RESEARCH NOTES

10/23

MICROROBOTS MEETING NOTES

1) REVIEWED CURRENT STATUS OF EXPERIMENTATION
   a) ARE RANDOMLY GENERATED BOARDS CONNECTED?
      NO, 40% ARE NOT
   b) ARE THE ACTUAL MICROROBOTS BOARDS CONNECTED IN ALL PERMUTATIONS?
      YES, BOTH SIDES

DISCUSSION

THIS WILL MARK THE TRANSITION FROM CODING & EXPERIMENTATION TO THEORETICAL

1) WHEN RANDOMLY GENERATING GRAPHS, HOW MANY OF THEM SHARE THE PROPERTY OF THE MICROROBOTS BOARDS SUCH THAT, IN ALL PERMUTATIONS THE GRAPH IS CONNECTED?

   a) WHAT ARE THE CHARACTERISTICS OF THOSE GRAPHS?

2) BASIC THEORY: GROUP THEORY & ABSTRACT ALGEBRA

   a) OF THE 6144 CONFIGURATIONS OF THE BOARD, ONLY 384 ARE UNIQUE. SPECIFICALLY,

   LET R = THE SET OF UNIQUE GRAPHS
   Z = THE SET OF NON-UNIQUE GRAPHS
   $\forall G_i \in R \; \exists K \subseteq Z$ s.t. $|K| = 16$ AND
   $\forall K_i \in K \quad K_i \cong G_i$

THE PERMUTATIONS OF THE GRAPH WHICH RESULT IN AN ISOMORPHISM FORM A SYMMETRY AND THE "ACTION" OR BIJECTION WHICH RESULTS IN THE ISOMORPHISM IS AN AUTOMORPHISM.

EXPLOITING THE FACT WE ARE CONNECTED ON ROW & COLUMN, ONE SUCH AUTOMORPHISM WOULD BE THE TRANSPOSITION OF TWO ROWS OR COLUMNS OF THE MATRIX GENERATED BY THE FORMATION OF A BOARD.

b) CONSIDER THE FULL $6! \times 6! = 720 \times 720$ MATRIX GENERATED BY ALL PERMUTATIONS OF COLORS/NUMBERS. CONNELT THOSE ENTRIES WITH SAME COLOR OR NUMBER OR THAT ARE "NEXT TO" EACHOTHER TO CREATE QUOTIENT MAP. (NOTE: I NEED TO THINK MORE ABOUT THIS)

ACTION ITEMS:

TRY SWAPPING ROWS & COLUMNS IN ACTUAL MICROBOTS BOARD MATRICES. DOES THIS CHANGE CONNECTEDNESS?

GENERATE THE EXAMPLES OF RANDOM GRAPHS THAT REMAIN CONNECTED ACROSS ALL PERMUTATIONS.

ATTEMPT TO IDENTIFY PATTERNS IN THOSE GRAPHS WHICH CAN BE USED TO IDENTIFY THE ACTIONS/ AUTOMORPHISMS/FUNCTIONS WHICH ALLOW FOR THE GRAPHS TO ALWAYS BE CONNECTED.

LEVERAGE THOSE FINDINGS TO GENERATE A SET OF RULES OR A FUNDAMENTAL THEOREM FOR THE COMPOSITION OF SUBGRAPHS (TILES) S.T. THEIR COMPOSITION INTO A BOARD RESULTS IN A CONNECTED GRAPH IN ALL PERMUTATIONS.

START A WRITEUP/LATEX DOCUMENT AND BEGIN STRUCTURING MOTIVATION & EXPLANATION OF PROBLEM SECTIONS.