LINEAR PROGRAMMING

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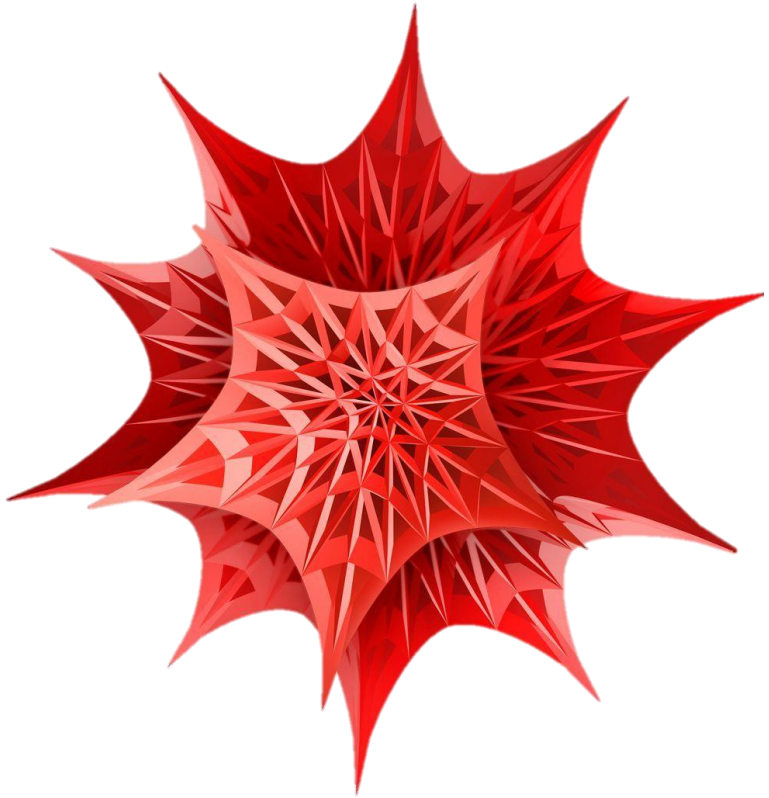
CONTENT

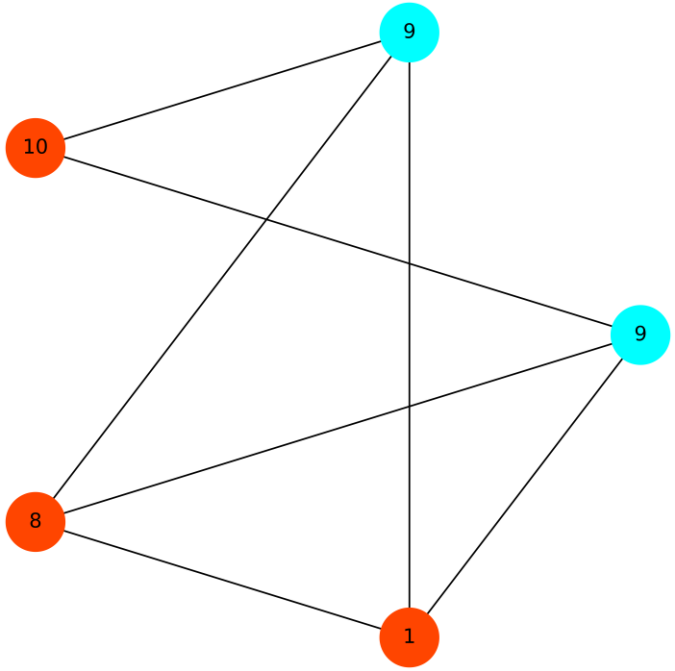
1. Greedy Set Cover Algorithm has best result
2. Price Method Algorithm has best result
3. LP-based Algorithm has best result

LINEAR PROGRAMMING SOFTWARE

- The software which I use is Mathematica. It is a numerical calculation software published by the Wolfram company.
- In all of the example follow, I will use Mathematica to verify the result that I calculated by Python.

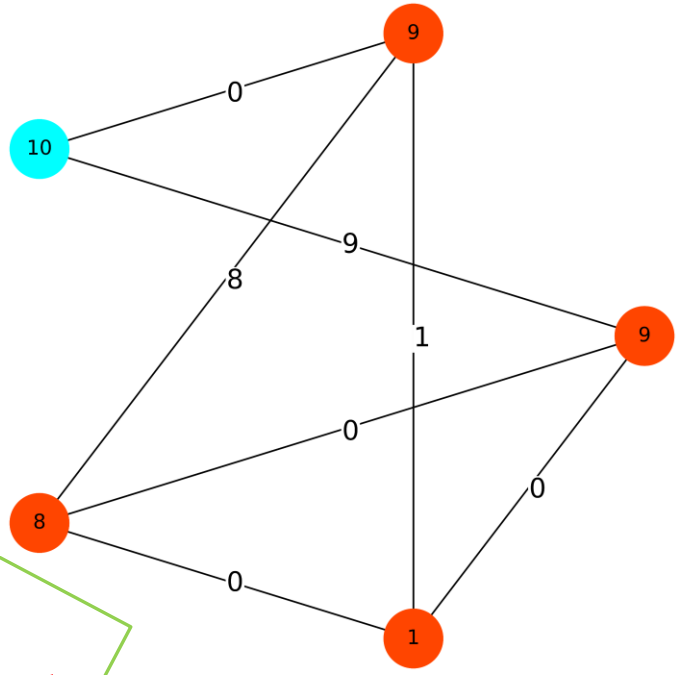


GREEDY SET COVER ALGORITHM HAS BEST RESULT

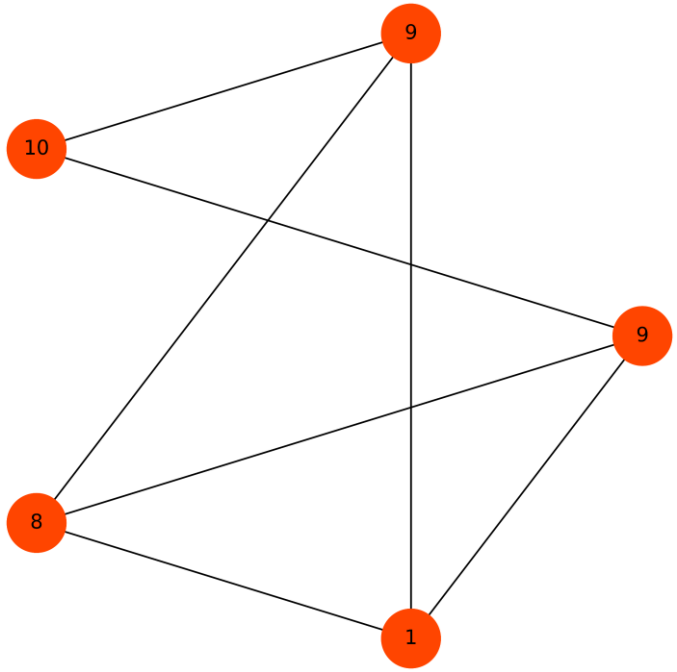


Result From Greedy Set Cover
Cost is 19

Order Independent !



Best Result From Price Method
The min cost is 27



Result From LP-based
Cost is 47

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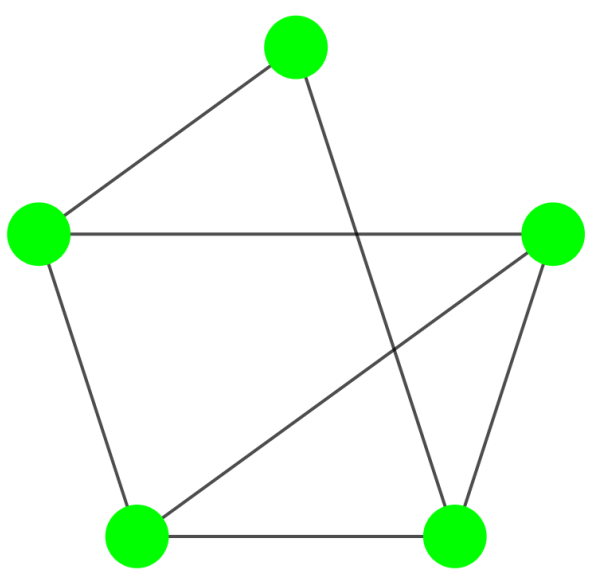
LP RESULT FROM MATHEMATICA

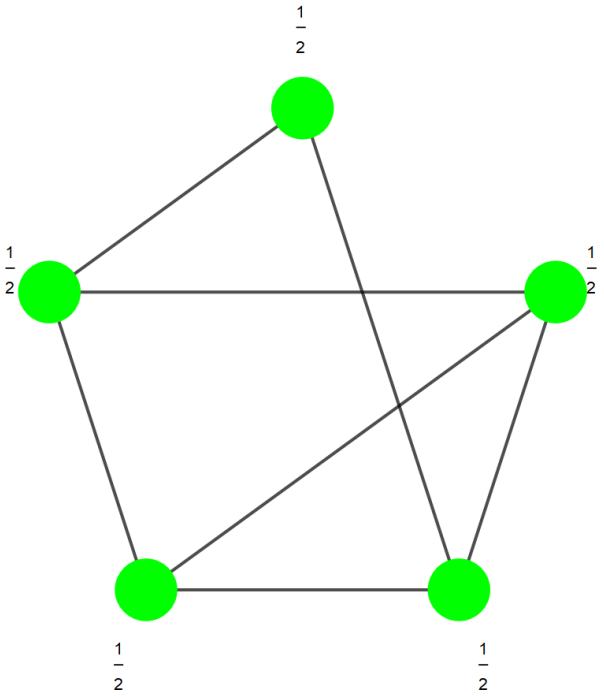
In[45]:=
```
M = {{0, 0, 1, 1, 1}, {0, 0, 1, 1, 1}, {0, 0, 0, 0, 0}, {0, 0, 0, 0, 0}, {0, 0, 0, 1, 0}};
weights = {9, 9, 10, 8, 1};
g = UndirectedGraph[AdjacencyGraph[M]];
```
无向图 邻接矩阵图
```
edgeNum = 7;
nodeNum = 5;
```

In[36]:=
```
g
```



In[71]:=
```
SetProperty[%67, VertexLabels → Table[i → x[[i]], {i, 5}]]
```
设置属性 顶点的标签 表格

Out[71]=



In[72]:=
```
edges = Table[{i[[1]], i[[2]]}, {i, EdgeList[g]}];
```
表格 边的列表
```
A =
  SparseArray[{Join[Table[{i, edges[[i]][[1]]}, {i, Length[edges]}], Table[{i, edges[[i]][[2]]}, {i, Length
```
稀疏数组 连接 表格 长度 表格 长度
```
   {edgeNum, nodeNum}];
```

In[70]:=
```
x = LinearProgramming[weights, A, Table[1, {i, edgeNum}], Table[{0, 1}, {i, nodeNum}], Method → "Simplex"]
```
线性规划 表格 表格 方法

Out[70]= $\left\{\frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}, \frac{1}{2}\right\}$

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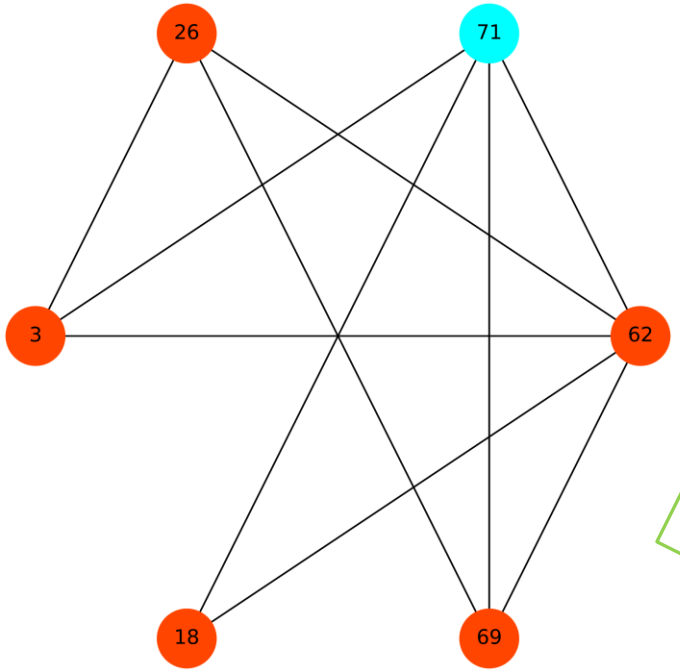
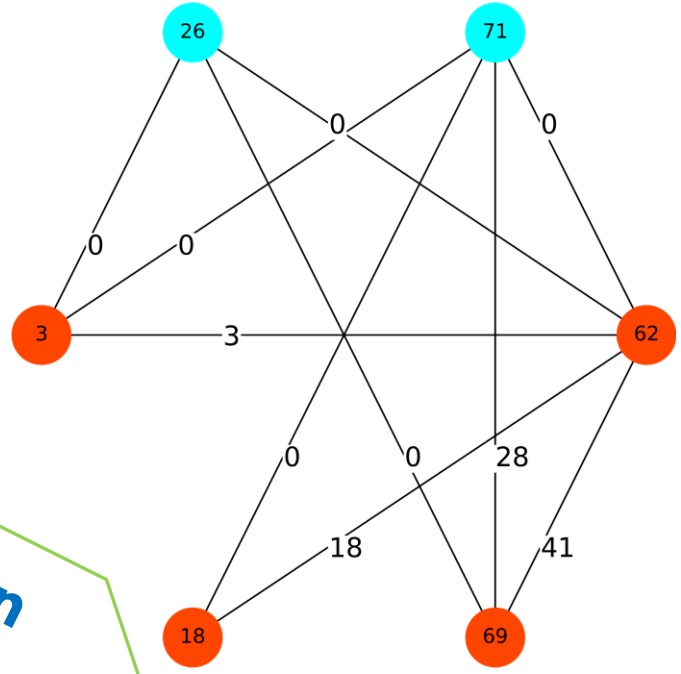
PRICE METHOD ALGORITHM HAS BEST RESULT

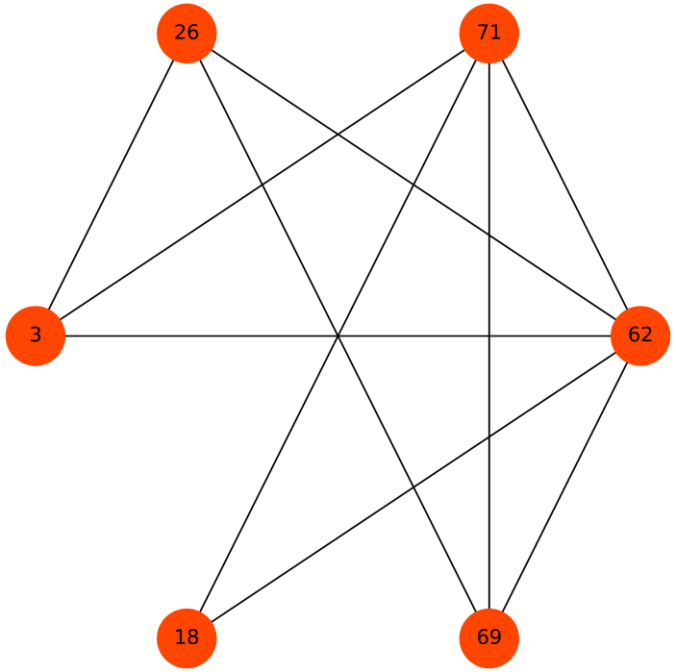


Result From Greedy Set Cover
Cost is 178

Depend on
The Order (TwT)



Best Result From Price Method
The min cost is 152



Result From LP-based
Cost is 249

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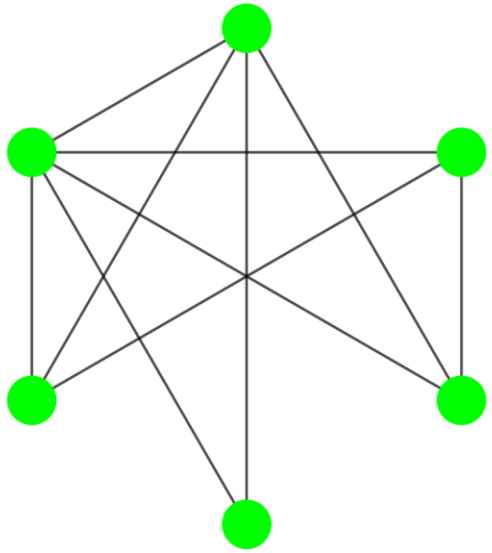
LP RESULT FROM MATHEMATICA

```
M = {{0, 0, 1, 1, 1, 0}, {1, 0, 0, 1, 0, 1}, {0, 0, 0, 1, 0, 1},
    {0, 0, 0, 0, 0, 0}, {0, 1, 0, 0, 0, 0}, {1, 0, 0, 0, 0, 0}};
weights = {62, 71, 26, 3, 18, 69};
g = UndirectedGraph[AdjacencyGraph[M]];
edgeNum = Length[EdgeList[g]];
nodeNum = Length[weights];
```

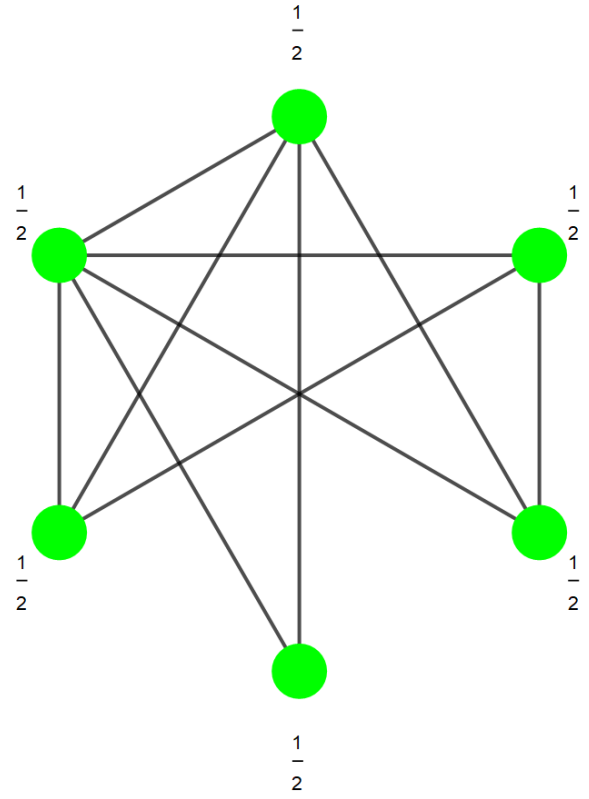
In[84]:= g

In[100]:=



```
In[105]:= SetProperty[%100, VertexLabels → Table[i → x[[i]], {i, nodeNum}]]
```

Out[105]=




```
In[102]:= edges = Table[{i[[1]], i[[2]]}, {i, EdgeList[g]}];

          A =
            SparseArray[{Join[Table[{i, edges[[i]][[1]]}, {i, Length[edges]}], Table[{i, edges[[i]][[2]]}, {i, Len
              {edgeNum, nodeNum}];

In[104]:= x = LinearProgramming[weights, A, Table[1, {i, edgeNum}], Table[{0, 1}, {i, nodeNum}], Method → "Simplex"]

Out[104]= {1/2, 1/2, 1/2, 1/2, 1/2, 1/2}
```

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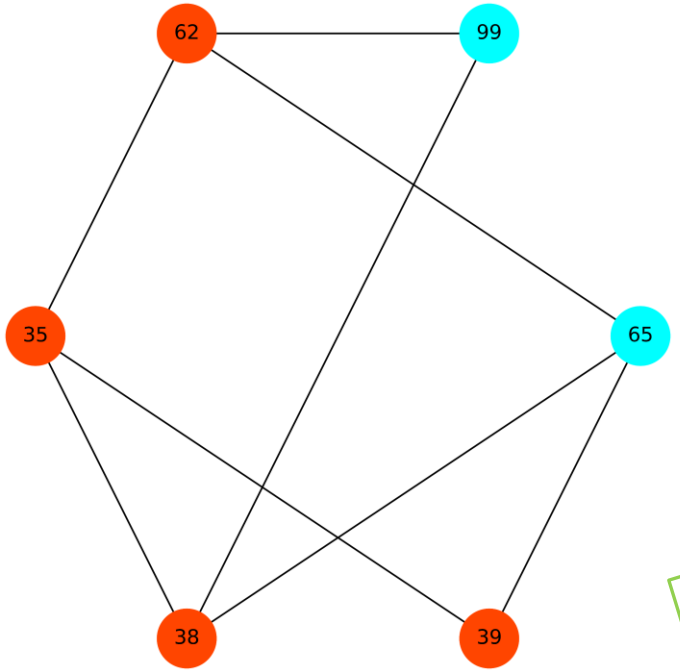
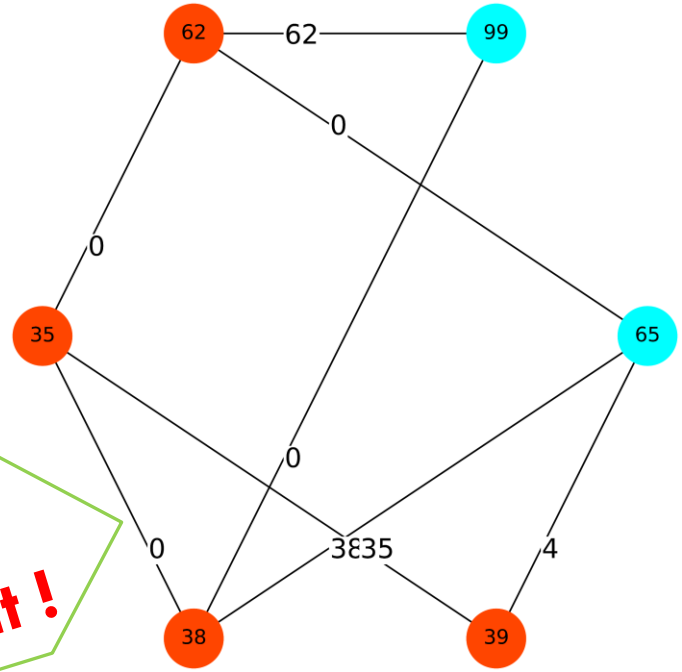
GREEDY SET COVER ALGORITHM HAS BEST RESULT

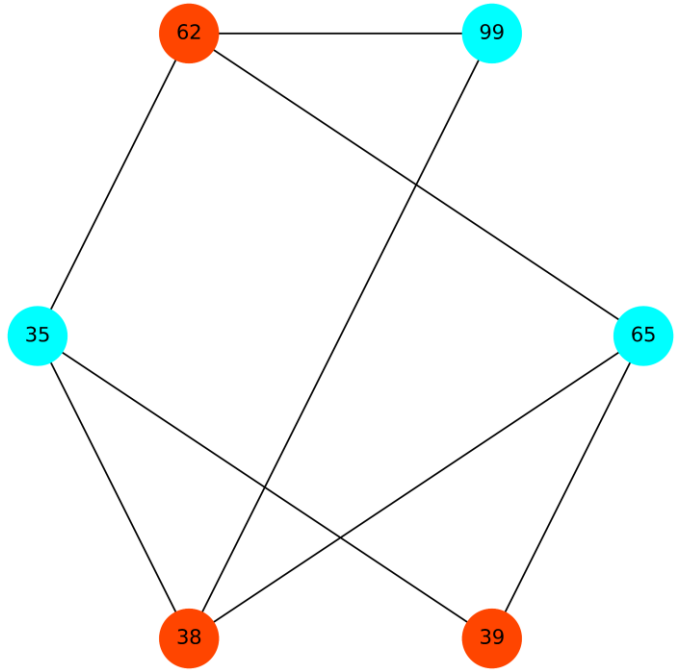


Result From Greedy Set Cover
Cost is 174

Order Independent !



Best Result From Price Method
The min cost is 174



Result From LP-based
Cost is 139

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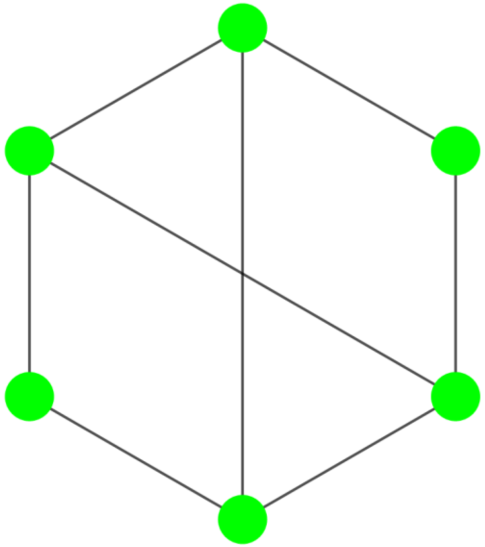
LP RESULT FROM MATHEMATICA

```
M = {{0, 0, 0, 0, 1, 1}, {0, 0, 1, 0, 1, 0}, {1, 0, 0, 1, 0, 0},
   {0, 0, 0, 0, 1, 0}, {0, 0, 0, 0, 0, 0}, {0, 0, 0, 1, 0, 0}};
weights = {65, 99, 62, 35, 38, 39};
g = UndirectedGraph[AdjacencyGraph[M]];
    无向图          邻接矩阵图
edgeNum = Length[EdgeList[g]];
          长度    边的列表
nodeNum = Length[weights];
          长度
```

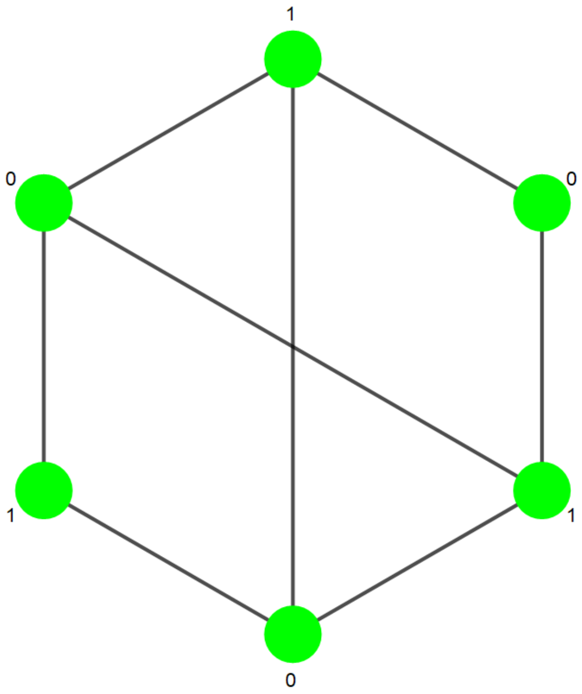
```
In[114]:= g
```

In[121]:=



```
In[122]:= SetProperty[%121, VertexLabels → Table[i → x[[i]], {i, nodeNum}]]
          设置属性          顶点的标签          表格
```

Out[122]=




```
In[111]:= edges = Table[{i[[1]], i[[2]]}, {i, EdgeList[g]}];
                  表格                       边的列表
          A =
           SparseArray[{Join[Table[{i, edges[[i]][[1]]}, {i, Length[edges]}], Table[{i, edges[[i]][[2]]}, {i, Lengt
           稀疏数组      连接  表格                            长度                表格                            长度
             {edgeNum, nodeNum}];

In[113]:= x = LinearProgramming[weights, A, Table[1, {i, edgeNum}], Table[{0, 1}, {i, nodeNum}], Method → "Simplex"]
              线性规划                          表格                   表格                             方法

Out[113]= {0, 0, 1, 0, 1, 1}
```

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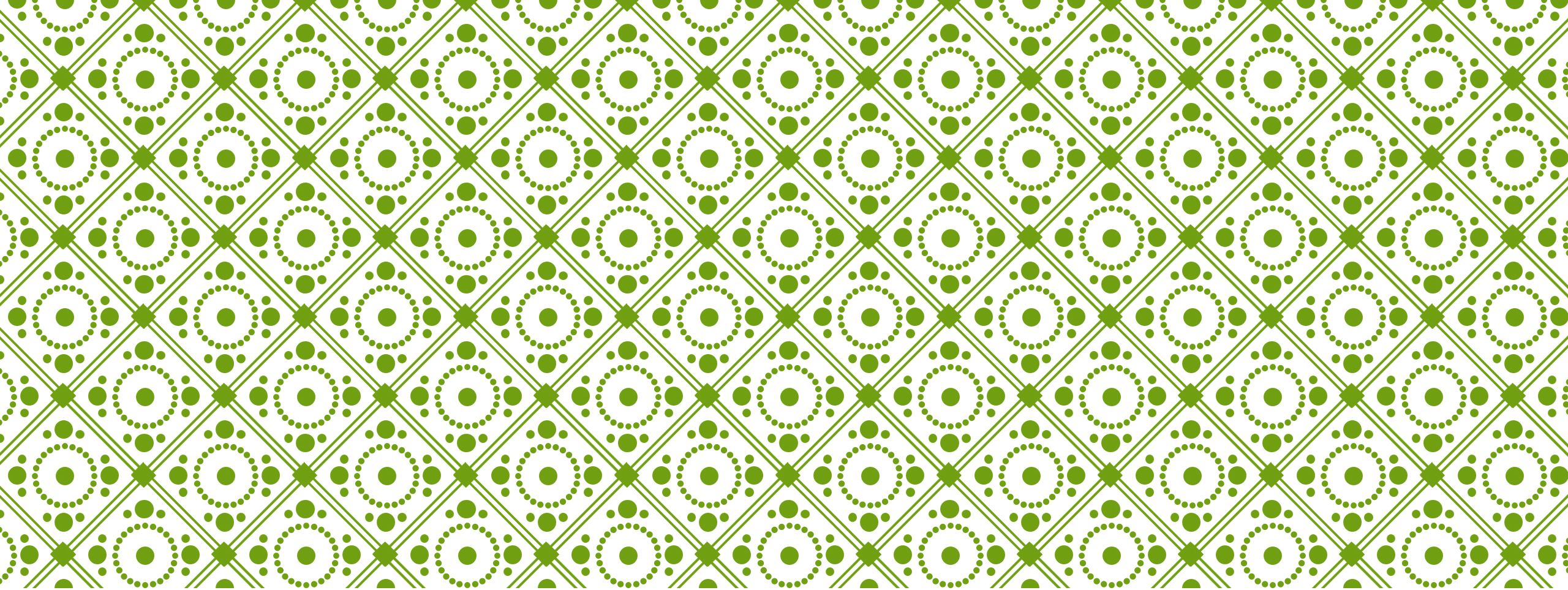

THANK YOU !

Q&A

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