Diskrētā matemātika

Hamiltona grafi (25.02.2008.)

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```
In[1]:= <<DiscreteMath`Combinatorica`
```

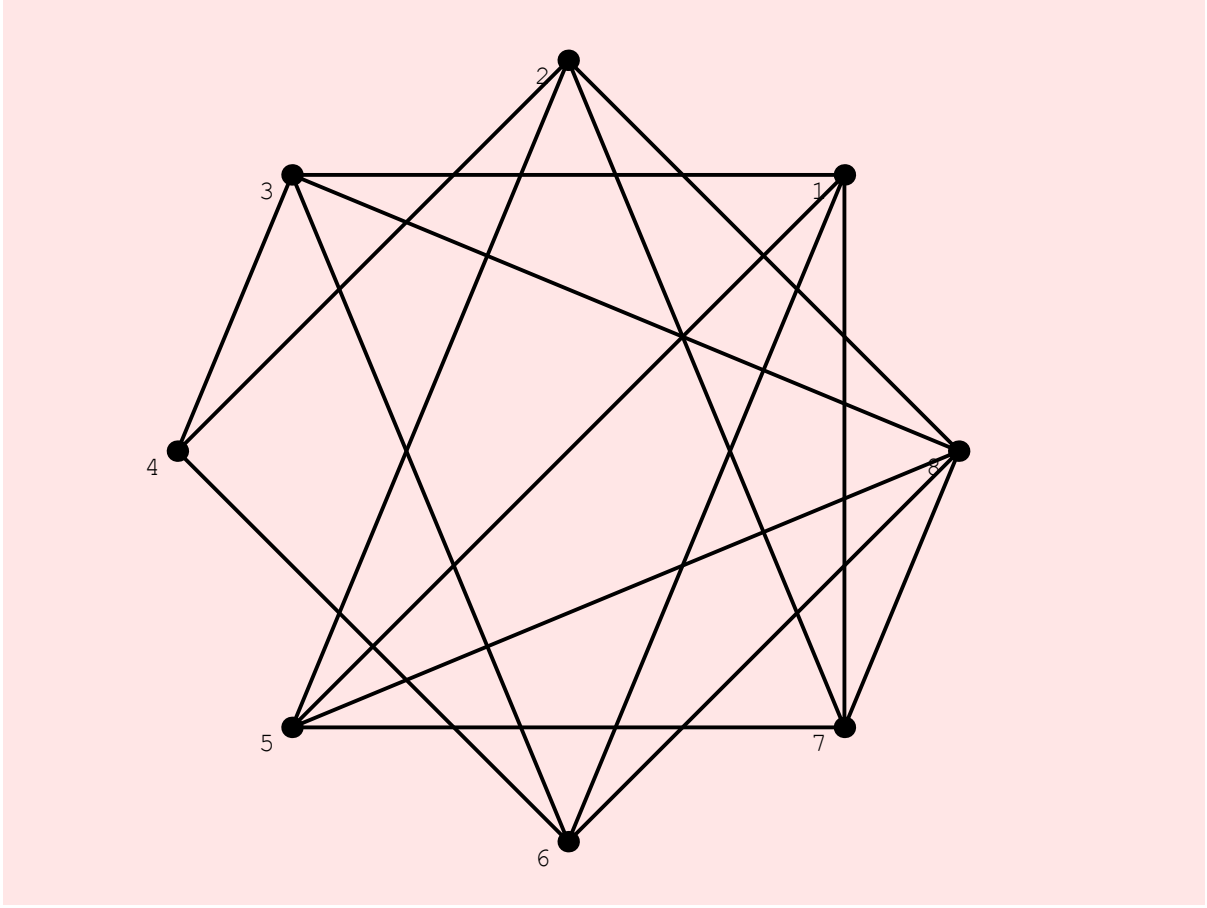
Izveidosim grafu G (skat. lekcijās aplūkoto grafu), pievienojot tukšajam grafam O_8 ar virsotnēm 1, 2 ,3 ,4 ,5 ,6 ,7 ,8 šķautnes {1,3}, {1,5}, {1,6}, {1,7}, {2,4}, {2,5}, {2,7}, {2,8}, {3,4}, {3,6}, {3,8}, {4,6}, {5,8}, {5,7}, {6,8}, {7,8}.

```
In[2]:= G=AddEdges[EmptyGraph[8],{{1,3},{1,5},{1,6},{1,7},{2,4},{2,5},{2,7},{2,8
        },{3,4},{3,6},{3,8},{4,6},{5,8},{5,7},{6,8},{7,8}}]
```

```
Out[2]= -Graph:<16, 8, Undirected>-
```

Attēlojam grafiski grafu G.

In[3]:=
```
ShowGraph[G,VertexNumber→On]
```



Out[3]= - Graphics -

Noskaidrojam, vai G ir Hamiltona grafs.

In[4]:=
```
HamiltonianQ[G]
```

Out[4]= True

Jā, grafs G ir Hamiltona grafs.

Atrodam kādu Hamiltona ciklu grafā G.

In[5]:=
```
HamiltonianCycle[G]
```

Out[5]= {1, 3, 4, 2, 5, 7, 8, 6, 1}

Tagad atrodam visus Hamiltona ciklus grafā G.

In[6]:=
```
HamiltonianCycle[G,All]
```

Out[6]=
```
{{1, 3, 4, 2, 5, 7, 8, 6, 1}, {1, 3, 4, 2, 7, 5, 8, 6, 1},
 {1, 3, 4, 6, 8, 2, 5, 7, 1}, {1, 3, 4, 6, 8, 2, 7, 5, 1},
 {1, 3, 4, 6, 8, 5, 2, 7, 1}, {1, 3, 4, 6, 8, 7, 2, 5, 1},
 {1, 3, 6, 4, 2, 5, 8, 7, 1}, {1, 3, 6, 4, 2, 7, 8, 5, 1},
 {1, 3, 6, 4, 2, 8, 5, 7, 1}, {1, 3, 6, 4, 2, 8, 7, 5, 1},
 {1, 3, 8, 5, 7, 2, 4, 6, 1}, {1, 3, 8, 6, 4, 2, 5, 7, 1},
 {1, 3, 8, 6, 4, 2, 7, 5, 1}, {1, 3, 8, 7, 5, 2, 4, 6, 1},
 {1, 5, 2, 4, 3, 6, 8, 7, 1}, {1, 5, 2, 4, 6, 3, 8, 7, 1},
 {1, 5, 2, 7, 8, 3, 4, 6, 1}, {1, 5, 2, 7, 8, 6, 4, 3, 1},
 {1, 5, 7, 2, 4, 3, 8, 6, 1}, {1, 5, 7, 2, 4, 6, 8, 3, 1},
 {1, 5, 7, 2, 8, 3, 4, 6, 1}, {1, 5, 7, 2, 8, 6, 4, 3, 1},
 {1, 5, 7, 8, 2, 4, 3, 6, 1}, {1, 5, 7, 8, 2, 4, 6, 3, 1},
 {1, 5, 8, 3, 6, 4, 2, 7, 1}, {1, 5, 8, 6, 3, 4, 2, 7, 1},
 {1, 5, 8, 7, 2, 4, 3, 6, 1}, {1, 5, 8, 7, 2, 4, 6, 3, 1},
 {1, 6, 3, 4, 2, 5, 8, 7, 1}, {1, 6, 3, 4, 2, 7, 8, 5, 1},
 {1, 6, 3, 4, 2, 8, 5, 7, 1}, {1, 6, 3, 4, 2, 8, 7, 5, 1},
 {1, 6, 4, 2, 5, 7, 8, 3, 1}, {1, 6, 4, 2, 7, 5, 8, 3, 1},
 {1, 6, 4, 3, 8, 2, 5, 7, 1}, {1, 6, 4, 3, 8, 2, 7, 5, 1},
 {1, 6, 4, 3, 8, 5, 2, 7, 1}, {1, 6, 4, 3, 8, 7, 2, 5, 1},
 {1, 6, 8, 3, 4, 2, 5, 7, 1}, {1, 6, 8, 3, 4, 2, 7, 5, 1},
 {1, 6, 8, 5, 7, 2, 4, 3, 1}, {1, 6, 8, 7, 5, 2, 4, 3, 1},
 {1, 7, 2, 4, 3, 6, 8, 5, 1}, {1, 7, 2, 4, 6, 3, 8, 5, 1},
 {1, 7, 2, 5, 8, 3, 4, 6, 1}, {1, 7, 2, 5, 8, 6, 4, 3, 1},
 {1, 7, 5, 2, 4, 3, 8, 6, 1}, {1, 7, 5, 2, 4, 6, 8, 3, 1},
 {1, 7, 5, 2, 8, 3, 4, 6, 1}, {1, 7, 5, 2, 8, 6, 4, 3, 1},
 {1, 7, 5, 8, 2, 4, 3, 6, 1}, {1, 7, 5, 8, 2, 4, 6, 3, 1},
 {1, 7, 8, 3, 6, 4, 2, 5, 1}, {1, 7, 8, 5, 2, 4, 3, 6, 1},
 {1, 7, 8, 5, 2, 4, 6, 3, 1}, {1, 7, 8, 6, 3, 4, 2, 5, 1}}
```

Atrodam kādu Hamiltona ķēdi.

In[7]:=
```
HamiltonianPath[G]
```

Out[7]=
```
{1, 3, 4, 2, 5, 7, 8, 6}
```

Ar komandas **HamiltonianPath[G,All]** palīdzību var atrast visas Hamiltona ķēdes grafā G. Izmēģiniet!

Izveidojam grafu ar svariem H, pievienojot grafa G šķautnēm svarus.

In[8]:=
```
H=SetEdgeWeights[G,{{1,3},{1,5},{1,6},{1,7},{2,4},{2,5},{2,7},{2,8},{3,4
},{3,6},{3,8},{4,6},{5,8},{5,7},{6,8},{7,8}},{6,13,1,7,8,12,13,15,11,5,1
7,4,12,8,13,5}]
```

Out[8]=
```
-Graph:<16, 8, Undirected>-
```

Atrodam kādu Hamiltona ciklu ar vismazāko svaru.

In[9]:=
```
TravelingSalesman[H]
```

Out[9]=
```
{1, 3, 6, 4, 2, 5, 8, 7, 1}
```

Atrodam šī Hamiltona cikla svaru.

In[10]:=
```
CostOfPath[H,{1,3,6,4,2,5,8,7,1}]
```

Out[10]=
```
59
```