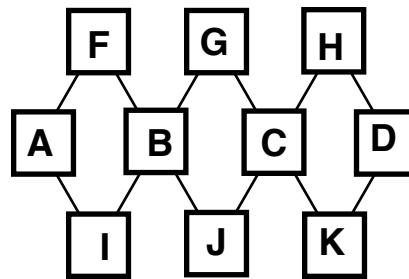
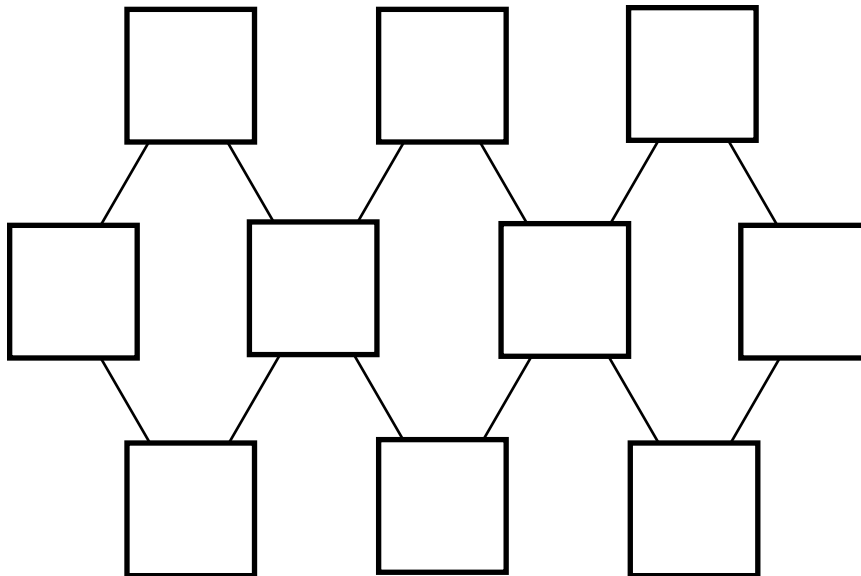
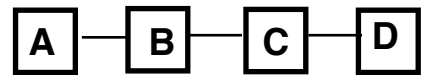
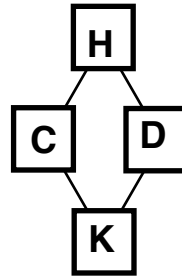
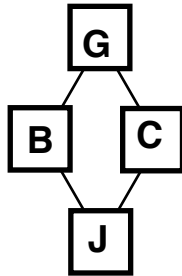
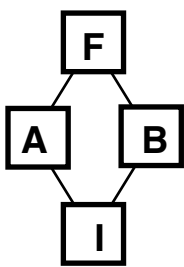


## Danish Solitaire

The diagram below has 10 squares arranged to form 3 diamonds (rhombus) forming horizontal a row of 4 squares in the middle.

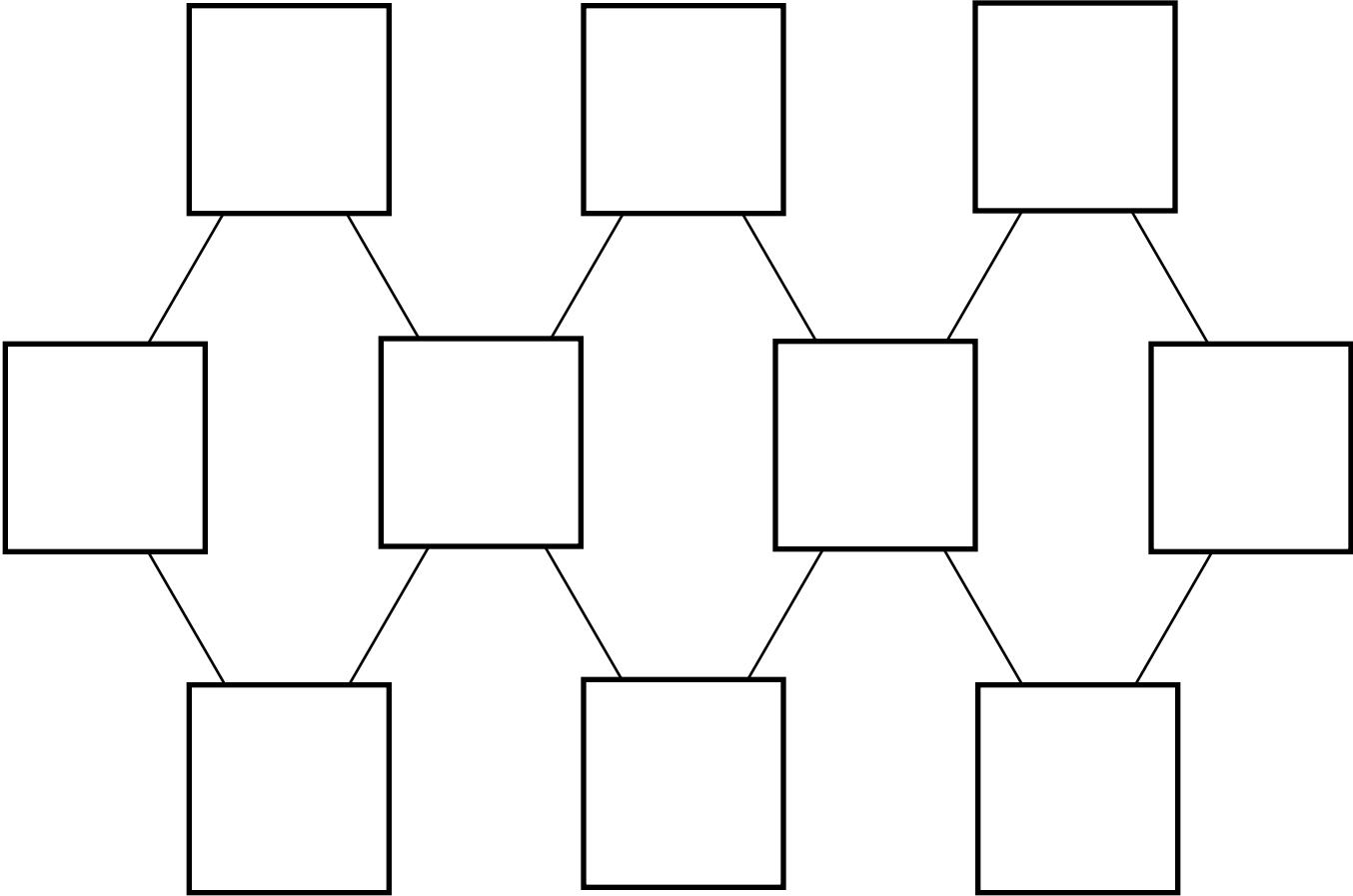


Find 4 different arrangements of the digits 1 to 10 so that all 3 diamonds and the row of 4 squares have a total of 21, 22, 23 or 24,



# Danish Solitaire

The diagram below as 10 squares arranged to form 3 diamonds (a rhombus) forming a horizontal row of 4 squares in the middle. Find 4 different arraignment of the digits 1 to 10 so that all 3 diamonds and the row of 4 squares have a total of 21, 22 23 and 24,

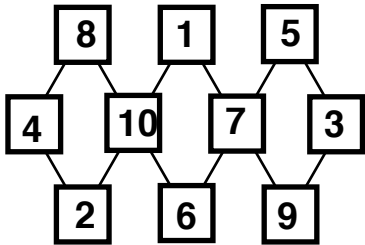


10	<u>9</u>	8	7	<u>6</u>
5	4	3	2	1

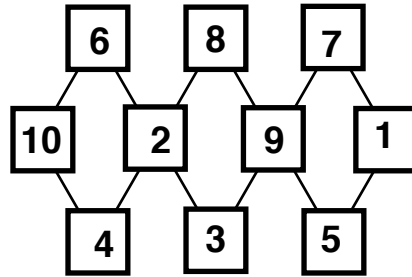
## Possible Solutions:

It is possible to get a total of 21, 22, 23 and 24 in many different ways. In general there are too many solutions to print here. I have listed some solutions for each of the totals.

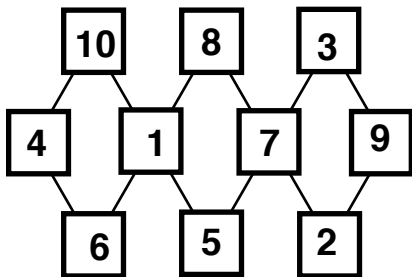
**Total of 24**



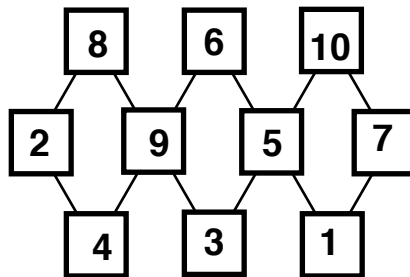
**Total of 22**



**Total of 21**



**Total of 23**



There are many solutions to the puzzle and there are many patterns to the solutions. In many cases certain combinations cannot exist and limit the search for solutions. In many cases only a limited number of combinations are allowed in the middle row. This also limits the search for solutions.

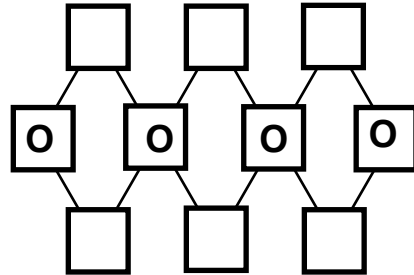
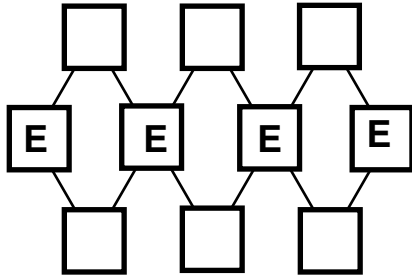
The following pages examine the limitations on solutions and present a systemic approach to find solutions. Students could gain an appreciation for what mathematicians do by looking at some or all of the material.

## Even totals

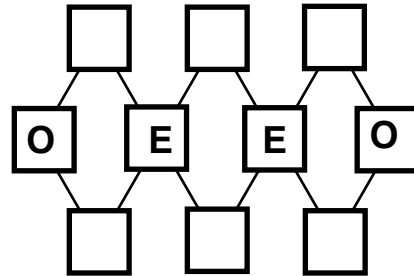
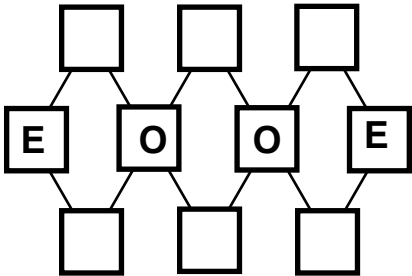
If the total of  $A + B + C + D = \text{EVEN NUMBER}$

then each set of 4 boxes in the 3 diamonds and the middle row need to have an even number of evens and an even number of odds.

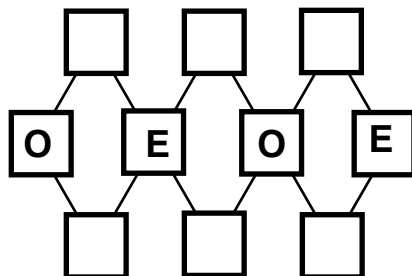
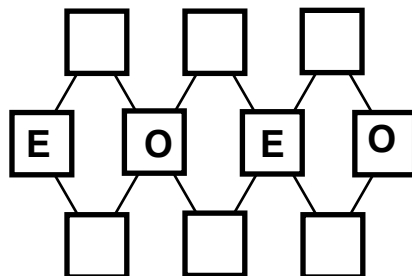
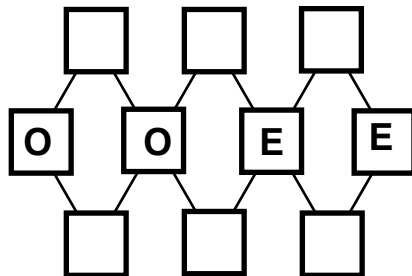
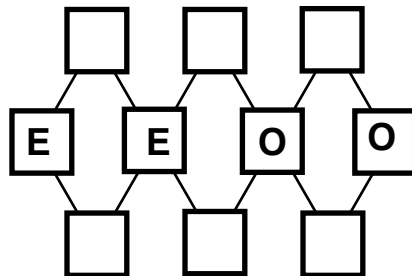
Case 1: The middle row is all evens or all odds



Case 2: The middle row has 2 evens and 2 odds

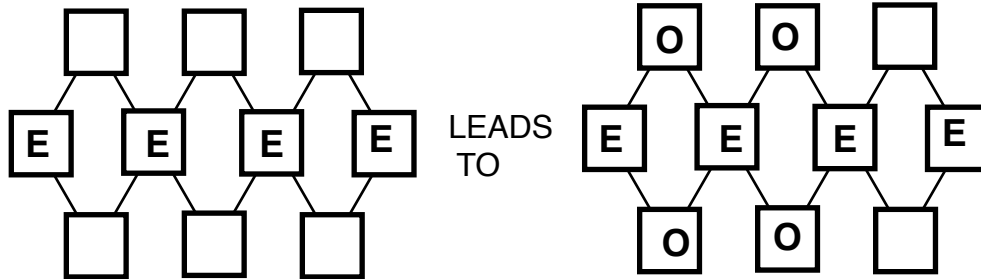


These two arrangements are the same. One is the reflection of the other.

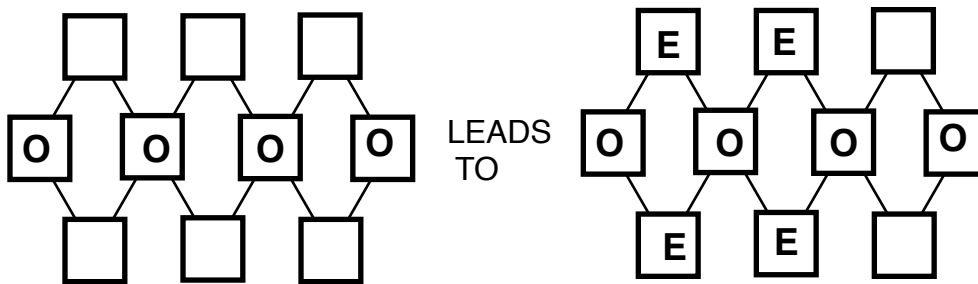


## The following combinations are not possible

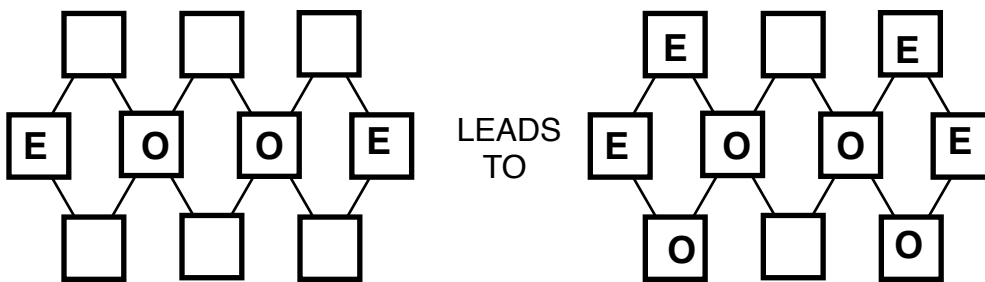
A middle row with **EEEE** is **not** possible. For the three triangles to have an even total the top and bottom pairs for each diamond would need to be a **pair or evens** or a **pair of odds**. You do not have a pair of evens left but you could use 2 PAIRS OF ODDS to fill the left 2 diamonds. You are left with one even and one odd to fill the boxes in the right diamond which will sum to an odd.



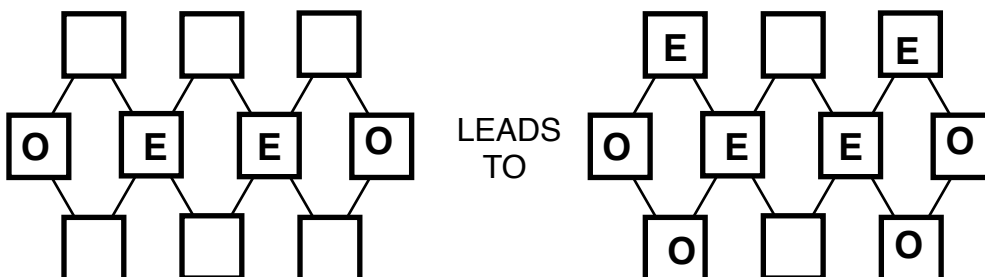
A middle row with **OOOO** is also **not** possible using the same reasoning given above,



A middle row with **EOOE** is not possible. The far left and far right diamonds have 1 even and 1 odd and they will sum to an odd. For the final total to be even the 2 remaining boxes need to have 1 even and 1 odd. The 8 boxes in the right and left diamonds will use up 4 evens and 4 odds. This leaves 1 even and 1 odd for the remaining boxes in the middle diamond. The middle diamond has 2 odds that must sum to an even and there is there is 1 even and one odd left. The total of these 4 numbers must be odd so a middle row of **EOOE** is not possible.

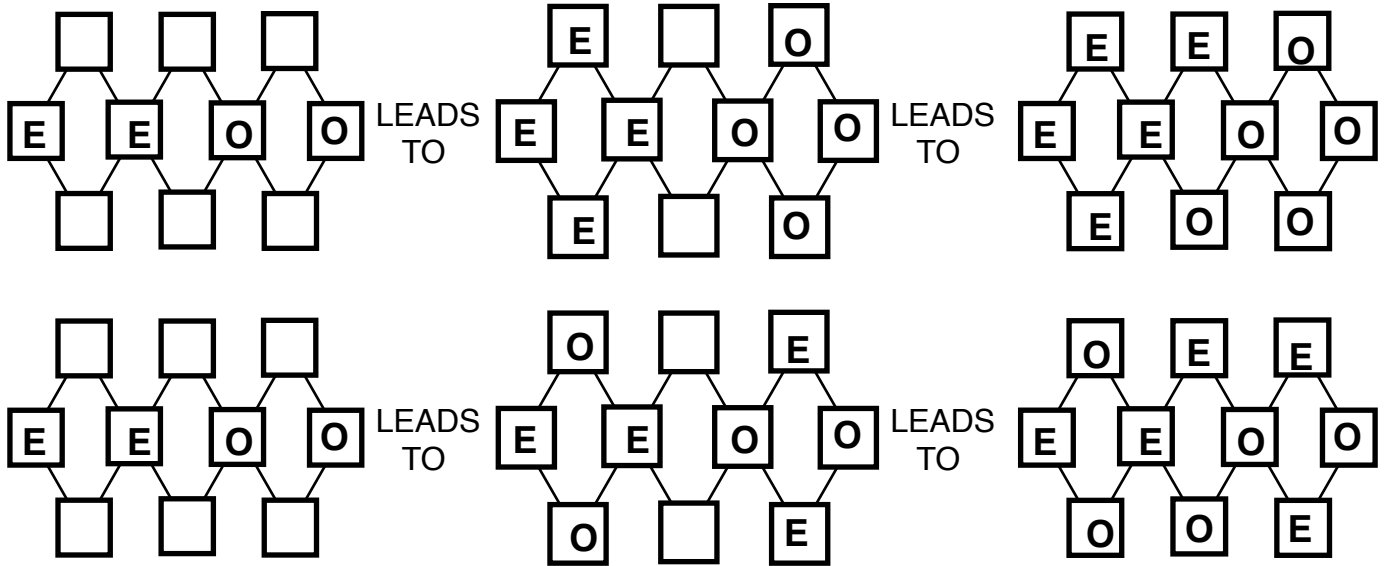


A middle row with **OEEO** is **not possible** using the same arraignment as above.

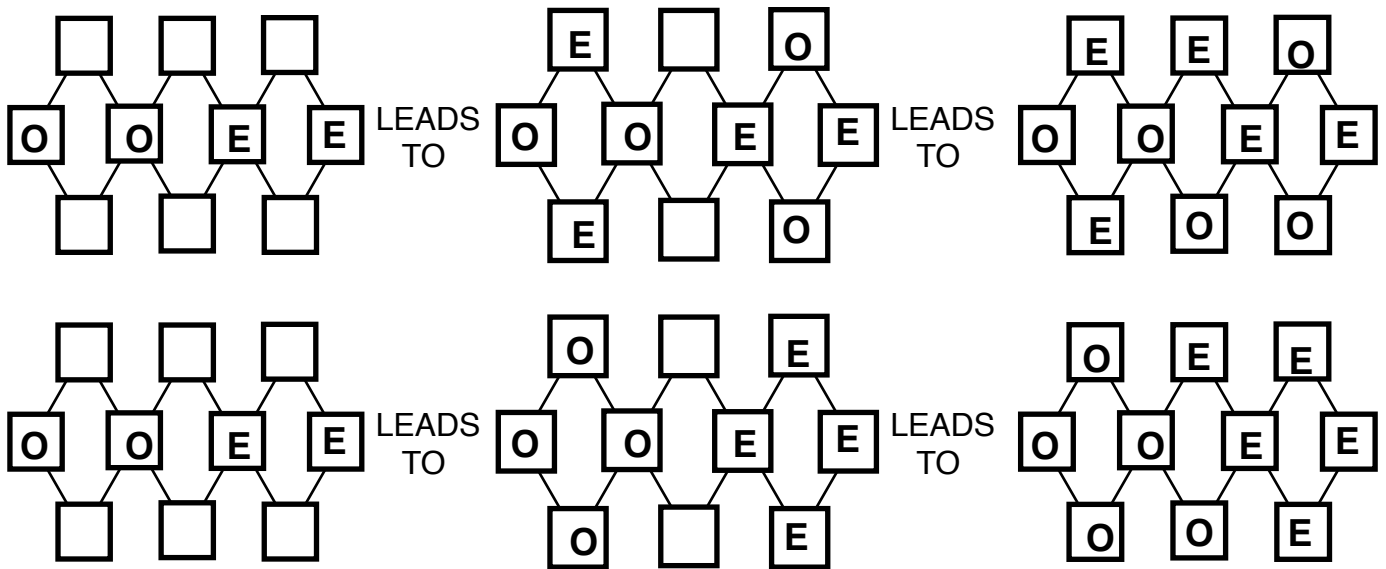


A middle row with EEOO is possible.

The far left diamond has 2 evens and the far right diamond has 2 odds. For the final total to be even the 2 remaining boxes in the right diamond need to have 2 evens or 2 odds and the same thing is true for the far right diamond. If you put 2 evens in the far right diamond you have 1 even left over. This means you must put 2 odds in the far right diamond and have one odd left over. These two numbers go in the open boxes in the middle diamond giving an even total for that diamond.



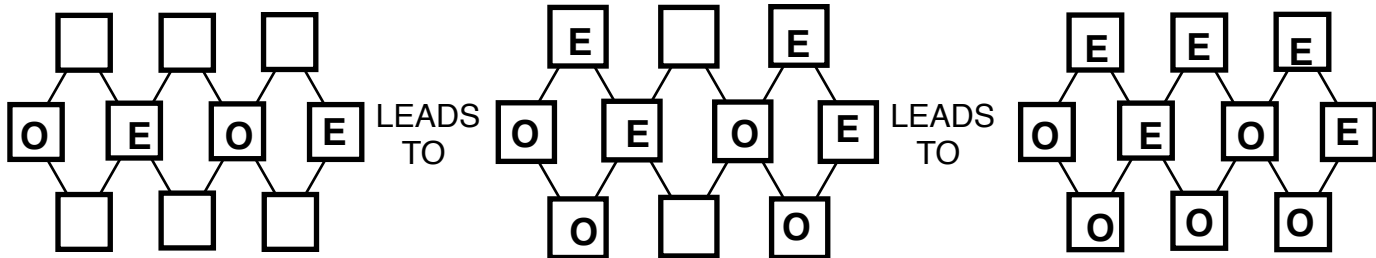
A middle row with OOOE is also possible using the same reasoning given above.



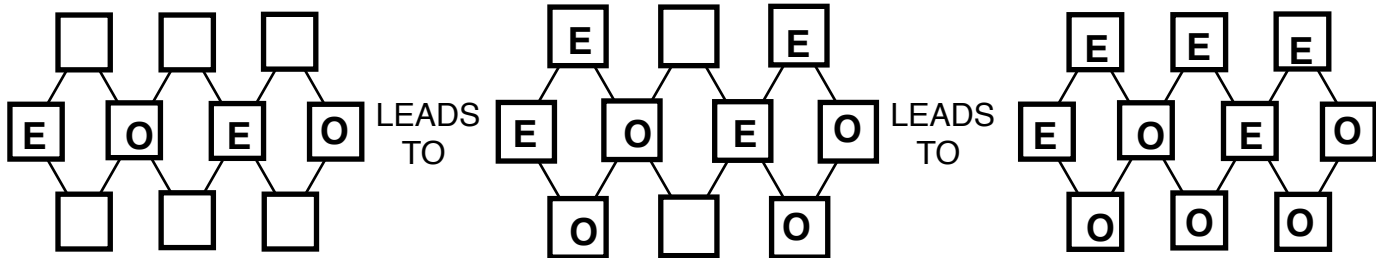
The last 2 cases are reflections of the first 2 case so there are really only 2 different patterns.

**A middle row with OEOE is possible.**

The far left and far right diamonds have an even and odd that total to an odd. For the diamonds total to be even the 2 remaining boxes need to have 1 even and 1 odd. This gives the 4 boxes 2 evens and 2 odds. The same situation occurs in the far right diamond. The middle diamond also has 1 even and 1 odd. That total is odd and the remaining 2 boxes need to be 1 even and 1 odd and there is 1 even and 1 odd left.

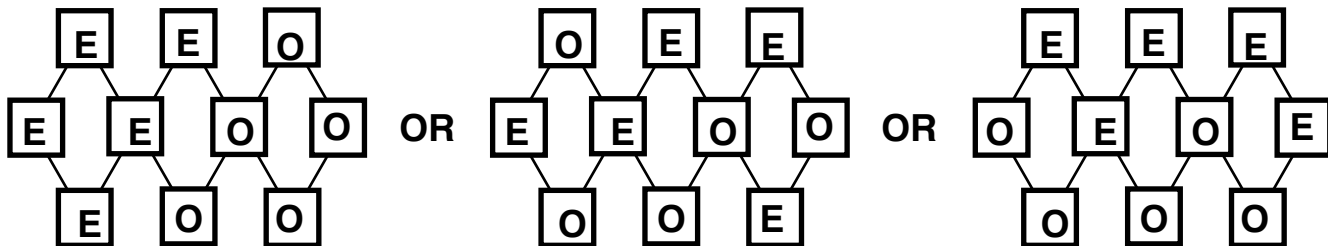


A middle row with EOEO is also possible using the same reasoning given above

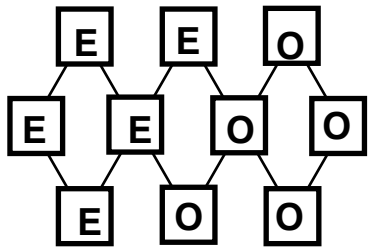


The last case is a reflection of the first case so there are really only 1 pattern.

**There are only 3 possible different arrangements for the solutions with even totals.**

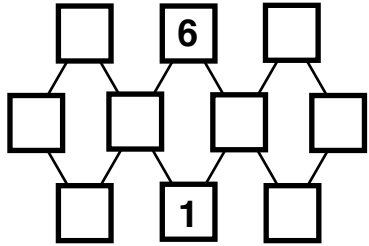


**Find a Total of 24** with a middle row of EEOO  
and a top row of EEO and a bottom row of EOO



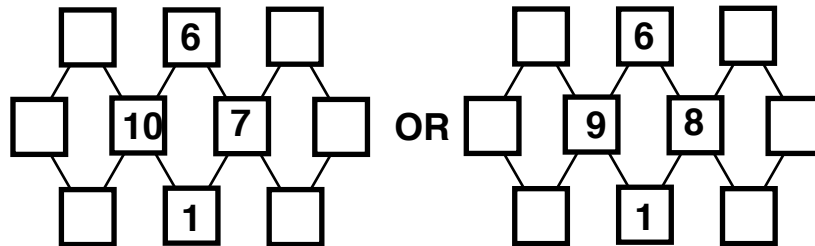
The left diamond has 4 even numbers that total 24. The only 4 evens that total 24 are 2, 4, 8 and 10. The even number 6 is left over.

The right diamond has 4 odd numbers that total 24. The only 4 odds that total 24 are 3, 9, 7 and 5. The odd number 1 is left over,



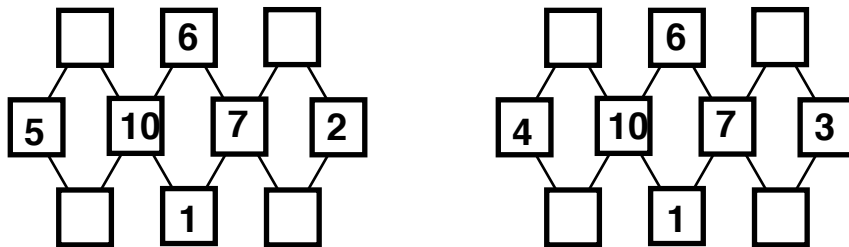
The 6 and the 1 must go in the upper and lower middle boxes that are not used by the right or left diamonds.

The middle diamond already has a 6 and a 1. The remaining 2 boxes in the middle diamond must total 17. The only pairs that total 17 are **10 and 7** or **9 and 8**. These 2 cases are shown below.



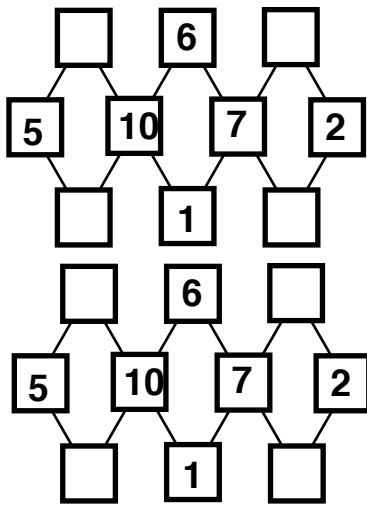
### The 10, 7 cases

If there is a 10 and 7 in the two boxes of the middle row a total of 7 is needed for the other two boxes with both numbers being odd. There are two possible arrangements.





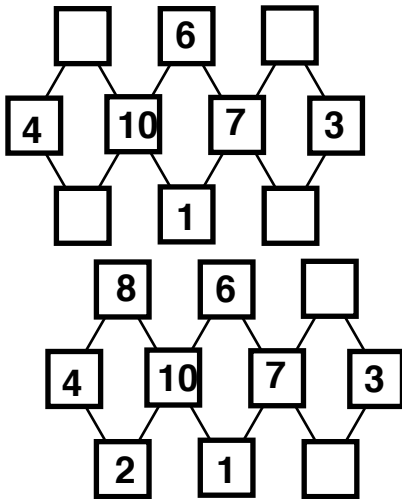
### The 5, 10, 7, 2 case is not possible



The left diamond needs 2 numbers that total 9 to make a total of 24. The possible pairs are 8,1 or 7, 2 or 6,3 or 5,4 Each pair has a number already used so a middle row of 5 ,10, 7,2 is **not possible**.

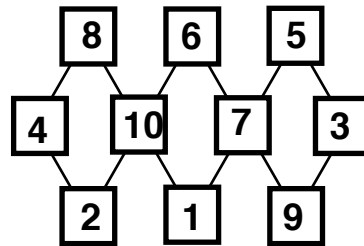
The left diamond needs 2 numbers that total 9 to make a total of 24. The possible pairs are 8,1 or 7, 2 or 6,3 or 5,4 Each pair has a number already used so a middle row of 5 ,10, 7,2 is **not possible**.

### The 4, 10, 7, 3 case



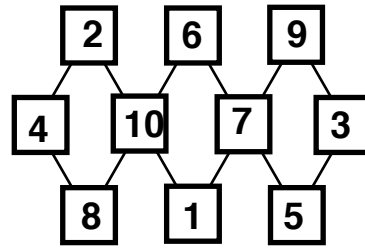
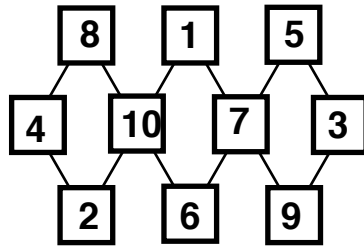
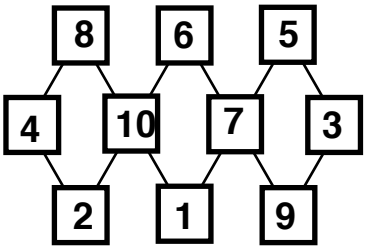
The left diamond needs 2 numbers that total 10 to make a total of 24. The possible pairs are 9,1 or 8,2 or 7,3 or 6,4 Only the 8,2 pair has numbers not already used. Put the 8 and 2 in the open boxes for the left diamond.

This leaves only a 5 and 9 to put in the 2 remaining boxes

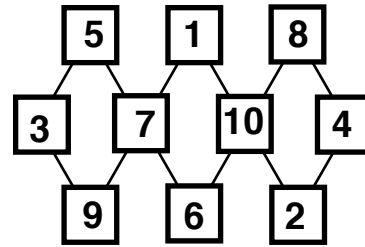
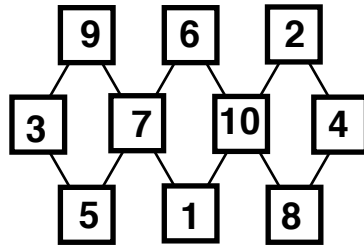
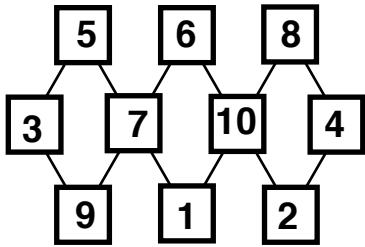


**Note:** The number pairs on the top and bottom of each diamond can be switched and the total will still be 24. This creates several others solutions. The entire puzzle can be reflected horizontally to create a middle row is 3, 7, 10, 4 set of solutions that are still based on the same fixed row 4, 10 , 7, 3. They may appear different bot each one is based on the middle row that is fixed.

Some of the possible solution based on a middle row of 4 ,10, 7, 3

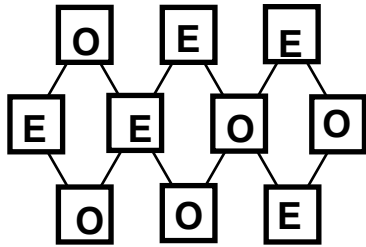


Some of the possible solution based on a middle row of 3 ,7 , 10, 4



**Find a Total of 24** with a middle row of EEOO  
and a top row of fOEE and a bottom row of OOE

Have the 3 diamonds and middle row to each total 24 using the EEOO middle row  
and the OEE top row and OOE bottom row



**The only POSSABLE middle rows**

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

**2 6 9 7**

If we use 2 6 and 9 7 as the even and odds pairs on the middle row then the top and bottom boxes of the **right** diamond need to be 2 even numbers that add to 8, The only evens that do this are 6 and 2 but the 6 has been used. No other arraignments of the 2 and 6 and the 9 and 7 change this restriction.

**2 8 9 5**

If we use 2 8 and 9 5 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 14, The only odds that do this are 9 and 5 but they have been used so a middle row of 2 8 and 9 5 is not possible.

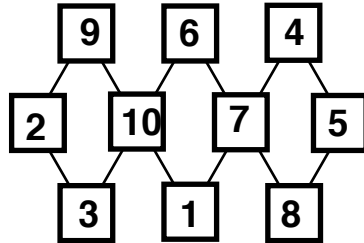
No other arraignments of the 2 and 8 and the 9 and 5 change this restriction.

**2 10 9 3**

If we use 2 10 and 9 3 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 12, The only **unused** odds that do this are 5 and 7. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 12. The only **unused** evens that do this are 8 and 4. This leaves a 6 and a 1 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. No arraignments of the 2 and 10 and the 9 and 3 work so a middle row of 2 10 9 3 is not possible.

### 2 10 7 5

If we use 2 10 and 7 5 then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 12, The only **unused** odds that do this are 9 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 12, The only **unused** evens that do this are 8 and 4. This leaves a 6 and a 1 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 10 and 7 with in middle diamond and the 2 and 5 at the ends creates the following solution.

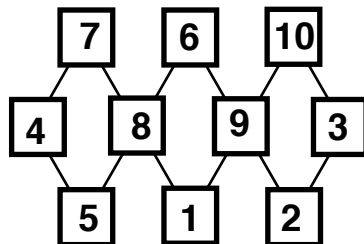


### 4 6 9 5

If we use 4 6 and 9 7 as the even and odds pairs on the middle row then the top and bottom boxes of the **left** diamond need to be 2 odds numbers that add to 14, The only odds that do this are 9 and 5 but the they have been used. No other arraignments of the 2 and 6 and the 9 and 7 change this restriction.

### 4 8 9 3

If we use 4 8 and 9 3 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 12, The only **unused** odds that do this are 5 and 7. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 12. The only **unused** evens that do this are 10 and 2. This leaves a 6 and a 1 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 4 and 3 at the ends creates the following solution.



### 4 8 7 5

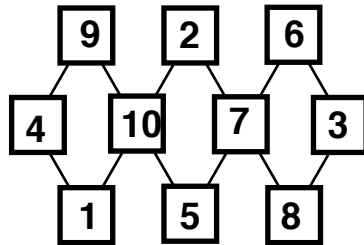
If we use 4 8 and 7 5 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 12, The only **unused** odds that do this are 9 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 12. The only **unused** evens that do this are 10 and 2. This leaves a 6 and a 1 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. No arraignments of the 4 and 8 and the 7 and 5 work so a middle row of 4 8 7 5 is not possible.

#### 4 10 9 1

If we use 4 10 and 9 1 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 10, The only **unused** odds that do this are 7 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 12. The only **unused** evens that do this are 6 and 8 This leaves a 2 and a 5 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. No arrangements of the 4,10 and 9 , 1 work so a middle row of 4 , 10 and 9 ,1 is not possible.

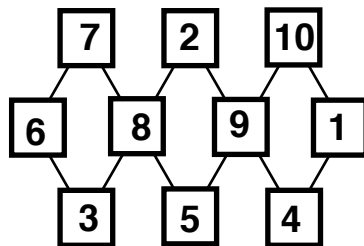
#### 4 10 7 3

If we use 4 10 and 7 3 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 10, The only **unused** odds that do this are 9 and 1. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 14. The only **unused** evens that do this are 6 and 8. This leaves a 5 and a 2 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 10 and 7 in middle diamond and the 4 and 3 at the ends creates the following solution.



#### 6 8 9 1

If we use 6 8 and 1 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 10, The only **unused** odds that do this are 7 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 14. The only **unused** evens that do this are 10 and 4. This leaves a 5 and a 2 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 6 and 1 at the ends creates the following solution.



### 6 8 7 3

If we use 6 8 and 7 3 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 10, The only **unused** odds that do this are 9 and 1. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 14. The only **unused** evens that do this are 4 and 10 This leaves a 2 and a 5 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. No arrangements of the 6, 8 and 7, 3 work so a middle row of 6 8 and 7 3 is not possible.

### 6 10 7 1

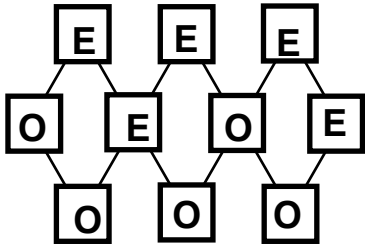
If we use 6 10 and 7 1 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 8, The only **unused** odds that do this are 5 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 16. The evens that do this are 10 and 6 but they have been used so a middle row of 6 10 and 7 1 is not possible.

### 6 10 5 3

If we use 6 10 and 5 3 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 8, The only **unused** odds that do this are 5 and 3. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 16. The evens that do this are 10 and 6 but they have been used so a middle row of 6 10 and 5 3 is not possible.

**Find a Total of 24** with a middle row of EEOO  
and a top row of EEE and a bottom row of OOO

Have the 3 diamonds and middle row to each total 24 using the EEOO middle row and the OEE top row and OOE bottom row



- |          |          |          |          |          |          |          |          |
|----------|----------|----------|----------|----------|----------|----------|----------|
| 1 4 9 10 | 1 6 7 10 | 1 6 9 8  | 1 8 9 6  | 1 8 5 10 | 1 10 9 4 | 1 10 7 6 | 1 10 5 8 |
| 3 2 9 10 | 3 4 7 10 | 3 4 9 8  | 3 6 5 10 | 3 6 7 8  | 3 8 7 6  | 3 8 9 4  | 3 10 5 6 |
| 3 10 7 4 | 3 10 9 2 | 5 2 7 10 | 5 2 9 8  | 5 4 9 6  | 5 4 7 8  | 5 6 3 10 | 5 6 9 4  |
| 5 8 7 4  | 5 8 9 2  | 5 10 1 8 | 5 10 3 6 | 5 10 7 2 | 7 2 5 10 | 7 2 9 6  | 7 4 5 8  |
| 7 6 3 8  | 7 6 9 2  | 7 8 3 6  | 7 8 5 4  | 7 10 1 6 | 7 10 3 4 | 7 10 5 2 |          |

**1 4 9 10**

If we use 1 4 and 9 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be an even and odd pair that add to 19. The only even and odd pair that do this are 9 and 10 but they have been used so a middle row of 1 4 and 9 10 is not possible.

**1 6 7 10**

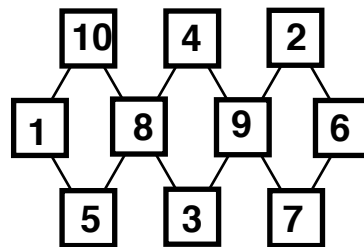
If we use 1 6 and 7 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be an even and odd pair that add to 17, The only **unused** odds that do this are 9 and 8. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 7. The **unused** even odd pairs that do this are 5 and 2 or 4 and 3. If you use the 5 and 2 then a 4 and 3 are left for top and bottom boxes of the right diamond. If you use the 4 and 3 then a 5 and 2 are left for top and bottom boxes of the right diamond. These numbers total 7 so the 2 boxes on the middle row with them need to be an even and odd that total 17. No arraignment of the 1 and 6 left pair and the 7 and 10 right pair will work.

### 1 6 9 8

If we use 1 6 and 9 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 17, The only **unused** odds that do this are 10 and 7. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 7. The **unused** even odd pairs that do this are 5 and 2 or 4 and 3. If you use the 5 and 2 then a 4 and 3 are left for top and bottom boxes of the right diamond. If you use the 4 and 3 then a 5 and 2 are left for top and bottom boxes of the right diamond. These numbers total 7 so the 2 boxes on the middle row with them need to be an even and odd that total 17. No arraignment of the 1 and 6 left pair and the 7 and 10 right pair will work.

### 1 8 9 6

If we use 1 8 and 9 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be 2 odd numbers that add to 17, The only **unused** odds that do this are 10 and 7. The top and bottom boxes of the right diamond need to be 2 even numbers that add to 9. The only **unused** evens that do this are 4 and 2. This leaves a 3 and 4 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 6 and 1 at the ends creates the following solution.



### 1 8 5 10

If we use 1 8 and 5 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15, The only **unused** odds that do this are 9 and 6. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 9. The **unused** even odd pairs that do this are 7 and 2. These numbers total 9 so the 2 boxes on the middle row with them need to be an even and odd that total 15. The 8 5 middle pair will not work.

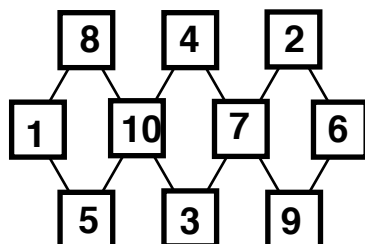
### 1 10 9 4

If we use 1 10 and 9 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The **unused** even odd pairs that do this are 8 and 5 or 7 and 6. If you use the 8 and 5 for the left diamond then no even odd pair will work in the right diamond. If you use the 7 and 6 for the left diamond then the **unused** even odd pair that do this is 8 and 3. This leaves a 2 and 5 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. The 10 4 middle pair will not work with the 3 and 4.



### 1 10 7 6

If we use 1 10 and 7 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13, The only **unused** odds that do this are 8 and 5. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 11. The **unused** even odd pairs that do this are 9 and 2. This leaves a 3 and 4 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 10 and 7 in middle diamond and the 6 and 1 at the ends creates the following solution.



### 1 10 5 8

If we use 1 10 and 5 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The **unused** even odd pairs that do this are 9 and 4 or 7 and 6. If you use the 9 and 4 for the left diamond then no even odd pair will work in the right diamond. If you use the 7 and 6 for the left diamond then the **unused** even odd pair that do this is 9 and 2. This leaves a 3 and 4 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. The 5 8 middle pair will not work with the 3 and 4.

### 3 2 9 10

If we use 3 2 and 9 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be an even and odd pair that add to 19. The only even and odd pair that do this are 9 and 10 but they have been used so a middle row of 3 2 and 9 10 is not possible.

### 3 4 9 8

If we use 3 4 and 9 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 17. The only **unused** even odd pair that do this is 10 and 7. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 7. The **unused** even odd pairs that do this are 5 and 2 or 6 and 1. If you use the 5 and 2 then a 6 and 1 are left for top and bottom boxes of the right diamond. If you use the 6 and 1 then a 5 and 2 are left for top and bottom boxes of the right diamond. These numbers total 7 so the 2 boxes on the middle row with them need to be an even and odd that total 17. The 4 9 middle pair will not work in either case.

### 3 4 7 10

If we use 3 4 and 7 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 17. The only **unused** even odd pair that do this is 9 and 8. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 7. The **unused** even odd pairs that do this are 5 and 2 or 6 and 1. If you use the 5 and 2 then a 6 and 1 are left for top and bottom boxes of the right diamond. If you use the 6 and 1 then a 5 and 2 are left for top and bottom boxes of the right diamond. These numbers total 7 so the 2 boxes on the middle row with them need to be an even and odd that total 17. The 4 7 middle pair will not work in either case.

### 3 6 5 10

If we use 3 6 and 7 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15, The only **unused** odds that do this are 8 and 7. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 9. There are no **unused** even odd pairs that do this. The 6 5 middle pair will not work.

### 3 6 7 8

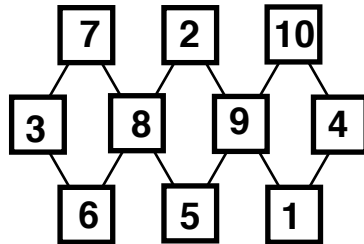
If we use 3 6 and 7 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15, The only **unused** odds that do this are 10 and 5. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 9. There are no **unused** even odd pairs that do this. The 6 7 middle pair will not work.

### 3 8 7 6

If we use 3 8 and 7 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The only **unused** even odd pair that do this is 9 and 4. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 11. The only **unused** even odd pair that do this is 10 and 1. This leaves a 5 and 2 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. The 8 7 middle pair will not work in either case.

### 3 8 9 4

If we use 3 8 and 9 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13, The only **unused** odds that do this are 8 and 5. The top and bottom boxes of the right diamond need to be an even and odd pair that add to 11. The only **unused** even odd pair that do this is 1 and 10. This leaves a 5 and 2 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 3 and 4 at the ends creates the following solution.



### 3 10 5 6

If we use 3 10 and 5 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The **unused** even odd pairs that do this are 7 and 4 or 9 and 2.

If you use the 7 and 4 for the left diamond then the top and bottom of the right diamond need to total 13. There are **no unused even odd pair that do this..**

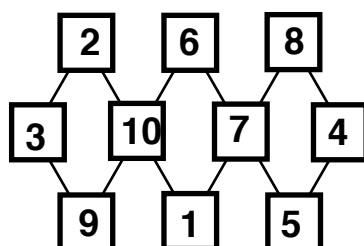
If you use the 9 and 2 for the left diamond then the top and bottom of the right diamond need to total 13. There are **no unused even odd pair that do this.**

### 3 10 7 4

If we use 3 10 and 7 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The **unused** even odd pairs that do this are 7 and 4 or 9 and 2.

If you use the 7 and 4 for the left diamond then the top and bottom of the right diamond need to total 13. There are **no unused even odd pair that do this.**

If you use the 9 and 2 for the left diamond then the top and bottom of the right diamond need to total 13. The only ed to be an even and odd pair that add to 13, The only **unused** even and odd pairs that do this are 8 and 5. This leaves a 1 and 6 for the 2 boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 10 and 7 in middle diamond and the 3 and 4 at the ends creates the following solution.



### 3 10 9 2

If we use 3 10 and 9 2 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The **unused** even odd pairs that do this are 7 and 4 or 6 and 5.

If you use the 7 and 4 for the left diamond then the top and bottom of the right diamond need to total 13. The only unused even odd pair that does this is 8 and 5. This leaves a 1 and 6 for the 2 top and bottom boxes in the middle diamond. These numbers total 7 so the 10 9 middle pair will not work..

If you use the 6 and 5 for the left diamond then the top and bottom of the right diamond need to total 13. There are no unused even odd pairs that do. The 10 9 middle pair will not work.

### 5 2 7 10

If we use 5 2 and 7 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 17. The only **unused** even odd pair that does this is 9 and 8. If you use the 9 and 8 for the left diamond then the top and bottom of the right diamond need to total 7. The only unused even odd pairs that do this are 6 and 1 or 4 and 3.

If you use the 6 and 1 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 7 middle pair will not work..

If you use the 4 and 3 for the right diamond then this leaves a 1 and 6 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 7 middle pair will not work..

### 5 2 9 8

If we use 5 2 and 9 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 17. The only **unused** even odd pair that does this is 10 and 7. If you use the 9 and 8 for the left diamond then the top and bottom of the right diamond need to total 7. The only unused even odd pairs that do this are 6 and 1 or 4 and 3.

If you use the 6 and 1 for the right diamond then this leaves a 4 and 3 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 9 middle pair will not work.

If you use the 4 and 3 for the right diamond then this leaves a 1 and 6 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 9 middle pair will not work..

### 5 4 7 8

If we use 5 4 and 7 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15. The only **unused** even odd pair that do this is 9 and 6. If you use the 9 and 6 for the left diamond then the top and bottom of the right diamond need to total 9. There are **no unused even odd pair that do this.**

### 5 4 9 6

If we use 5 4 and 9 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15. The only **unused** even odd pair that do this is 8 and 7. If you use the 8 and 7 for the left diamond then the top and bottom of the right diamond need to total 9. There are **no unused even odd pair that do this.**

### 5 6 3 10

If we use 5 6 and 3 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The only **unused** even odd pair that do this is 9 and 4. If you use the 9 and 4 for the left diamond then the top and bottom of the right diamond need to total 11. There are **no unused even odd pair that does this**.

### 5 6 9 4

If we use 5 6 and 9 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The only **unused** even odd pair that do this is 10 and 3. If you use the 10 and 3 for the left diamond then the top and bottom of the right diamond need to total 11. There are **no unused even odd pair that does this**.

### 5 8 7 4

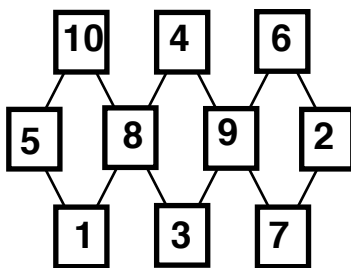
If we use 5 8 and 7 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The only **unused** odds that do this are 10 and 1 or 9 and 2.

If you use the 9 and 2 then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The only **unused** even and odd pair that does this is 10 and 3. If you use the 10 and 3 for the right diamond then this leaves a 1 and 6 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 8 7 middle pair will not work.

### 5 8 9 2

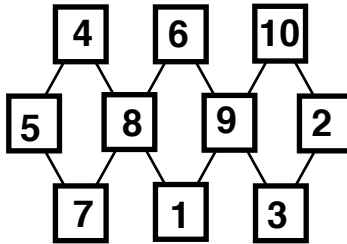
If we use 5 8 and 9 2 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The only **unused** even odd pairs that does this are 10 and 1 or 7 and 4.

If you use the 10 and 1 for the left diamond then the top and bottom of the right diamond need to total 13. The only unused even odd pair that does this is 6 and 7. If you use the 6 and 7 for the right diamond then this leaves a 4 and 3 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 5 and 2 at the ends creates the following solution.



## 5 8 9 2 continued

If you use the 7 and 4 for the left diamond then the top and bottom of the right diamond need to total 13. The only unused even odd pair that does this is 10 and 3. If you use the 10 and 3 for the right diamond then this leaves a 6 and 1 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 8 and 9 in middle diamond and the 5 and 2 at the ends creates the following solution.



## 5 10 1 8

If we use 5 10 and 1 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 9. The only **unused** even odd pairs that does this are 7 and 2 or 1 and 8.

If you use the 7 and 2 then the top and bottom boxes of the right diamond needs to be an even and odd pair that add to 15. The only **unused** even and odd pair that does this is 9 and 6. If you use the 9 and 6 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 1 middle pair will not work.

If you use the 6 and 3 then the top and bottom boxes of the right diamond needs to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 10 1 middle pair will not work.

## 5 10 3 6

If we use 5 10 and 3 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 9. The only **unused** even odd pairs that does this are 8 and 1 or 7 and 2.

If you use the 8 and 1 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 10 7 middle pair will not work.

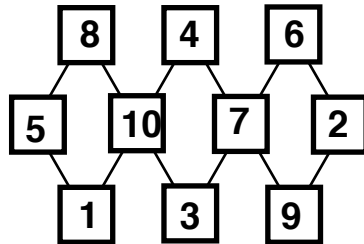
If you use the 7 and 2 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 10 7 middle pair will not work.

### 5 10 7 2

If we use 5 10 and 7 2 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 9. The only **unused** even odd pairs that does this are 6 and 3 or 7 and 2.

If you use the 6 and 3 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 10 7 middle pair will not work.

If you use the 8 and 1 then the top and bottom boxes of the right diamond need to be need to be an even and odd pair that add to 15. The only **unused** even and odd pair that do this is 9 6. If you use the 9 and 6 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 boxes on the middle row with them need to total 17. Putting the 10 and 7 in middle diamond and the 5 and 2 at the ends creates the following solution.



### 7 2 5 10

If we use 7 2 and 5 10 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15. The only **unused** even odd pair that does this is 9 and 6. If you use the 9 and 6 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 9. The only **unused** even and odd pair that does this is 8 and 1. If you use the 8 and 1 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 5 middle pair will not work.

### 7 2 9 6

If we use 7 2 and 9 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 15. The only **unused** even odd pair that does this is 10 and 5. If you use the 10 and 5 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 9. The only **unused** even and odd pair that does this is 8 and 1. If you use the 8 and 1 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 5 middle pair will not work.

### 7 4 5 8

If we use 7 4 and 5 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 13. The only **unused** even odd pair that does this is 10 and 3. If you use the 10 and 3 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 11. The only **unused** even and odd pair that does this is 9 and 2. If you use the 9 and 2 for the right diamond then this leaves a 1 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 2 9 middle pair will not work.

### 7 6 3 8

If we use 7 6 and 3 8 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The only **unused** even odd pairs that do this are 9 and 2 or 10 and 1.

If you use the 9 and 2 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 13. There are no **unused** even and odd pair that do this so the 6 3 middle pair will not work.

If you use the 10 and 1 for the left diamond then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 13. The only **unused** even and odd pair that does this is 9 and 4. If you use the 9 and 4 for the right diamond then this leaves a 1 and 6 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 6 5 middle pair will not work.

### 7 6 9 2

If we use 7 6 and 9 2 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 11. The only **unused** even odd pairs that do this are 8 and 3 or 10 and 1.

If you use the 8 and 3 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 13. There are no **unused** even and odd pair that do this so the 6 9 middle pair will not work.

If you use the 10 and 1 for the left diamond then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 13. The only **unused** even and odd pair that does this is 8 and 5. If you use the 8 and 5 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 9 6 middle

### 7 8 3 6

If we use 7 8 and 3 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 9. The only **unused** even odd pair that does this is 5 and 4.

If you use the 5 and 4 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 8 3 middle pair will not work.

### 7 8 5 4

If we use 7 8 and 5 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 9. The only **unused** even odd pair that does this is 6 and 3.

If you use the 6 and 3 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 15. There are no **unused** even and odd pair that do this so the 8 5 middle pair will not work.



### 7 10 1 6

If we use 7 10 and 1 6 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 7. The only **unused** even odd pairs that do this are 5 and 2 or 4 and 3.

If you use the 5 and 2 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 1 middle pair will not work.

If you use the 4 and 3 for the left diamond then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 1 middle pair will not work.

### 7 10 3 4

If we use 7 10 and 3 4 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 7. The only **unused** even odd pairs that do this are 5 and 2 or 4 and 3.

If you use the 5 and 2 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 1 middle pair will not work.

If you use the 4 and 3 for the left diamond then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 3 and 4 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 1 middle pair will not work.

### 7 10 5 2

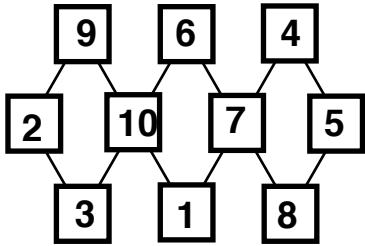
If we use 7 10 and 5 2 as the even and odds pairs on the middle row then the top and bottom boxes of the left diamond need to be need to be an even and odd pair that add to 7. The only **unused** even odd pairs that do this are 6 and 1 or 4 and 3.

If you use the 6 and 1 then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 6 and 1 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 5 middle pair will not work.

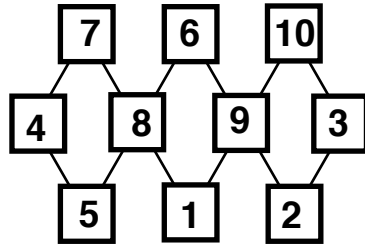
If you use the 4 and 3 for the left diamond then the top and bottom boxes of the right diamond needs to be need to be an even and odd pair that add to 17. The only **unused** even and odd pair that does this is 9 and 8. If you use the 9 and 8 for the right diamond then this leaves a 6 and 1 for the top and bottom boxes in the middle diamond. These numbers total 7 so the 10 5 middle pair will not work.

# The solutions for a total of 24.

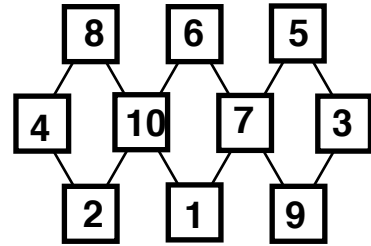
2 10 7 5



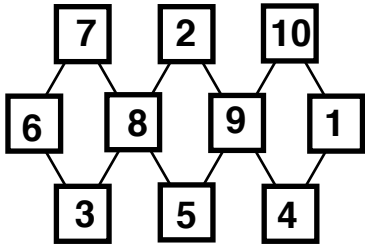
4 6 9 5



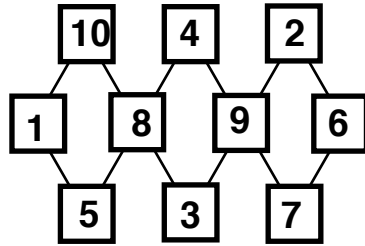
4 10 7 3



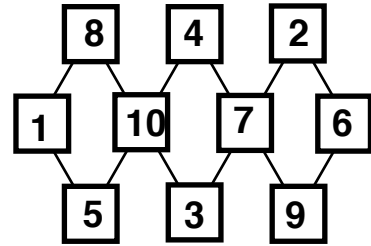
6 8 9 1



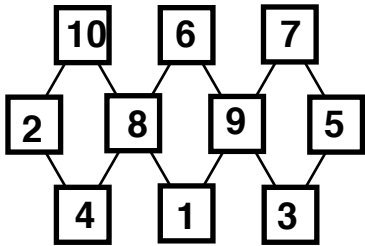
1 8 9 6



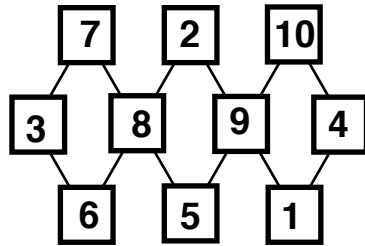
1 10 7 6



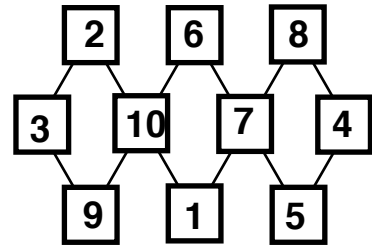
2 8 9 5



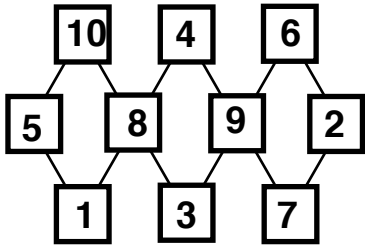
3 8 9 4



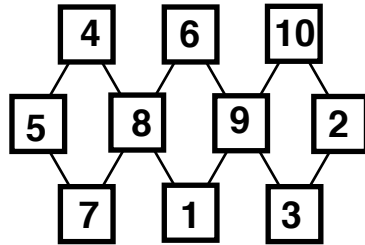
3 10 7 4



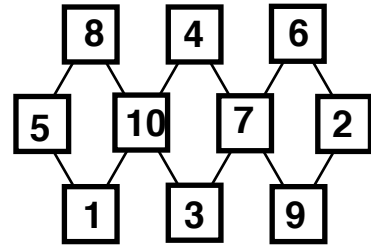
5 8 9 2



5 8 9 2

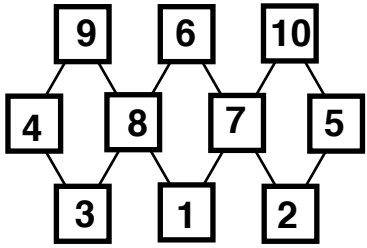


5 10 7 2

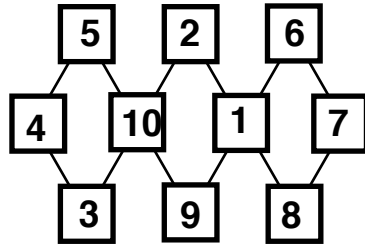


# The solutions for a total of 22.

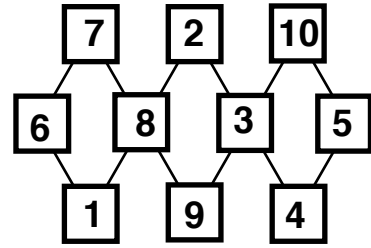
4 8 7 5



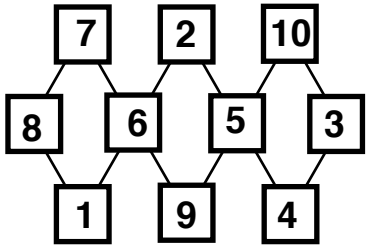
4 10 1 7



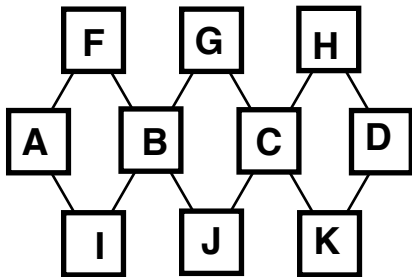
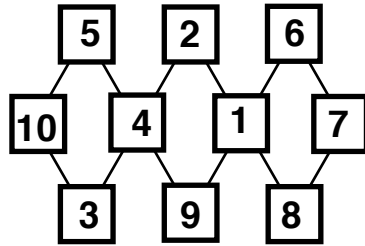
6 8 3 5



8 6 5 3



10 4 1 7

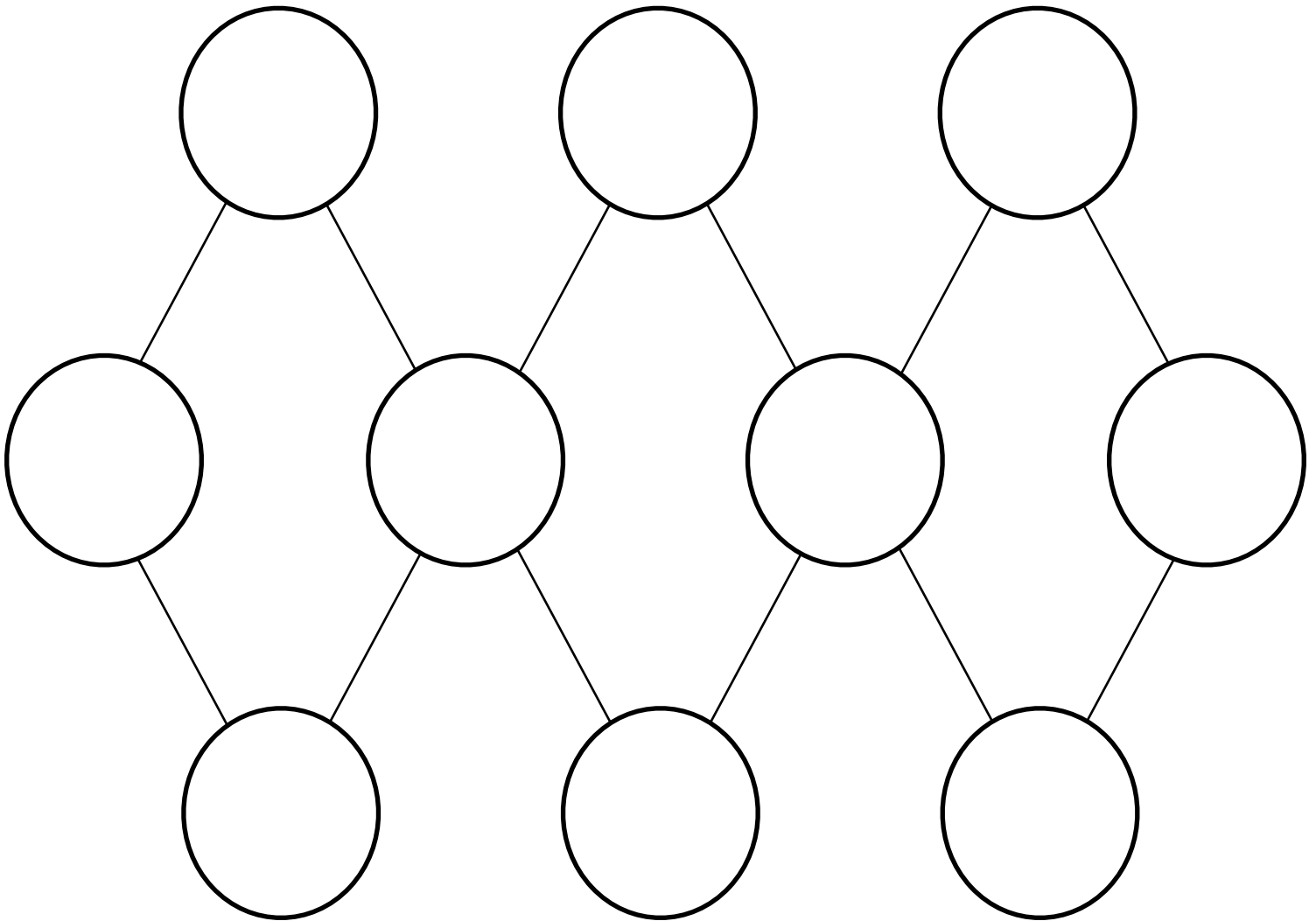
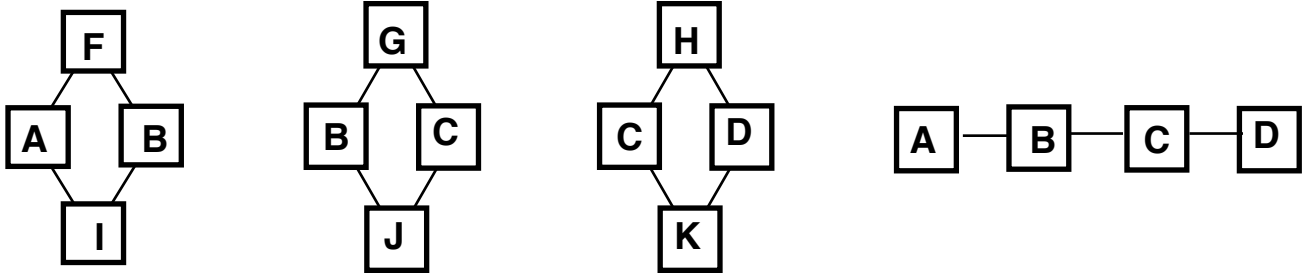


Odds [1] [3] [5] [7] [9]

Evens [2] [4] [6] [8] [10]

## Danish Solitaire

The diagram below has 10 circles arranged to form 3 diamonds (rhombus) forming horizontal a row of 4 squares in the middle. Find 4 different arraignment of the digits 1 to 10 so that all 3 diamonds and middle the row of 4 circles have a total of 21, 22 23 or 24,



10

9

8

7

6

5

4

3

2

\*\*\*\*\*

\* Danish Solitaire Game

\*

\* b e h

\* ^^^

\* /\ /\ /\

\* /VV\

\* a d g j

\* \^^/

\* \ /\ /\ /

\* VVV

\* c f i

\*

\*\*\*\*\*/

```
#include <stdio.h>
```

```
main(int argc, char *argv[])
```

```
{
```

```
int a,b,c,d,e,f,g,h,i,j;
```

```
int N;
```

```
N = atoi(argv[1]);
```

```
for (a = 1; a<=10; a++)
```

```
for (b = 1; b<=10; b++)
```

```
for (c = 1; c<=10; c++)
```

```
for (d = 1; d<=10; d++)
```

```
for (e = 1; e<=10; e++)
```

```
for (f = 1; f<=10; f++)
```

```
for (g = 1; g<=10; g++)
```

```
for (h = 1; h<=10; h++)
```

```
for (i = 1; i<=10; i++)
```

```
for (j = 1; j<=10; j++)
```

```
{
```

```
if ( (a+b+c+d == N) &&
```

```
(d+e+f+g == N) &&
```

```
(g+h+i+j == N) &&
```

```
(a+d+g+j == N) &&
```

```
unique(a,b,c,d,e,f,g,h,i,j) )
```

```
printf ("a = %d, b = %d, c = %d, d = %d, e = %d, f = %d, g = %d, h = %d, i = %d, j = %d\n", a,b,c,d,e,f,g,h,i,j);
```

```
}
```

```
}
```

```
unique(a,b,c,d,e,f,g,h,i,j)
```

```
int a,b,c,d,e,f,g,h,i,j;
```

```
{
```

```
int pegs[10];
```

```
int x,y;
```

```
pegs[0] = a; pegs[1] = b;
```

```
pegs[2] = c; pegs[3] = d;
```

```
pegs[4] = e; pegs[5] = f;
```

```
pegs[6] = g; pegs[7] = h;
```

```
pegs[8] = i; pegs[9] = j;
```

```
for (x = 0; x <10; x++)
```

```
for (y = x+1; y <10; y++)
```

```
if (pegs[x] == pegs[y]) return 0;
```

```
return(1);
```

```
}
```