Name(s): _____

SUPERSYMMETRY PROJECTS

1. Pick an Adinkra. Find all odd dashings on this Adinkra. If we declare two odd dashings equivalent if we can get from one to the other by a series of vertex switches, how many equivalence classes are there?

2. Classify small Adinkras up to isomorphism (that is, up to vertex switches).

3. Pick your favorite valise Adinkra, and let L_I, R_I be its signed adjacency matrices. Define

$$V_{IJ} = L_I R_J - L_J R_I, \tag{1}$$

and

$$\widetilde{V}_{IJ} = R_I L_J - R_J L_I. \tag{2}$$

How do V_{IJ} and $\widetilde{V}_{IJ}$ change if we change the order of the bosons? How about if we change the order of the fermions?

What is the effect on V_{IJ} and $\widetilde{V}_{IJ}$ of performing a vertex switch on a boson? How about if you perform a vertex switch on a fermion? Does it matter which vertex you switch?

4. We defined the *gadget* for $N = 4$. What is the appropriate definition for $N \leq 4$? For a small (fixed) N and a small number of vertices, which Adinkras are most similar according to the gadget?

5. Find all Adinkra topologies for a certain N.

6. Classify even or doubly even codes for small N. Can you estimate the number of even or doubly even codes as N grows larger?

7. Chromotopologies have some, but not all, of the properties of Adinkras. Pick a *different* Adinkra property to relax. Can you describe the resulting graphs? Can you classify small graphs of this type?

8. We described graphs similar to Adinkras related to permutation groups S_n. Illustrate these graphs for small n. Can you extend this construction to certain subgroups of S_n? If so, which subgroups? Can you characterize the resulting graphs?

9. Create an activity to teach members of a math club about Adinkras. How would you test or evaluate your activity?

10. In Sage, write a function that will take information about an Adinkra and automatically draw the Adinkra.