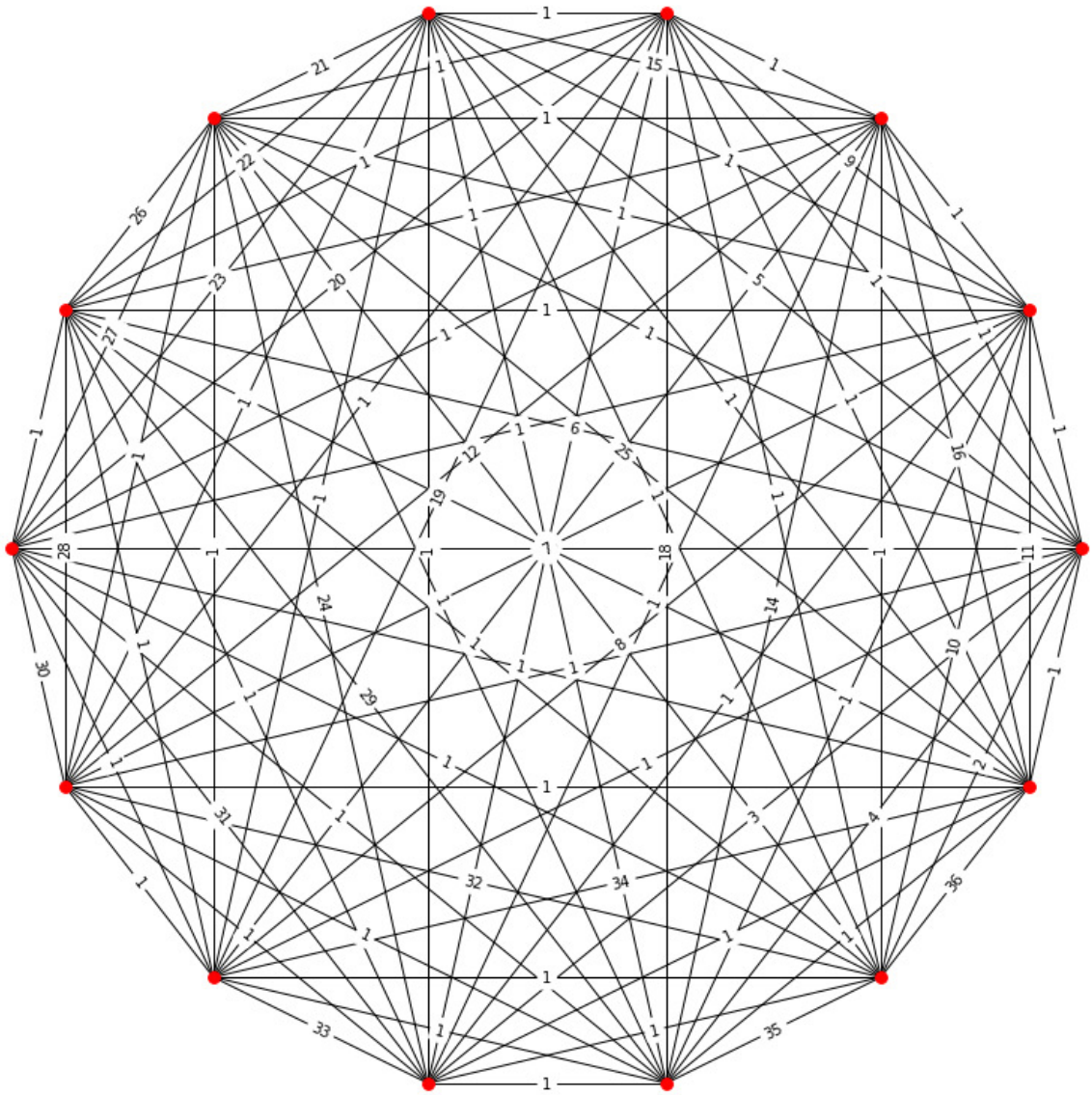



```
In [11]: rainbow_methods.present_results(14,6)

Graf pełny o 14 wierzchołkach.
Ma 91.0 krawędzi.
Będziemy kolorować na 36 kolorów.
Tak by nie było gwiazdy TMC o 7 krawędziach.

WYNIK

Wykorzystano 36 kolorów.

Pokolorowanie, lista krawędzi:
[(0, 1, {'color': 1}),
 (0, 2, {'color': 1}),
 (0, 3, {'color': 1}),
```

```
(0, 4, {'color': 5}),
(0, 5, {'color': 1}),
(0, 6, {'color': 6}),
(0, 7, {'color': 1}),
(0, 8, {'color': 1}),
(0, 9, {'color': 1}),
(0, 10, {'color': 3}),
(0, 11, {'color': 4}),
(0, 12, {'color': 2}),
(0, 13, {'color': 1}),
(1, 2, {'color': 1}),
(1, 3, {'color': 9}),
(1, 4, {'color': 1}),
(1, 5, {'color': 1}),
(1, 6, {'color': 1}),
(1, 7, {'color': 1}),
(1, 8, {'color': 7}),
(1, 9, {'color': 8}),
(1, 10, {'color': 1}),
(1, 11, {'color': 1}),
(1, 12, {'color': 10}),
(1, 13, {'color': 11}),
(2, 3, {'color': 1}),
(2, 4, {'color': 15}),
(2, 5, {'color': 1}),
(2, 6, {'color': 1}),
(2, 7, {'color': 1}),
(2, 8, {'color': 12}),
(2, 9, {'color': 13}),
(2, 10, {'color': 1}),
(2, 11, {'color': 14}),
(2, 12, {'color': 1}),
(2, 13, {'color': 16}),
(3, 4, {'color': 1}),
(3, 5, {'color': 1}),
(3, 6, {'color': 1}),
(3, 7, {'color': 20}),
(3, 8, {'color': 1}),
(3, 9, {'color': 19}),
(3, 10, {'color': 17}),
(3, 11, {'color': 18}),
(3, 12, {'color': 1}),
(3, 13, {'color': 1}),
(4, 5, {'color': 21}),
(4, 6, {'color': 22}),
(4, 7, {'color': 23}),
(4, 8, {'color': 1}),
(4, 9, {'color': 1}),
(4, 10, {'color': 1}),
(4, 11, {'color': 1}),
(4, 12, {'color': 1}),
(4, 13, {'color': 1}),
(5, 6, {'color': 26}),
(5, 7, {'color': 27}),
(5, 8, {'color': 1}),
(5, 9, {'color': 1}),
(5, 10, {'color': 24}),
(5, 11, {'color': 1}),
(5, 12, {'color': 1}),
```

```
 (5, 13, {'color': 25}),
 (6, 7, {'color': 1}),
 (6, 8, {'color': 28}),
 (6, 9, {'color': 1}),
 (6, 10, {'color': 1}),
 (6, 11, {'color': 29}),
 (6, 12, {'color': 1}),
 (6, 13, {'color': 1}),
 (7, 8, {'color': 30}),
 (7, 9, {'color': 1}),
 (7, 10, {'color': 31}),
 (7, 11, {'color': 1}),
 (7, 12, {'color': 1}),
 (7, 13, {'color': 1}),
 (8, 9, {'color': 1}),
 (8, 10, {'color': 1}),
 (8, 11, {'color': 1}),
 (8, 12, {'color': 32}),
 (8, 13, {'color': 1}),
 (9, 10, {'color': 33}),
 (9, 11, {'color': 1}),
 (9, 12, {'color': 1}),
 (9, 13, {'color': 34}),
 (10, 11, {'color': 1}),
 (10, 12, {'color': 1}),
 (10, 13, {'color': 1}),
 (11, 12, {'color': 35}),
 (11, 13, {'color': 1}),
 (12, 13, {'color': 36})]

Pokolorowanie, macierz sąsiedztwa (0 - brak krawędzi):
[[  0.   1.   1.   1.   5.   1.   6.   1.   1.   1.   3.   4.   2.   1.]
 [  1.   0.   1.   9.   1.   1.   1.   1.   7.   8.   1.   1.  10.  11.]
 [  1.   1.   0.   1.  15.   1.   1.   1.  12.  13.   1.  14.   1.  16.]
 [  1.   9.   1.   0.   1.   1.   1.  20.   1.  19.  17.  18.   1.   1.]
 [  5.   1.  15.   1.   0.  21.  22.  23.   1.   1.   1.   1.   1.   1.]
 [  1.   1.   1.   1.  21.   0.  26.  27.   1.   1.  24.   1.   1.  25.]
 [  6.   1.   1.   1.  22.  26.   0.   1.  28.   1.   1.  29.   1.   1.]
 [  1.   1.   1.  20.  23.  27.   1.   0.  30.   1.  31.   1.   1.   1.]
 [  1.   7.  12.   1.   1.   1.  28.  30.   0.   1.   1.   1.  32.   1.]
 [  1.   8.  13.  19.   1.   1.   1.   1.   1.   0.  33.   1.   1.  34.]
 [  3.   1.   1.  17.   1.  24.   1.  31.   1.  33.   0.   1.   1.   1.]
 [  4.   1.  14.  18.   1.   1.  29.   1.   1.   1.   1.   0.  35.   1.]
 [  2.  10.   1.   1.   1.   1.   1.   1.  32.   1.   1.  35.   0.  36.]
 [  1.  11.  16.   1.   1.  25.   1.   1.   1.  34.   1.   1.  36.   0.]]

Liczba kolorów na które są pokolorowane wszystkie krawędzie kolejnych wierzchołków
{0: 6,
 1: 6,
 2: 6,
 3: 6,
 4: 6,
 5: 6,
 6: 6,
 7: 6,
 8: 6,
 9: 6,
 10: 6,
 11: 6,
```

```
 12: 6,
 13: 6}

Największy tęczowy podgraf jest pokolorowany na: 6 różnych kolorów.
```



```
In [12]: rainbow_methods.present_results(20,8)

Graf pełny o 20 wierzchołkach.
Ma 190.0 krawędzi.
Będziemy kolorować na 71 kolorów.
Tak by nie było gwiazdy TMC o 9 krawędziach.

WYNIK

Wykorzystano 71 kolorów.
```

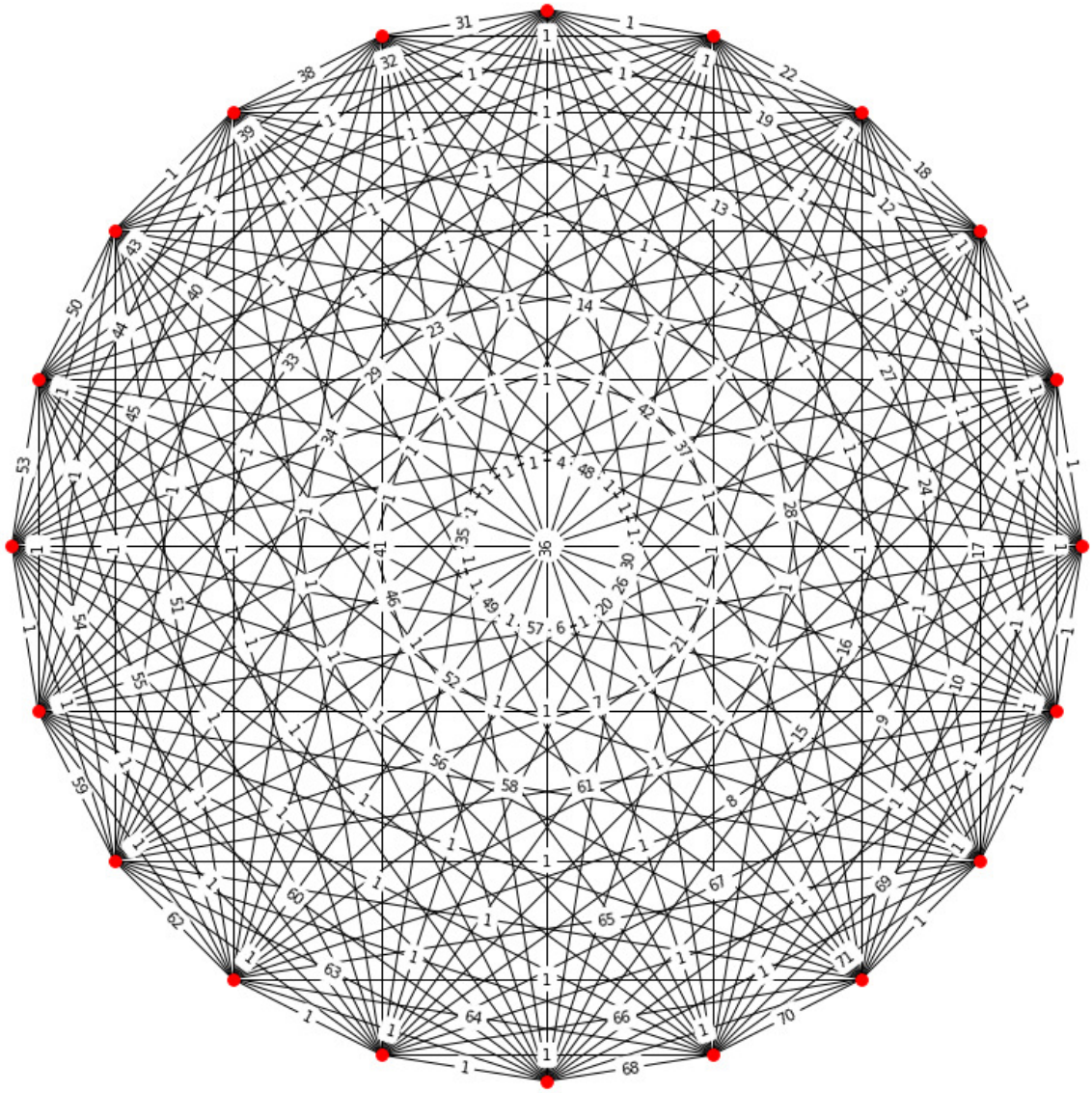
```
Pokolorowanie, lista krawędzi:
[(0, 1, {'color': 1}),
 (0, 2, {'color': 1}),
 (0, 3, {'color': 2}),
 (0, 4, {'color': 3}),
 (0, 5, {'color': 1}),
 (0, 6, {'color': 1}),
 (0, 7, {'color': 1}),
 (0, 8, {'color': 1}),
 (0, 9, {'color': 4}),
 (0, 10, {'color': 5}),
 (0, 11, {'color': 6}),
 (0, 12, {'color': 7}),
 (0, 13, {'color': 1}),
 (0, 14, {'color': 8}),
 (0, 15, {'color': 1}),
 (0, 16, {'color': 1}),
 (0, 17, {'color': 1}),
 (0, 18, {'color': 1}),
 (0, 19, {'color': 1}),
 (1, 2, {'color': 11}),
 (1, 3, {'color': 1}),
 (1, 4, {'color': 12}),
 (1, 5, {'color': 1}),
 (1, 6, {'color': 13}),
 (1, 7, {'color': 1}),
 (1, 8, {'color': 14}),
 (1, 9, {'color': 1}),
 (1, 10, {'color': 1}),
 (1, 11, {'color': 1}),
 (1, 12, {'color': 1}),
 (1, 13, {'color': 1}),
 (1, 14, {'color': 1}),
 (1, 15, {'color': 15}),
 (1, 16, {'color': 9}),
 (1, 17, {'color': 10}),
 (1, 18, {'color': 1}),
 (1, 19, {'color': 1}),
 (2, 3, {'color': 18}),
 (2, 4, {'color': 1}),
 (2, 5, {'color': 19}),
 (2, 6, {'color': 1}),
 (2, 7, {'color': 1}),
 (2, 8, {'color': 1}),
 (2, 9, {'color': 1}),
 (2, 10, {'color': 1}),
 (2, 11, {'color': 1}),
 (2, 12, {'color': 1}),
 (2, 13, {'color': 20}),
 (2, 14, {'color': 21}),
 (2, 15, {'color': 1}),
 (2, 16, {'color': 16}),
 (2, 17, {'color': 1}),
 (2, 18, {'color': 17}),
 (2, 19, {'color': 1}),
 (3, 4, {'color': 22}),
 (3, 5, {'color': 1}),
 (3, 6, {'color': 1}),
```

```
(3, 7, {'color': 1}),
(3, 8, {'color': 1}),
(3, 9, {'color': 1}),
(3, 10, {'color': 23}),
(3, 11, {'color': 1}),
(3, 12, {'color': 1}),
(3, 13, {'color': 25}),
(3, 14, {'color': 26}),
(3, 15, {'color': 1}),
(3, 16, {'color': 1}),
(3, 17, {'color': 1}),
(3, 18, {'color': 24}),
(3, 19, {'color': 1}),
(4, 5, {'color': 1}),
(4, 6, {'color': 1}),
(4, 7, {'color': 1}),
(4, 8, {'color': 1}),
(4, 9, {'color': 1}),
(4, 10, {'color': 1}),
(4, 11, {'color': 29}),
(4, 12, {'color': 1}),
(4, 13, {'color': 1}),
(4, 14, {'color': 1}),
(4, 15, {'color': 30}),
(4, 16, {'color': 1}),
(4, 17, {'color': 28}),
(4, 18, {'color': 1}),
(4, 19, {'color': 27}),
(5, 6, {'color': 31}),
(5, 7, {'color': 32}),
(5, 8, {'color': 1}),
(5, 9, {'color': 1}),
(5, 10, {'color': 1}),
(5, 11, {'color': 33}),
(5, 12, {'color': 34}),
(5, 13, {'color': 1}),
(5, 14, {'color': 35}),
(5, 15, {'color': 36}),
(5, 16, {'color': 1}),
(5, 17, {'color': 1}),
(5, 18, {'color': 1}),
(5, 19, {'color': 1}),
(6, 7, {'color': 38}),
(6, 8, {'color': 39}),
(6, 9, {'color': 1}),
(6, 10, {'color': 40}),
(6, 11, {'color': 1}),
(6, 12, {'color': 1}),
(6, 13, {'color': 1}),
(6, 14, {'color': 41}),
(6, 15, {'color': 1}),
(6, 16, {'color': 1}),
(6, 17, {'color': 1}),
(6, 18, {'color': 37}),
(6, 19, {'color': 1}),
(7, 8, {'color': 1}),
(7, 9, {'color': 43}),
(7, 10, {'color': 44}),
(7, 11, {'color': 45}),
```

```
(7, 12, {'color': 1}),
(7, 13, {'color': 1}),
(7, 14, {'color': 1}),
(7, 15, {'color': 46}),
(7, 16, {'color': 1}),
(7, 17, {'color': 1}),
(7, 18, {'color': 1}),
(7, 19, {'color': 42}),
(8, 9, {'color': 50}),
(8, 10, {'color': 1}),
(8, 11, {'color': 1}),
(8, 12, {'color': 1}),
(8, 13, {'color': 51}),
(8, 14, {'color': 1}),
(8, 15, {'color': 1}),
(8, 16, {'color': 1}),
(8, 17, {'color': 49}),
(8, 18, {'color': 47}),
(8, 19, {'color': 48}),
(9, 10, {'color': 53}),
(9, 11, {'color': 1}),
(9, 12, {'color': 54}),
(9, 13, {'color': 55}),
(9, 14, {'color': 1}),
(9, 15, {'color': 1}),
(9, 16, {'color': 1}),
(9, 17, {'color': 52}),
(9, 18, {'color': 1}),
(9, 19, {'color': 1}),
(10, 11, {'color': 1}),
(10, 12, {'color': 1}),
(10, 13, {'color': 1}),
(10, 14, {'color': 1}),
(10, 15, {'color': 1}),
(10, 16, {'color': 1}),
(10, 17, {'color': 56}),
(10, 18, {'color': 1}),
(10, 19, {'color': 57}),
(11, 12, {'color': 59}),
(11, 13, {'color': 1}),
(11, 14, {'color': 1}),
(11, 15, {'color': 60}),
(11, 16, {'color': 1}),
(11, 17, {'color': 1}),
(11, 18, {'color': 58}),
(11, 19, {'color': 1}),
(12, 13, {'color': 62}),
(12, 14, {'color': 1}),
(12, 15, {'color': 63}),
(12, 16, {'color': 1}),
(12, 17, {'color': 1}),
(12, 18, {'color': 1}),
(12, 19, {'color': 61}),
(13, 14, {'color': 1}),
(13, 15, {'color': 1}),
(13, 16, {'color': 64}),
(13, 17, {'color': 1}),
(13, 18, {'color': 65}),
(13, 19, {'color': 1}),
```

```
 (14, 15, {'color': 1}),
 (14, 16, {'color': 1}),
 (14, 17, {'color': 66}),
 (14, 18, {'color': 1}),
 (14, 19, {'color': 67}),
 (15, 16, {'color': 68}),
 (15, 17, {'color': 1}),
 (15, 18, {'color': 1}),
 (15, 19, {'color': 1}),
 (16, 17, {'color': 70}),
 (16, 18, {'color': 71}),
 (16, 19, {'color': 69}),
 (17, 18, {'color': 1}),
 (17, 19, {'color': 1}),
 (18, 19, {'color': 1})]

Pokolorowanie, macierz sąsiedztwa (0 - brak krawędzi):
[[  0.   1.   1.   2.   3.   1.   1.   1.   1.   4.   5.   6.   7.   1.
    8.   1.   1.   1.   1.   1.]
 [  1.   0.  11.   1.  12.   1.  13.   1.  14.   1.   1.   1.   1.   1.
    1.  15.   9.  10.   1.   1.]
 [  1.  11.   0.  18.   1.  19.   1.   1.   1.   1.   1.   1.   1.  20.
   21.   1.  16.   1.  17.   1.]
 [  2.   1.  18.   0.  22.   1.   1.   1.   1.   1.  23.   1.   1.  25.
   26.   1.   1.   1.  24.   1.]
 [  3.  12.   1.  22.   0.   1.   1.   1.   1.   1.   1.  29.   1.   1.
    1.  30.   1.  28.   1.  27.]
 [  1.   1.  19.   1.   1.   0.  31.  32.   1.   1.   1.  33.  34.   1.
   35.  36.   1.   1.   1.   1.]
 [  1.  13.   1.   1.   1.  31.   0.  38.  39.   1.  40.   1.   1.   1.
   41.   1.   1.   1.  37.   1.]
 [  1.   1.   1.   1.   1.  32.  38.   0.   1.  43.  44.  45.   1.   1.
    1.  46.   1.   1.   1.  42.]
 [  1.  14.   1.   1.   1.   1.  39.   1.   0.  50.   1.   1.   1.  51.
    1.   1.   1.  49.  47.  48.]
 [  4.   1.   1.   1.   1.   1.   1.  43.  50.   0.  53.   1.  54.  55.
    1.   1.   1.  52.   1.   1.]
 [  5.   1.   1.  23.   1.   1.  40.  44.   1.  53.   0.   1.   1.   1.
    1.   1.   1.  56.   1.  57.]
 [  6.   1.   1.   1.  29.  33.   1.  45.   1.   1.   1.   0.  59.   1.
    1.  60.   1.   1.  58.   1.]
 [  7.   1.   1.   1.   1.  34.   1.   1.   1.  54.   1.  59.   0.  62.
    1.  63.   1.   1.   1.  61.]
 [  1.   1.  20.  25.   1.   1.   1.   1.  51.  55.   1.   1.  62.   0.
    1.   1.  64.   1.  65.   1.]
 [  8.   1.  21.  26.   1.  35.  41.   1.   1.   1.   1.   1.   1.   1.
    0.   1.   1.  66.   1.  67.]
 [  1.  15.   1.   1.  30.  36.   1.  46.   1.   1.   1.  60.  63.   1.
    1.   0.  68.   1.   1.   1.]
 [  1.   9.  16.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.  64.
    1.  68.   0.  70.  71.  69.]
 [  1.  10.   1.   1.  28.   1.   1.   1.  49.  52.  56.   1.   1.   1.
   66.   1.  70.   0.   1.   1.]
 [  1.   1.  17.  24.   1.   1.  37.   1.  47.   1.   1.  58.   1.  65.
    1.   1.  71.   1.   0.   1.]
 [  1.   1.   1.   1.  27.   1.   1.  42.  48.   1.  57.   1.  61.   1.
   67.   1.  69.   1.   1.   0.]]

Liczba kolorów na które są pokolorowane wszystkie krawędzie kolejnych wierzchołków
```

```
{0: 8,
 1: 8,
 2: 8,
 3: 8,
 4: 8,
 5: 8,
 6: 8,
 7: 8,
 8: 8,
 9: 8,
 10: 8,
 11: 8,
 12: 8,
 13: 8,
 14: 8,
 15: 8,
 16: 8,
 17: 8,
 18: 8,
 19: 8}

Największy tęczowy podgraf jest pokolorowany na: 8 różnych kolorów.
```



In [13]: