**Optimal Chains**

* The chain with the minimal / maximal **value**.
* Check as many chains as possible in order to be certain that you have the optimal one.
* Using colors to identify the paths MIGHT help you cover ALL the possibilities

**Example #1**

Determine the **Minimal Value** connecting A and D

DD

A

**B**

C

E

F

G

3

4

2

5

3

3

1

2

2

4

4

ABCD – 3 + 3 + 3 = 9  
ABCGD – 3 + 3 + 1 + 2 = 9  
ABCGED – 3 + 3 + 1 + 2 + 2 = 11  
ABED – 3 + 4 + 2 = 9  
ABEGD – 3 + 4 + 2 + 2 = 11  
AED – 5 + 2 = 7  
AEGD – 5 + 2 + 2 = 9  
AFED – 4 + 4 + 2 = 10  
AFEGD – 4 + 4 + 2 + 2 = 12

Optimal Chain would be AED with a value of 7

**Example #2**

Determine the **Minimal Value** connecting vertices B and D

A

D

C

B

E

5

2

3

4

7

2

6

3

BAED – 2 + 3 + 4 = 9  
BAECD – 2 + 3 + 3 + 2 = 10  
BAD – 2 + 5 = 7  
BED – 7 + 4 = 11  
BECD – 7 + 3 + 2 = 12  
BCD – 6 + 2 = 8

Optimal Chain would be BAD with a value of 7

**Example #3**

Determine the **Maximal Value** connecting points G and E

A

B

C

D

E

F

G

5

8

6

2

2

2

5

3

Optimal Chain would be GFABCDE with a value of 25

GFABE – 5 + 8 + 2 + 6 = 21  
GFABCDE – 5 + 8 + 2 + 2 + 5 + 3 = 25

**Optimal Trees**

* A tree graph that uses either the minimal or maximal values

Note – Don’t forget the 3 rules that make a tree graph:

1. 1 less edge than vertex
2. Connected graph
3. No simple cycles

**Example #1**

Determine the minimal value of this graph:

A

20

B

30

C

50

10

D

30

E

50

40

Step 1 – Draw a blank template of the graph with just the vertices

A

D

E

C

B

Step 2 – Connect the edges one at a time, starting with the SMALLEST values first. Stop when you have created your tree.

A

D

E

C

B

10

A

D

E

C

B

10

20

A

D

E

C

B

10

20

30

40

A

D

E

C

B

10

20

30

QUESTION - Why didn’t we connect AD?

The optimal value for the graph would be 100

**Example #2**

Determine the maximal value of this graph:

A

D

C

B

E

5

2

3

4

7

2

6

3

Step 1 – Draw a blank template of the graph with just the vertices

A

B

C

D

E

Step 2 – Connect the edges one at a time, starting with the LARGEST values first. Stop when you have created your tree.

A

B

C

D

E

7

A

B

C

D

E

7

6

5

A

B

C

D

E

7

6

4

5

A

B

C

D

E

7

6

The optimal value for the graph would be 22