**UNIVERSITY OF ENGINEERING AND**

**TECHNOLOGY LAHORE**



**Assignment # 3**

**Economic Dispatch using Dynamic Programming**

**Course Title: Advanced Power System Operation and Control**

**Course Code: EE 641**

**Submitted to:**

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**ID # 2018-MS-EE-4**

**Date of Submission: 30 March 2020**

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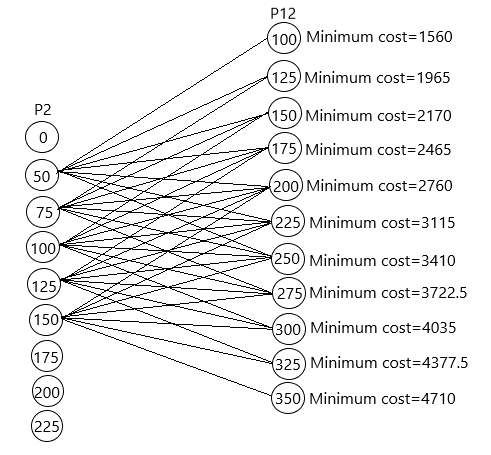
**Problem Statement**

Three generator units with non-convex input output curves must be optimally scheduled to meet a load demand of D = 310 MW. The costs for different power levels are shown in the table below.

|  |  |  |  |
| --- | --- | --- | --- |
| Power Levels (MW) | Costs ($/h) | | |
|  |  |  |  |
| 0 |  |  |  |
| 50 | 810 | 750 | 806 |
| 75 | 1355 | 1155 | 1108.5 |
| 100 | 1460 | 1360 | 1411 |
| 125 | 1772.5 | 1655 | 1704.5 |
| 150 | 208.5 | 1950 | 1998 |
| 175 | 2427.5 |  | 2358 |
| 200 | 2760 |  |  |
| 225 |  |  |  |

Scheduling units 1 and 2, we find the minimum cost for the function

Over the allowable range of and for . The results are shown in the Figure below and the MATLAB code is given as well.



**MATLAB Code for**

clc;clear all;

D12=zeros(27,1);

Ans12=zeros(27,1);

D123=zeros(27,1);

Ans123=zeros(27,1);

Powers=[0;50;75;100;125;150;175;200;225];

Costs=[ inf inf inf;

810 750 806;

1355 1155 1108.5;

1460 1360 1411;

1772.5 1655 1704.5;

2085 1950 1998;

2427.5 inf 2358;

2760 inf inf;

inf inf inf];

for r=1:9

for c=1:9

D12(r,1)=Powers(r,1);

D12(r+c,1)=max(D12(r+c,1),Powers(r)+Powers(c));

D12(r,2)=Costs(r,1);

D12(r+c,c+2)=Costs(r,1)+Costs(c,2);

end

end

for r=1:18

for c=1:8

if (D12(r,c+1)==0)

D12(r,c+1)=inf;

end

if (D12(r,10)==inf)

D12(r,10)=0;

end

end

end

for r=1:18

for c=3:8

D12(r,9)=min(D12(r,3:8));

if (min(D12(r,3:8))~=inf)

if (D12(r,9)==D12(r,c))

D12(r,10)=Powers(c-2);

end

if (D12(r,9)==D12(r,c))

D12(r,11)=D12(r,1)-D12(r,10);

end

end

end

end

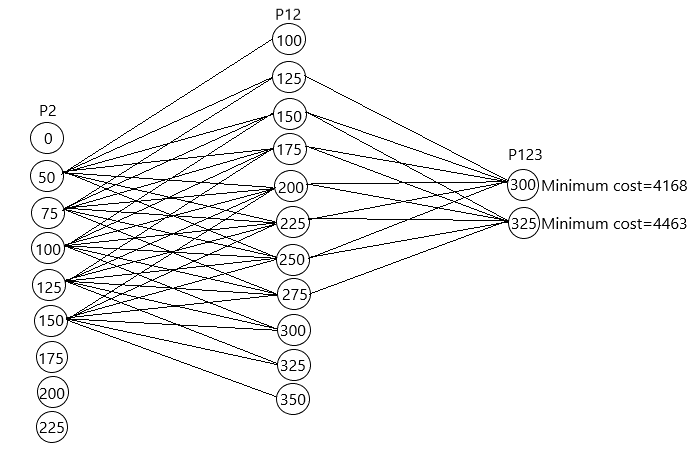
D12(1:14,:)

Ans12=[D12(:,1) D12(:,9) D12(:,10) D12(:,11)];

Ans12(1:15,1:3)

Next, we minimize

The results are shown in the Figure below and the MATLAB code is given as well.



**MATLAB Code for**

for r=1:18

for c=1:9

D123(r,1)=Ans12(r,1);

D123(r+c,1)=max(D123(r+c,1),Ans12(r,1)+Powers(c));

D123(r,2)=Ans12(r,2);

D123(r+c,c+2)=Ans12(r,2)+Costs(c,3);

end

end

for r=1:27

for c=1:8

if (D123(r,c+1)==0)

D123(r,c+1)=inf;

end

if (D123(r,10)==inf)

D123(r,10)=0;

end

end

end

for r=1:27

for c=3:8

D123(r,10)=min(D123(r,3:9));

if (min(D123(r,3:9))~=inf)

if (D123(r,10)==D123(r,c))

D123(r,11)=Powers(c-2);

end

end

end

end

for r123=1:27

for r12=1:18

if ((D123(r123,1)-D123(r123,11))==Ans12(r12,1))

D123(r123,12)=Ans12(r12,3);

D123(r123,13)=Ans12(r12,4);

end

end

end

D123(12:13,1:11)

Ans123=[D123(:,1) D123(:,10) D123(:,11) D123(:,12) D123(:,13)];

Ans123(12:13,:)

The results show

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| D (MW) | Cost ($/h) | (MW) | (MW) | (MW) |
| 300 | 4168 | 150 | 100 | 50 |
| 325 | 4463 | 150 | 125 | 50 |

Between 300 MW and 325 MW levels, the marginal unit is unit 2. We can therefore interpolate to find a cost at a load level of D = 310 MW. This corresponds to an output level of 110 MW on unit 2. The results of D = 310 MW are