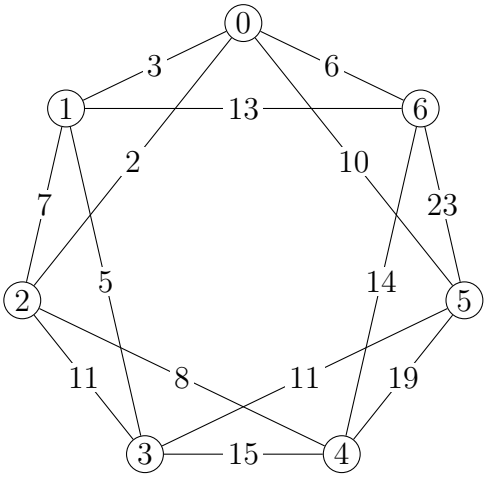
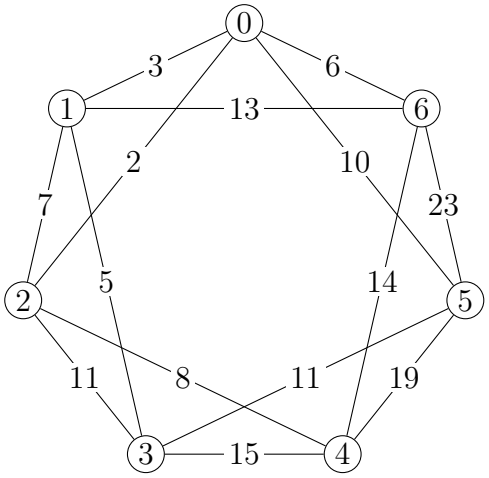
Hamiltonian Circuits and Paths (Day 2)

1. Recall the problem at the end of Worksheet 14.

   Use the Nearest Neighbor Algorithm starting at vertex 0 to find a Hamiltonian circuit. Highlight the circuit on the left-hand graph.



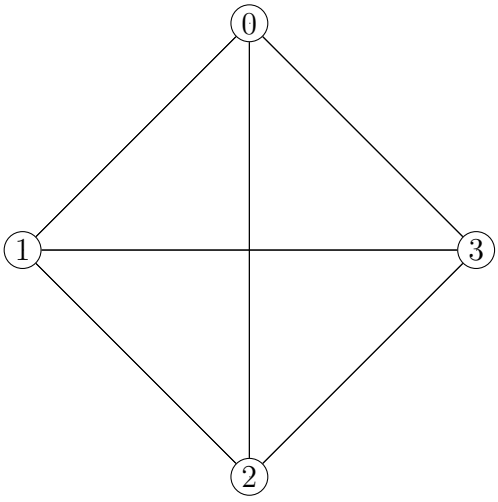


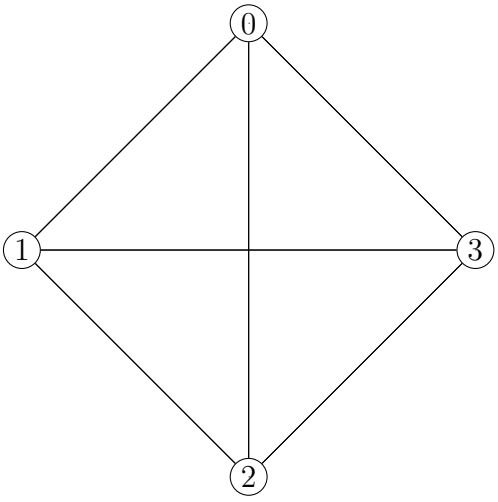
   List the vertices of the circuit in order: _____

   What is the weight of the circuit you found? _____

   The Hamiltonian circuit with smallest weight has weight 61. Can you find it? Draw it on the second graph.

2. Add weights to the complete 4-vertex graph below such that NNA starting at vertex 0 gives the *highest* weight Hamiltonian circuit. (That is, show that NNA can give the worst possible answer!)
   On the left, show the Hamiltonian circuit obtained by starting NNA at 0. On the right, find the minimum weight Hamiltonian circuit. Calculate the weights of each.

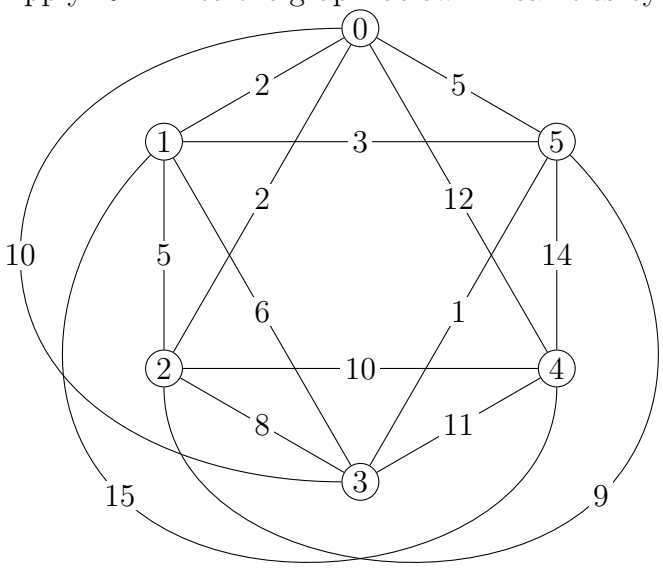




   How do you *know* that circuit on the right is a minimum?
   Will NNA ever give the circuit on the right?

3. Repeated Nearest Neighbor Algorithm:

4. Apply RNNA to the graph below. Break ties by choosing the smallest vertex.



5. How would be know if *any* of the circuits above are optimal?

6. Brute Force Algorithm

7. Find a *systematic* way of listing all possible circuits on four vertices with vertex set 0,1,2,3. How many are there?

8. Find a *systematic* way of listing all possible circuits on five vertices with vertex set 0,1,2,3,4. How many are there?

9. *Without* listing all possible circuits on six vertices with vertex set 0,1,2,3,4,5, how many are possible?

10. How many different circuits on 100 vertices with vertex set 0,1,2,3,4,5,...,99?

11. **Factorial Notation:**

12. **Scientific Notation:**

13. How do you calculate $n!$ for very large n-values?