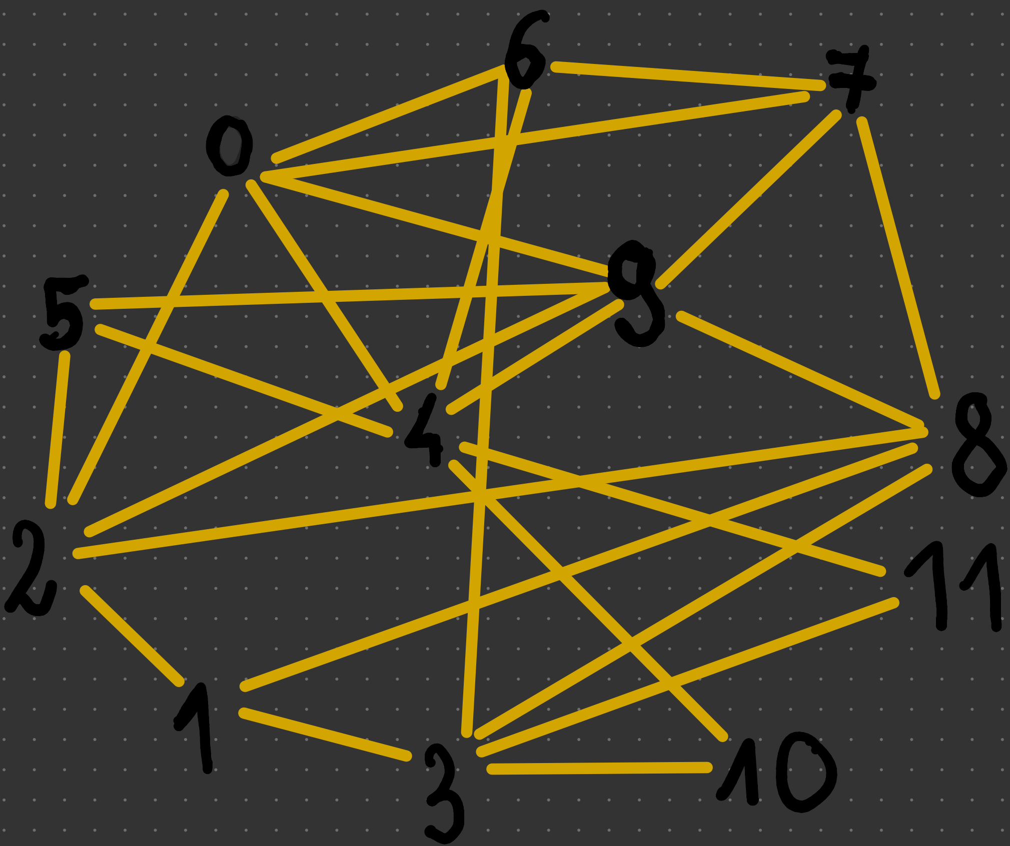
```
[[2, 7, 4, 9, 6],
[3, 2, 8],
[0, 5, 8, 1, 9],
[10, 1, 6, 11, 8],
[9, 6, 5, 11, 0, 10],
[2, 4, 9],
[4, 3, 7, 0],
[0, 9, 6, 8],
[9, 2, 1, 3, 7],
[4, 8, 5, 7, 0, 2],
[3, 4],
[4, 3],
```

1.

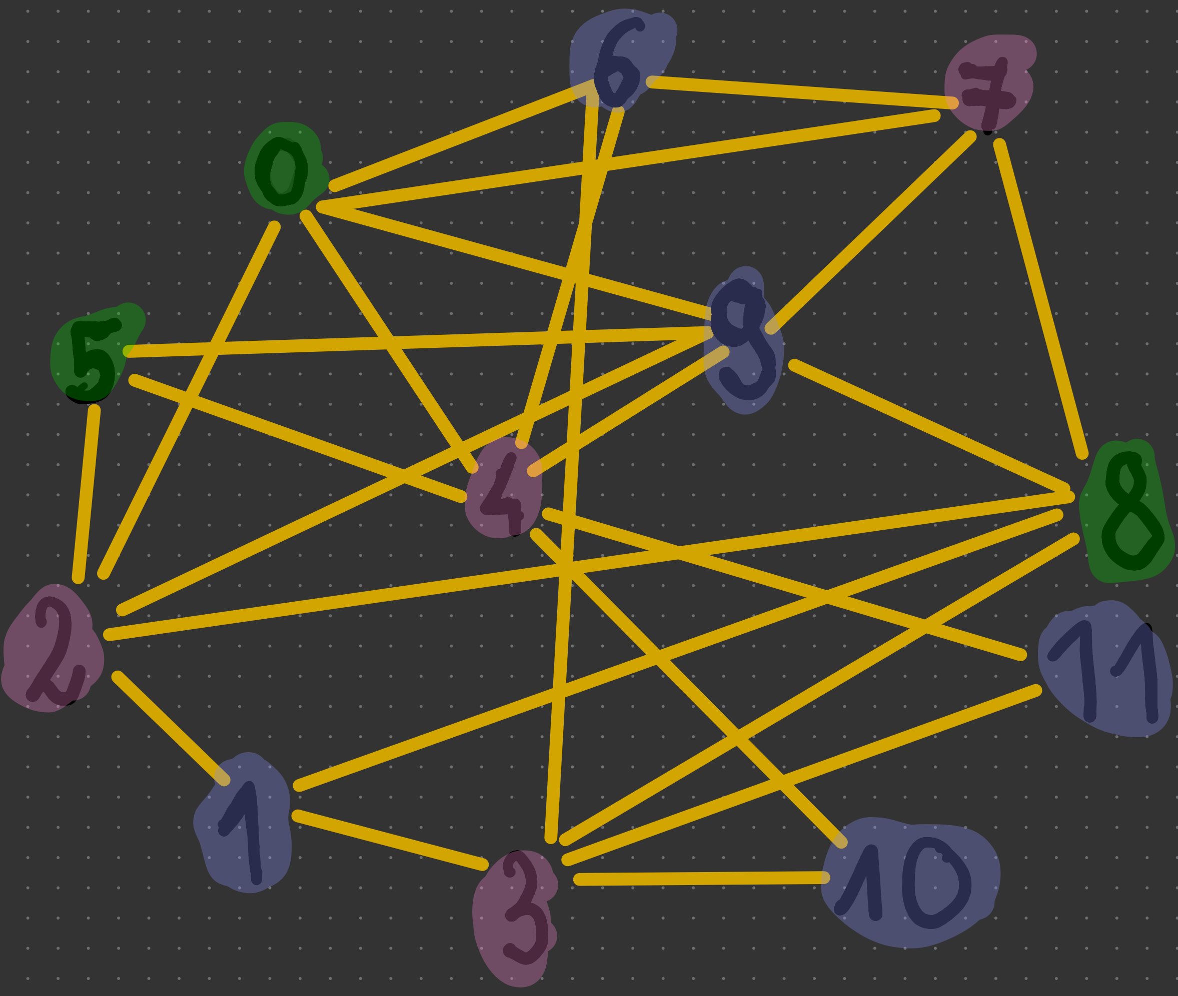


2.

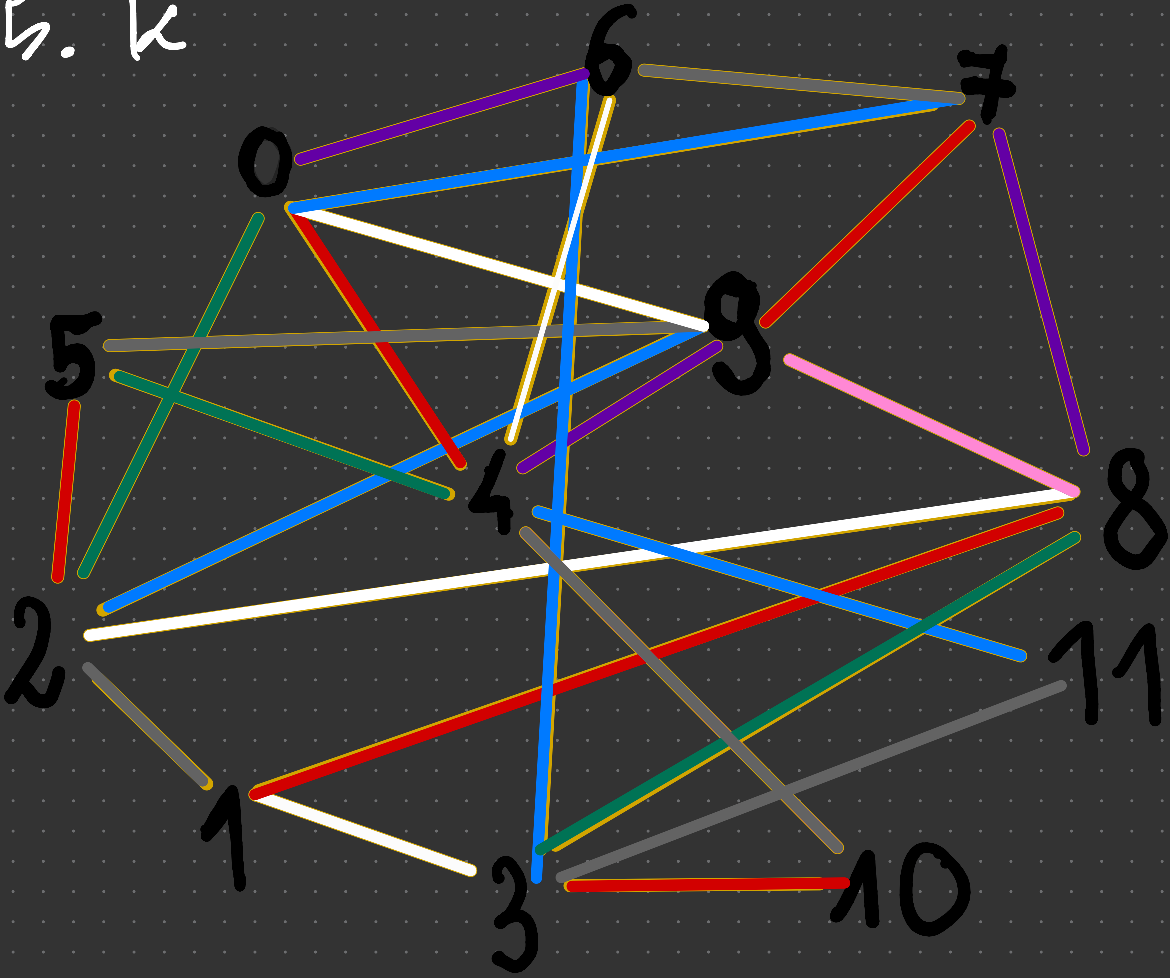
	0	1	2	3	4	5	6	7	8	9	10	11
0	0	0	1	0	1	0	1	1	0	1	0	0
1	0	0	1	1	0	0	0	0	1	0	0	0
2	1	1	0	0	0	1	0	0	1	1	0	0
3	0	1	0	0	0	0	1	0	1	0	1	1
4	1	0	0	0	0	1	1	0	0	1	1	1
5	0	0	1	0	1	0	0	0	0	1	0	0
6	1	0	0	1	1	0	0	1	0	0	0	0
7	1	0	0	0	0	0	1	0	1	1	0	0
8	0	1	1	1	0	0	0	1	0	1	0	0
9	1	0	1	0	1	1	0	1	1	0	0	0
10	0	0	0	1	1	0	0	0	0	0	0	0
11	0	0	0	1	1	0	0	0	0	0	0	0

0	`[[2, 7, 4, 9, 6],`
1	`[3, 2, 8],`
2	`[0, 5, 8, 1, 9],`
3	`[10, 1, 6, 11, 8],`
4	`[9, 6, 5, 11, 0, 10],`
5	`[2, 4, 9],`
6	`[4, 3, 7, 0],`
7	`[0, 9, 6, 8],`
8	`[9, 2, 1, 3, 7],`
9	`[4, 8, 5, 7, 0, 2],`
10	`[3, 4],`
11	`[4, 3]`

5. W

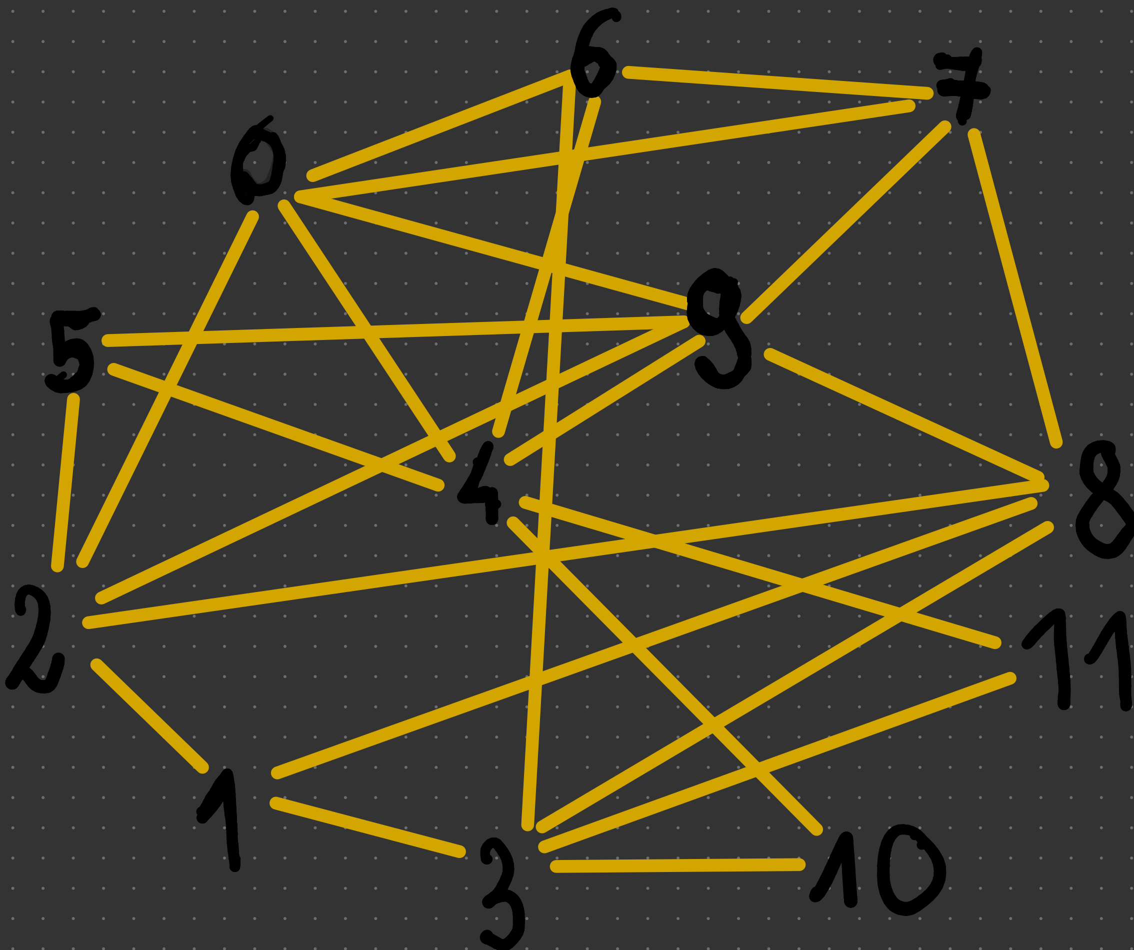


5. k



6. $\chi(G) = 3$

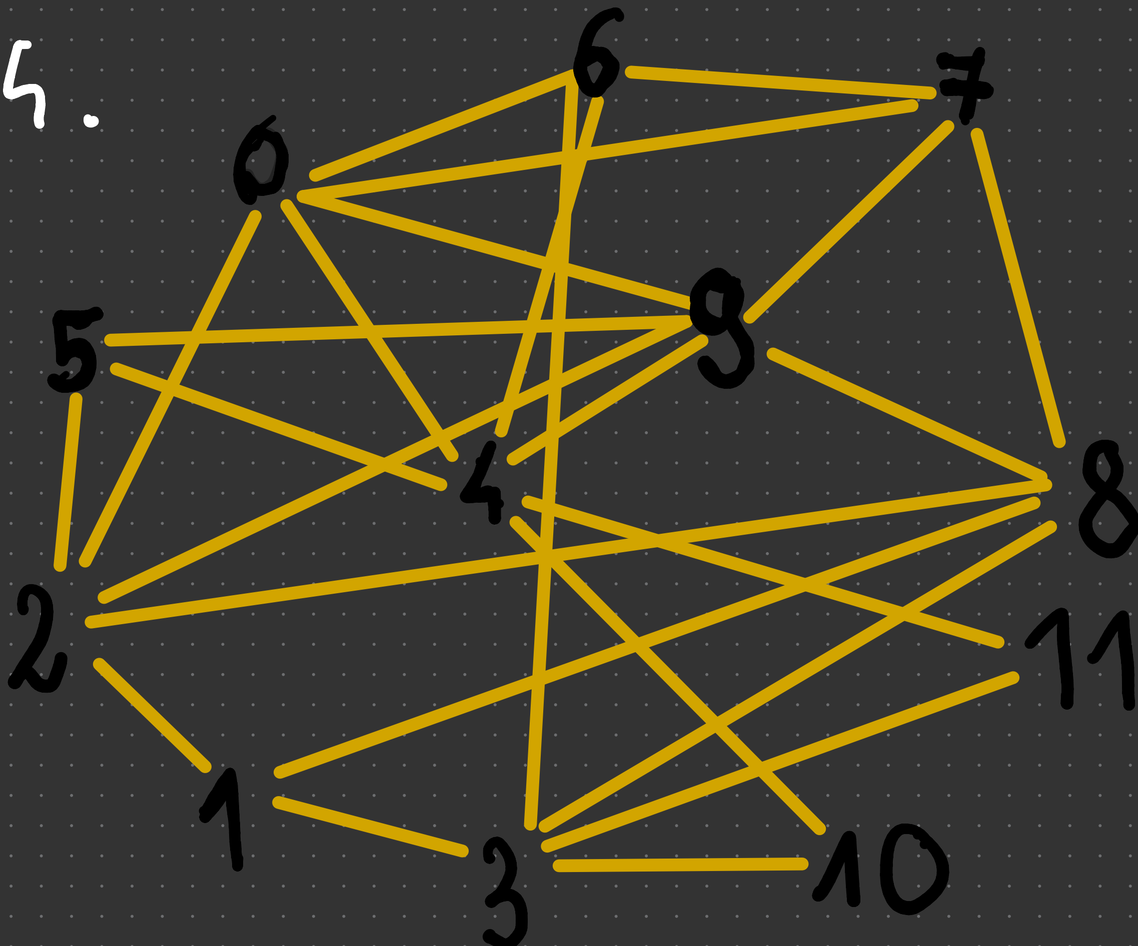
$\chi'(G) = 7$



Graf jest na pewno pół-hamiltonowski i
ścieżka Hamiltona:

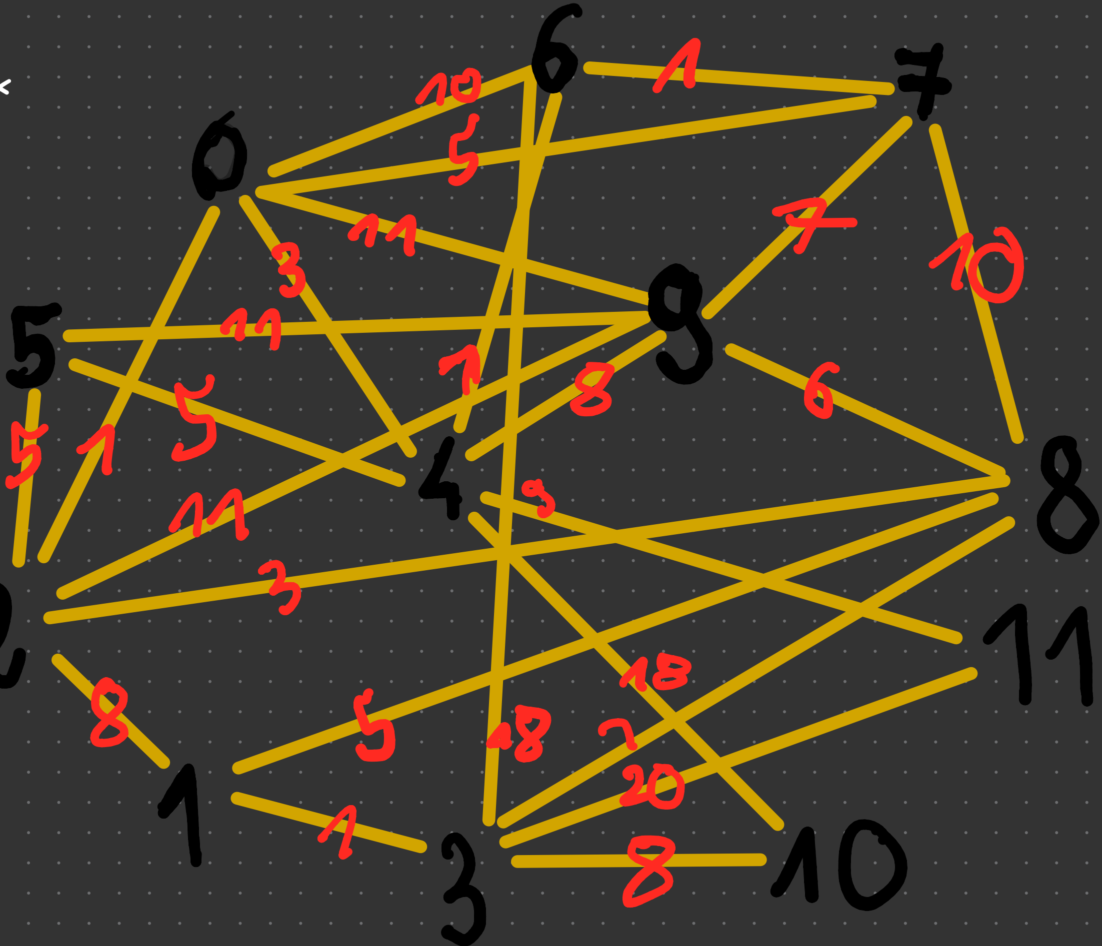
0 → 6 → 7 → 8 → 1 → 2 → 5 → 9 → 4 → 10 → 3 → 11

4.



Graf nie jest eulerowski/pół-eulerowski

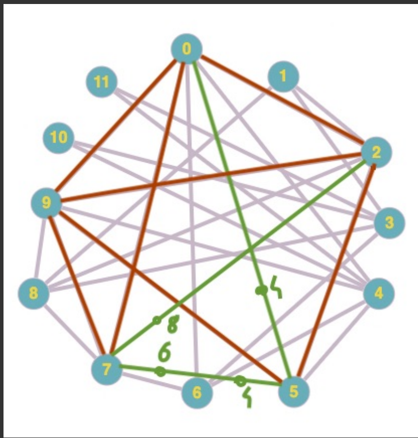
7.



MST = 39 :

$(9 \xrightarrow{6} 8), (8 \xrightarrow{3} 2), (8 \xrightarrow{1} 3), (3 \xrightarrow{8} 10), (3 \xrightarrow{1} 1), (2 \xrightarrow{5} 5),$
$(2 \xrightarrow{1} 0), (0 \xrightarrow{3} 4), (4 \xrightarrow{1} 6), (6 \xrightarrow{1} 7), (4 \xrightarrow{9} 11)$

8.



Żaden z grafów przedstawionych wcześniej, łącznie z widocznym obok nie jest grafem planarnym.

Powyższy graf zawiera podgraf K5. Za pomocą twierdzenia Kuratowskiego i twierdzenia Wagnera możemy wykazać, że powyższy graf nie jest planarny.